

## **Metadata analysis of systematic literature reviews on academic spin-offs: an overview of reviews**

**Marco A. Domingues<sup>1,2</sup>, Hortência E. P. Santana<sup>3</sup>, Denise S. Ruzene<sup>3,4</sup> and Daniel P. Silva<sup>1,3,4</sup>**

<sup>1</sup>Graduate Program in Intellectual Property Science, Federal University of Sergipe, Brazil

<sup>2</sup>Federal Institute of Education, Science and Technology of Sergipe, Brazil

<sup>3</sup>Graduate Program in Biotechnology, Federal University of Sergipe, Brazil

<sup>4</sup>Northeastern Biotechnology Network, Federal University of Sergipe, Brazil

### **Abstract**

*Besides assuming the role of teaching, research, and extension, the university, has expanded the boundaries of scientific knowledge to promote a business ecosystem. The business-related activities can be driven by the leadership of students with an entrepreneurial capacity, based on the technology transfer produced by the academic research and generated by companies that somehow have been idealized or had the active participation of the faculty members and the technology under their control. This model of companies, named in the literature as academic spin-off, has increased the attention of researchers at two main points: i. understanding the phenomenon itself and ii. contribute to identifying the lack of the process, whether related to the support structure or capacitation of faculty members to develop the entrepreneurial activities, as well as in understanding the commercialization of knowledge as technology transfer. In this context, the present work provided a metadata analysis of systematic literature reviews on the academic spin-off, mapping the knowledge on the subject and searching for reviews that cover the technology transfer models to study the viability of protecting the academic intellectual property as a product. Methodology: the data used in this study were retrieved from the database Web of Science and revised according to the protocol Extension for Scoping Reviews (PRISMA-ScR). The bibliometric analysis of metadata was conducted in RStudio software with the package Bibliometrix and its web interface Biblioshiny. Results: 40 review articles published in peer-reviewed journals from 2006 to 2021 were selected from the initial collection. Then, as result of the bibliometric analysis, it was obtained the data of production indices (main authors, sources, and most cited articles), the evolution of chronological discussion on the subject, and other complementary. Conclusion: it was found indications of studies that discuss technology transfer models and others that examined empiric models in the academic scenario. However, in the selected collection, was not identified any review papers on academic entrepreneurship that were related to the viability of intellectual property as products to be commercialized. Also, it was identified that the word academic entrepreneurship stands out as the main keyword word to represent the research.*

**Keywords:** academic spin-off; systematic review; metadata analysis; PRISMA-method; bibliometric.

## **1. Introduction**

The university has incorporated a new mission toward the development of the entrepreneurial universities model, to participate directly in the advancement of start-ups, contributing to the formation of human and social capital for academic spin-offs (Allen; Link; Rosenbaum, 2007; Davidsson; Honig, 2003; De Cleyn; Braet; Klofsten, 2015; Wright et al., 2007). In recent years, the universities have attempted to expand its role in society from the mere mission of teaching and providing a skilled labor force to encompass more entrepreneurial initiatives and act as a tool to contribute with social-economic development. This trend emphasizes that along with the traditional research, teaching, and technology generation, the university also has the potential to establish links with industry and external stakeholders to capitalize on the academic transfer of knowledge and, consequently, be more financially independent (Audretsch; Aldridge; Sanders, 2011; Davidsson; Honig, 2003; Guerrero et al., 2016).

The academic expertise corroborates with the entrepreneurial progress as a proactively support to seek and provide innovative solutions to better faces the local and global market competitiveness while improving the knowledge-based economy and society (Stal; Fujino, 2006). Capitalization in higher education can be accomplished in several ways: via specialized technology transfer offices, the researcher's participation in the process, and the integration of the university research group with partner enterprises' research programs (Agarwal et al., 2020; Carlsson et al., 2009; Chapman et al., 2011). Therefore, given its relevancy, this subject and its different approaches have raised discussions all over the world. In Brazil, the understanding and emergence of entrepreneur university practices were encouraged by the Innovation Law approved in December 2004, created to promote incentives for innovation and scientific and technological research in the productive environment (Stal; Fujino, 2006).

The general importance of the entrepreneurship in the economic growth, contributing to the increase of gross domestic product (GDP) and formal sector jobs, and the embedding of the academic spin-offs (ASOs) in the creative industry by introducing new concepts and products, have become major research themes (O'shea et al., 2005, 2007; O'shea; Chugh; Allen, 2008; O'shea, Rory; Allen, Thomas; O'gorman, Colm; Roche, 2004). Thus, studies realized in Brazil by the Brazilian Micro and Small Enterprises' Support Service (SEBRAE), Brazilian Institute of Geography and Statistics (IBGE), and local scientific academy, showed that only 40% of the Brazilian enterprises survive for longer than five years. Such results were similar to the ones obtained by the Organization for Economic Cooperation and Development (OECD) when considering an international perspective and applying different methodologies (IBGE, 2014a, 2014b; "OECD Environmental Indicators," 2001; OECD, 2007; SEBRAE, 2010, 2017, 2019).

In this context, the current work conduces an evaluation of published review articles in the field of academic spin-off entrepreneurship. More specifically, focused on mapping the knowledge of ASOs and providing an analysis of the metadata and scope of the reviews based on the protocol described in Figueiredo (2014). Thus, this systematic review aims to compare the comprehensive publications, identifying among literature reviews articles that explore models that analyze the business viability of academic spin-off entrepreneurship and complementing the scope of ASO covered in previous reviews.

## **2. Methods**

### **2.1 Protocol and registration**

The study was performed according to the protocol Extension for Scoping Reviews (PRISMA-ScR), an extension of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Liberati et al., 2009; Moher et al., 2009; Tricco et al., 2018). The data were analyzed in R language using RStudio software with the package Bibliometrix An R-tool for comprehensive science mapping analysis (Aria; Cuccurullo, 2017a) and its web interface Biblioshiny: Bibliometrix for no coders (Aria; Cuccurullo, 2017b).

### **2.2 Eligibility criteria**

For the purpose of this work, the search for relevant studies on the Academic Spin-off field was characterized by the keywords “academic\* spin-off\*”, including all its variants, and using as main criteria: research in the areas of Scientific Administration and Operations Management, Engineering, Business, and Economy, which coverage the thematic areas related to the present study; no restriction on publication time; and articles published in scientific peer-reviewed journals, preventing of poor-quality studies.

### **2.3 Information Sources**

The search was implemented on 31st October 2021 by retrieving publications from the Core Collection of the electronic database Web of Science (WoS). This database was selected since it provides better data quality to export to biblioshiny. Also, to keep the data integrity the raw files were exported in “plain text” rather than “BibTex” format (Aria; Cuccurullo, 2017b).

### **2.4 Search strategy**

The keywords combination and Booleans were used as follows: "academic\* spin-off\*" (All Fields) OR "universit\* spin-off\*" (All Fields) OR "Research-based spin-off\*" (All Fields) OR " spin-off\* academic\*" (All Fields) OR "spin-off\* universit\*" (All Fields) OR "academic\* entrepreneurship\*" (All Fields) OR "entrepreneurship\* academic\*" (All Fields) AND Review Articles (All Document Types).

### **2.5 Data collection**

The bibliographic metadata exported were Author(s)/Editor(s), Title, Source, Accession Number, Author Identifiers, Times Cited Count, ISSN/ISBN, Abstract, Cited References, Document type, Addresses, Cited Reference Count, Source Abbreviation, Page Count, IDS Number, Language, Web of Science Categories, Research Areas, Funding Information, Usage Count, Open Access Indicator, and Hot Paper. The data were loaded in biblioshiny interface according to the tutorial “Biblioshiny for non-coders” (Aria; Cuccurullo, 2017b).

### **3. Results and Discussion**

From the 75.856.191 data records allowed by the Federal University of Sergipe access in WoS, the search resulted in 644 potential publications in many languages and no duplicate records. By using the predefined keywords combination and Booleans in default configuration were identified a total of 1281 documents of those: 941 Articles, 268 Proceeding Papers, 40 Review Articles, 46 Early Access, 27 Editorial Materials, 2 Letter, 1 Book Chapter, and 1 Correction. Then, to proceed with the proposed analysis the 40 Review Articles were selected.

#### **3.1 Dataset**

The main results obtained from the 40 review articles analysis were compiled into three groups: (1) Main data information: Publication Period, Source (Journals), Documents, Average Years since Published, Average Citations per Paper, Average Citations per Year per Paper, and References (2) Document type: Review Article, Early Access (3) Document content: Keywords (ID), Authors Keywords (DE) (4) Authors: Authors, Authorship Appearances, Authors of single-authored papers, Authors of multi-authored papers (5) Collaborative Authors: Single-authored paper, Multi-authored paper, Authors per documents, Co-authors per paper, Collaborative Index (Table 1).

**Table 1.** Main Information on Academic Spin-off collection, data retrieved from WoS.

<b>Groups</b>	<b>Description</b>	<b>Results</b>
<b>Main Data</b>	<b>Period</b>	<b>2006 - 2021</b>
	<b>Information</b>	
	<b>Sources</b>	<b>31</b>
	<b>Documents</b>	<b>40</b>
	<b>Average Years since Published</b>	<b>3.68</b>
	<b>Average Citations per Paper</b>	<b>60.55</b>
	<b>Average Citations per Year per Paper</b>	<b>8.068</b>
	<b>References</b>	<b>3596</b>
<b>Document type</b>	<b>Review Article</b>	<b>38</b>
	<b>Early Access</b>	<b>2</b>
<b>Document content</b>	<b>Keywords</b>	<b>199</b>
	<b>Authors Keywords</b>	<b>136</b>
<b>Authors</b>	<b>Authors</b>	<b>182</b>
	<b>Authorship Appearances</b>	<b>196</b>
	<b>Authors of single-authored papers</b>	<b>4</b>
<b>Collaborative Authors</b>	<b>Single-authored paper</b>	<b>4</b>
	<b>Multi-authored paper</b>	<b>0.22</b>
	<b>Authors per documents</b>	<b>4.55</b>
	<b>Co-authors per paper</b>	<b>4.9</b>
	<b>Collaborative Index</b>	<b>4.94</b>

Regarding the annual scientific production, the Average Citations per Paper, and the Average Citations per Year, with the number of years cited, the years 2018, 2020, and 2021 stand out as the most relevant. As these results are related to Review Articles, they indicate the recent and growing interest in understanding the general context of the topic (Table 2).

**Table 1.** Annual scientific production and Average Citations per Year on *Academic Spin-off*, WoS database.

Year	Number	Mean TC <sup>1</sup> per Article	Mean TC <sup>1</sup> per Year	Citable Years
2006	1	567	35.4	16
2007	1	118	7.9	15
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	1	956	106.2	9
2014	2	16	2	8
2015	0	0	0	0
2016	0	0	0	0
2017	3	39.3	7.9	5
2018	7	65.9	16.5	4
2019	4	18	6	3
2020	10	7	3.5	2
2021	9	3	3	1

<sup>1</sup>TC - Total citation on the WoS main collection

### 3.2 Sources

In terms of the number of publications, it can be cited as the most relevant sources the *journals Journal of Technology Transfer and Technological Forecasting* (4 articles) and *Social Change and the Technological Forecasting and Social Change* (3 articles).

The Most Local Cited Sources parameter referred to the articles in the collection that were cited by the collection authors, which the most-cited sources were the *Reserch Policy* with 396 citations followed by the *Journal Technology Transfer* with 315 citations (Table 3).

**Table 3.** Most Local Cited Sources on the WoS database Collection.

Sources	Articles
<i>Res Policy</i>	396
<i>J Technol Transfer</i>	315
<i>J Bus Venturing</i>	145
<i>Technovation</i>	134
<i>Small Bus Econ</i>	92
<i>Entrep Theory Pract</i>	81
<i>Strategic Manage J</i>	68
<i>Scientometrics</i>	55
<i>Technol Forecast Soc</i>	53
<i>Sci Publ Policy</i>	49
<i>Int Entrep Manag J</i>	40
<i>Organ Sci</i>	40
<i>Manage Sci</i>	39
<i>R&amp;D Manage</i>	39
<i>Ind Corp Change</i>	38
<i>Acad Manage Rev</i>	37
<i>Res Evaluat</i>	35
<i>Acad Manage J</i>	34
<i>Entrep Region Dev</i>	34
<i>J Manage Stud</i>	34

The Source Local Impact was measured by Hirsch's index h- and m- (Hirsch, 2005), Leo Egghe's (2006) g-index, academic entrepreneurship, and the total number of citations. The Source was ranked in descending order based on the h-, m- and g-index, being founded as the most relevant in the field of academic entrepreneurship the *Journal of Technology Transfer*, *Technological Forecasting and Social Change*, *Research Policy*, and *Journal of Business Venturing* (Table 4).

**Table 4.** Source Local Impact on Academic Spin-off, WoS database.

Source	h_index	g_index	m_index	TC <sup>1</sup>	NP <sup>2</sup>	PY_start <sup>3</sup>
<i>Journal of Technology Transfer</i>	4	4	1.0000	129	4	2018
<i>Technological Forecasting and Social Change</i>	2	3	1.0000	22	3	2020
<i>Research Policy</i>	2	2	0.2222	975	2	2013
<i>Journal of Business Venturing</i>	2	2	0.1250	580	2	2006

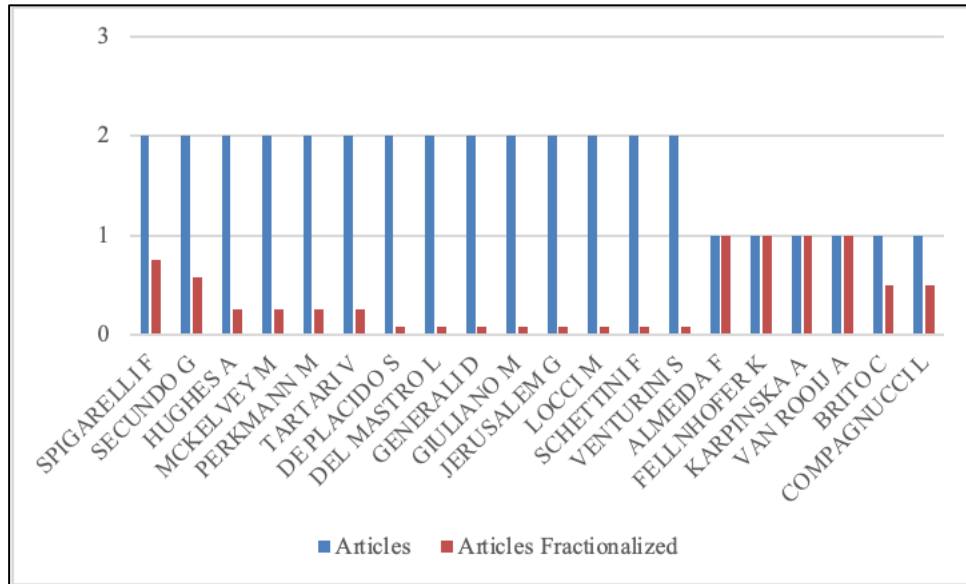
<sup>1</sup> Total Citations

<sup>2</sup> Number of publications

<sup>3</sup> Year of the first publication

### 3.3 Authors

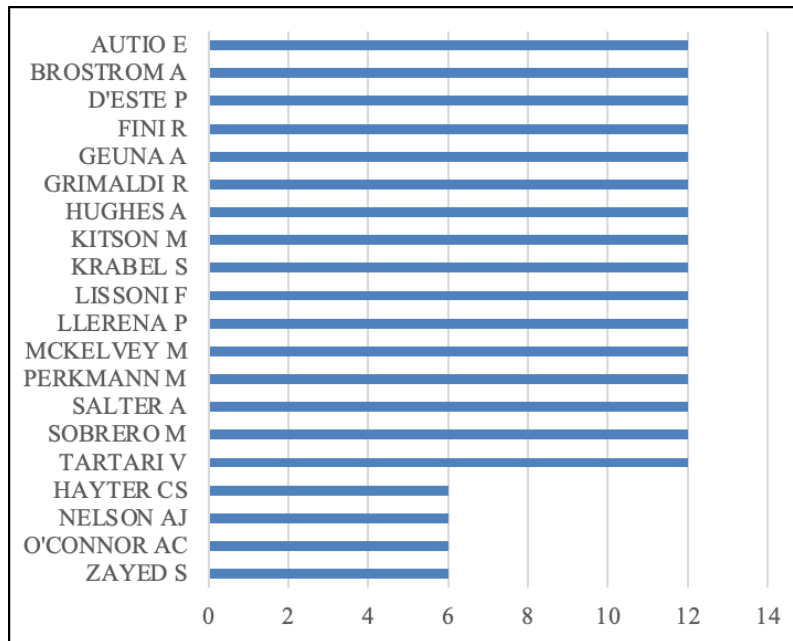
In bibliometrics, research productivity, commonly defined as the number of publications per researcher, distinguishing it from impact, is widely used as an indicator of efficiency. However, due to some limitations of this indicator, other methodologies are also used to analyze and compare author productivity (Abramo & D’Angelo, 2014). The analyzes in the present study used the Article Values and Article Fractionalized (Figure 1).



**Figure 1.** Most Relevant Authors on Academic Spin-off, WoS database.

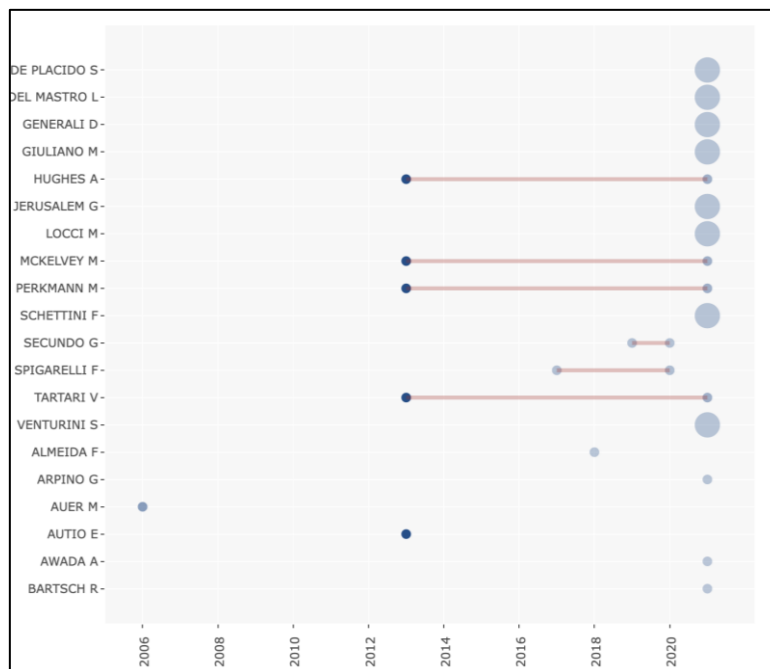
Analyzing how many times an author has been cited by the other authors in the collection (Most local cited authors), it was identified as the most cited authors, with 12 citations each: Autio E, Brostrom A, D’este P, Fini R, Geuna A, Grimaldi R, Hughes A, Kitson M, Krabel S, Lissoni F, Llerena P, Mckelvey M, Perkmann M, Salter A, Sobrero M, Tartari V. These 16 authors wrote together the article Academic engagement: a review of the literature 2011-2019 (Figure 2).





**Figure 2.** Most Local Cited Authors in the analyzed sample of Academic Spin-off articles, WoS database.

For the authors' production over time, it was observed an interval of 7 years between the first and second publications and another 4 years for the third. Since then, in the period examined, every year had a submitted review article, of which 15 were published in 2021, confirming the mentioned recent interest in the topic (Figure 3). The Authors Impact in the evaluated collection (Author Local Impact) were measured by the h-index, m-index g\_index and showed Secundo G. as the most impactful author (Table 5).



**Figure 3.** Top- Authors' Production over Time on Academic Spin-off, WoS database.

**Table 5.** Author Local Impact on Academic Spin-off.

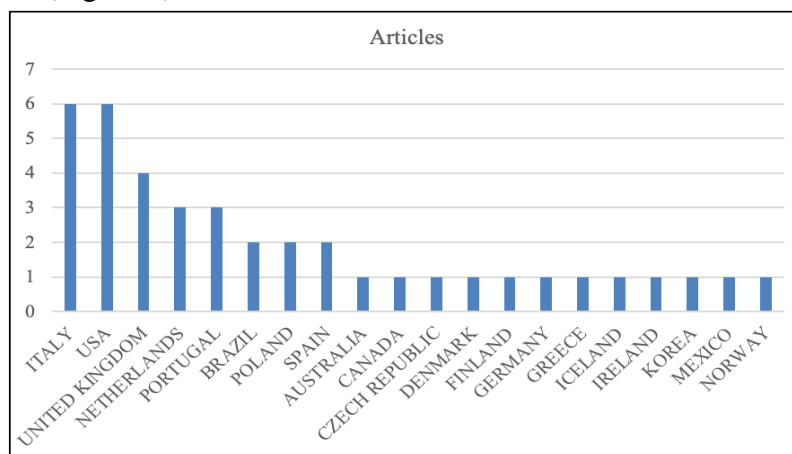
N.	Author	h_index	g_index	m_index	TC <sup>1</sup>	NP <sup>2</sup>	PY start <sup>3</sup>
1	Secundo G	2	2	0.667	20	2	2019
2	Spigarelli F	2	2	0.4	41	2	2017
3	Hughes A	2	2	0.222	975	2	2013
4	Mckelvey M	2	2	0.222	975	2	2013
5	Perkmann M	2	2	0.222	975	2	2013
6	Tartari V	2	2	0.222	975	2	2013
7	Salandra R	1	1	1	19	1	2021
8	Fernandes Ci	1	1	1	6	1	2021
9	Ferreira Jjm	1	1	1	6	1	2021
10	Romero Ec	1	1	1	6	1	2021
11	Arpino G	1	1	1	1	1	2021
12	Connolly N	1	1	1	1	1	2021
13	Conte B	1	1	1	1	1	2021
14	Conte P	1	1	1	1	1	2021
15	Cunningham Ja	1	1	1	1	1	2021
16	De Laurentiis M	1	1	1	1	1	2021
17	De Placido P	1	1	1	1	1	2021
18	De Placido S	1	1	1	1	2	2021
19	Del Mastro L	1	1	1	1	2	2021
20	Di Leo A	1	1	1	1	1	2021

<sup>1</sup> Total Citations

<sup>2</sup> Number of publications

<sup>3</sup> Year of the first publication

The country's relevance was provided by the number of articles published by the authors affiliated with the country, including Single Country Publication (SCP) and Multiple Countries Publication (MCP). The results revealed the production of 6 articles from Italy and the United States of America (USA), 4 articles from the United Kingdom (UK), and 3 articles from the Netherlands and Portugal, being the top 5 most pertinent countries (Figure 4).



**Figure 4.** Number of Single Country Publication (SCP) and Multiple Countries Publication (MCP) articles on Academic Spin-off, WoS database.

Concerning the total citations (in percentage), the countries were ranked as: UK (40.3%), Germany (23.4%), USA (10.1%), Canada (9.2%), Brazil (3.1%), and Ireland (2.9%), comprising 89% of all citations (Table 6).

**Table 6.** Most Cited Countries on Academic Spin-off, WoS database.

<b>N.</b>	<b>Country</b>	<b>Total Citations</b>	<b>Average Article Citations</b>
<b>1</b>	<b>United Kingdom</b>	<b>976</b>	<b>244.00</b>
<b>2</b>	<b>Germany</b>	<b>567</b>	<b>567.00</b>
<b>3</b>	<b>USA</b>	<b>244</b>	<b>40.67</b>
<b>4</b>	<b>Canada</b>	<b>224</b>	<b>224.00</b>
<b>5</b>	<b>Brazil</b>	<b>74</b>	<b>37.00</b>
<b>6</b>	<b>Ireland</b>	<b>71</b>	<b>71.00</b>
<b>7</b>	<b>Netherlands</b>	<b>45</b>	<b>15.00</b>
<b>8</b>	<b>Greece</b>	<b>44</b>	<b>44.00</b>
<b>9</b>	<b>Spain</b>	<b>39</b>	<b>19.50</b>
<b>10</b>	<b>Italy</b>	<b>35</b>	<b>5.83</b>
<b>11</b>	<b>Finland</b>	<b>28</b>	<b>28.00</b>
<b>12</b>	<b>Norway</b>	<b>27</b>	<b>27.00</b>
<b>13</b>	<b>Portugal</b>	<b>27</b>	<b>9.00</b>
<b>14</b>	<b>Denmark</b>	<b>12</b>	<b>12.00</b>
<b>15</b>	<b>Czech Republic</b>	<b>5</b>	<b>5.00</b>
<b>16</b>	<b>Poland</b>	<b>2</b>	<b>1.00</b>
<b>17</b>	<b>Iceland</b>	<b>1</b>	<b>1.00</b>
<b>18</b>	<b>Mexico</b>	<b>1</b>	<b>1.00</b>
<b>19</b>	<b>Australia</b>	<b>0</b>	<b>0.00</b>
<b>20</b>	<b>Korea</b>	<b>0</b>	<b>0.00</b>

### 3.4 Documents

From the WoS retrieved collection the most cited articles in a global scale were: Academic engagement and commercialization: A review of the literature on university-industry relations (Perkmann et al., 2013); The impact of network capabilities and entrepreneurial orientation on university spin-off performance (Walter et al., 2006); The global burden of pediatric and neonatal sepsis: a systematic review (Fleischmann-Struzek et al., 2018); Knowledge conversion capability and the performance of corporate and university spin-offs (Zahra; Van De Velde; Larrañeta, 2007) (Table7).

**Table 7.** Most Global Cited Documents on Academic Spin-off<sup>1</sup>

<b>N.</b>	<b>Paper</b>	<b>Total Citations</b>	<b>TC<sup>2</sup>/Year</b>
1	Perkmann M. 2013. Res Policy	956	106.22
2	Walter A. 2006. J Bus Venturing	567	35.44
3	Fleischmann-Struzek C. 2018. Lancet Resp Med	224	56.00
4	Zahra Sa. 2007. Ind Corp Change	118	7.87
5	Schmitz A. 2017. Int Entrep Manag J	74	14.80
6	Miller K. 2018. R&D Manage	71	17.75
7	Hayter Cs. 2018. J Technol Transfer	63	15.75
8	Nikitovic D. 2018. Front Endocrinol	44	11.00
9	Miranda Fj. 2018. J Technol Transfer	33	8.25
10	Van Wenum M. 2014. Expert Opin Biol Th	28	3.50
11	Fellnhofer K. 2019. Educ Res Rev-Neth	28	9.33
12	Mathisen Mt. 2019. J Technol Transfer	27	9.00
13	Rubens A. 2017. J Enterp Communities	27	5.40
14	Hmieleski Km. 2018. Acad Manage Perspect	22	5.50
15	Perkmann M. 2021. Res Policy	19	19.00
16	Mascarenhas C. 2017. J Enterp Communities	17	3.40
17	Compagnucci L. 2020. Technol Forecast Soc	14	7.00
18	Nsanzumuhire Su. 2020. J Clean Prod	13	6.50
19	Mmbaga Na. 2020. J Bus Venturing	13	6.50
20	Secundo G. 2019. Manage Decis	12	4.00

<sup>1</sup>Elaborated by the authors using the data generated by biblioshiny for bibliometrix

<sup>2</sup> Total Citations

The most influential institutions were the University of Naples Federico II and the University of Cambridge, with 5 and 4 publications respectively (Table 8).

**Table 8.** Authors Most Relevant Affiliations on Academic Spin-off<sup>1</sup>.

<b>N.</b>	<b>Affiliation</b>	<b>Art.</b>	<b>N.</b>	<b>Affiliation</b>	<b>Art.</b>
1	Univ Naples Federico II	5	21	Univ Liege	2
2	Univ Cambridge	4	22	Univ Macerata	2
3	Baylor Coll Med	3	23	Univ Milan	2
4	Copenhagen Business Sch	3	24	Univ Minnesota	2
5	Jena Univ Hosp	3	25	Univ Padua	2
6	Univ Amsterdam	3	26	Univ Porto	2
7	Univ Trieste	3	27	Univ Queensland	2
8	Univ Turin	3	28	Univ Salento	2
9	Charles Univ Prague	2	29	Univ Tras Os Montes And Alto Douro	2
10	Hosp Clin Barcelona	2	30	Xian Jiaotong Liverpool Univ	2
11	Irccs Osped Policlin San Martino	2	31	Aalborg Univ	1
12	Lmu Univ Hosp	2	32	Arizona State Univ	1
13	Queens Univ	2	33	Beta Univ Strasbourg	1
14	Univ Beira Interior	2	34	Bialystok Tech Univ	1
15	Univ British Columbia	2	35	British Columbia Childrens Hosp	1
16	Univ Crete	2	36	Butler Univ	1
17	Univ Extremadura	2	37	Charite Univ Med Berlin	1
18	Univ Fed Fluminense Uff	2	38	Chongqing Univ	1
19	Univ Genoa	2	39	Clemson Univ	1
20	Univ Gothenburg	2	40	Coll Carlo Alberto	1

<sup>1</sup>Elaborated by the authors using the data generated by biblioshiny for bibliometrix

In the evaluation of the Most Frequent Words, 136 different words were identified and classified by the frequency of occurrence. Table 9 listed the top 12 words with a frequency higher than 3, being “academic entrepreneurship” the word with the most appearance.

**Table 9.** Most Frequent Words – Author’s Keywords<sup>1</sup>.

<b>N.</b>	<b>Terms</b>	<b>Frequency</b>
1	academic entrepreneurship	17
2	knowledge transfer	7
3	technology transfer	7
4	entrepreneurial university	6
5	literature review	5
6	bibliometric analysis	3
7	commercialization	3
8	innovation	3
9	systematic literature review	3
10	third mission	3
11	triple helix	3
12	university	3

<sup>1</sup>Elaborated by the authors using the data generated by biblioshiny for bibliometrix

### **3.5 Articles Analyses**

The main purposes of each Review Article were analyzed and classified according to the WoS research areas. In this sense, the publications were divided into the following 4 groups:

#### **3.5.1 The main objectives of Business & Economics and Public Administration research areas**

Almeida (2018): provide a literature review in the field of university spin-offs, searching for the main and least explored dimensions in the university spin-offs research.

Compagnucci & Spigarelli (2020): perform a Systematic Literature Review of the state of knowledge and develops a new framework for the improvement of the Third Mission of universities, revealing the potential and constraints on the theme, especially on the commitment of non-academic stakeholders.

Silva et al. (2021): explore alternative perspectives on academic entrepreneurship typologies.

Guckenbiehl et al. (2021): study the use of knowledge for the innovation of star-ups, while investigating the relationship between knowledge and innovation, categorizing the knowledge into sources, mechanisms, and types; and identifying the antecedents of knowledge, innovation measures, descendants of innovation, moderators, and mediators.

Hemmert et al. (2021): conduct a systematic review of the studies on the entrepreneurship of new ventures in East Asia that have been published in Social Science Citation Index (SSCI)-listed journals between 2000 and 2020.

Hmieleski & Powell (2018): summarize the recent literature focused on the psychological aspects of academic scientists' engagement in university science commercialization activities, especially related to the topics of human capital, social capital, heterogeneous objectives, and demographic characteristics. Also, the review article aims to offer suggestions for potential theoretical and methodological advances to the studied literature and discuss the emerging trends in university science commercialization and the important part that individual academic scientists will likely need to play in order to ensure the future viability of universities' efforts to both generate and appropriate value from such activities.

Kobylińska & Lavios (2020): analyze the state of research in the field of the university ecosystem of academic entrepreneurship and identify the main research trends also related to this topic.

Maresova et al. (2019): detail existing models, processes, and roles assumed in some countries where sharing of intellectual property exists and is linked with aspects of university-industry technology transfer, such as policies surrounding patenting, government investment and marketing, and the process of academic entrepreneurship, etc.

Mascarenhas et al. (2017): describe how the research related to the entrepreneurial university is organized in terms of publications, authors, and sources; and identify the main cited references and the form they are grouped. The article also discusses how the literature presents the challenges and analyzes the research trends to identify the emerging areas in this field.

Miller et al. (2018): explore the changes in the role of academics to identify the main differences between entrepreneurial academics and academic entrepreneurs.

Mmbaga et al. (2020): identify the roles in entrepreneurship, and the theoretical discussions and methodological advancements, to then develop an organizing framework that reflects these discussions

within the body of research (distinctions, variations, constructions, and intersections). The authors plot a path for future research that reflects the broad spectrum of views in the literature, they propose new opportunities for research that takes a network-based approach, explores post-emergent venture states of identity and moves the study of identity to the digital world of online communities.

Neves & Brito (2020): evaluate the variable that encourages the individuals inside the academic community to get involved in knowledge exploitation activities. The study proposes to answer the question “What are the drivers of academic entrepreneurial intentions?”

Perkmann et al. (2013): provide a systematic review on academic engagement, which is defined as the knowledge-related collaboration between academic scientists and external organizations. These interactions include activities such as collaborative research, contract research, consulting, and informal relationships university-industry.

Perkmann et al. (2021): provide a systematic literature review related to the academic scientists' engagement in activities such as collaborative research, contract research, consulting, and informal ties for the knowledge transfer for university-industry, referred by the authors as “Academic engagement”. To answer the question of how academic engagement is distinct from commercialization. defined as the creation of intellectual property and faculty entrepreneurship, while identifying the individual, organizational and institutional antecedents of academic engagement and its consequences, to compare with commercialization antecedents and consequences.

Rubens et al. (2017): evaluate the challenges of the Higher Education Institution in fulfilling the third mission for economic development and the changing role of being an entrepreneurial university and the changes that need to be implemented to succeded in this new mission.

Schmitz et al. (2017): explore the scientific literature on innovation and entrepreneurship in the academic scenario, describing how the research field is organized, to identify the main terms and definitions, theoretical frameworks, and empirical models in order to direct future research.

Secundo et al. (2019): review and critique the knowledge management literature within Entrepreneurial universities, providing an overview of the state of research and outlining a future research agenda. The author's results show a failure to address the implications of findings for policymakers, which risks making knowledge management in entrepreneurial universities research irrelevant.

Secundo et al. (2020): review the literature on academic entrepreneurship according to the emergence of powerful digital technologies, providing a broad vision of the research state and outlining a future research agenda on digital academic entrepreneurship.

Terán - Pérez et al. (2020): identify how information on the field of academic entrepreneurship is organized and the theoretical and methodological approaches in the literature. The findings confirm that there is growing literature related to academic entrepreneurship, but it is fragmented under heterogeneous theoretical approaches. Then, quantitative methodologies are on the rise and future holistic research is suggested.

Walter et al. (2006): investigate the impact of network capability, defined as a firm's ability to develop and utilize inter-organizational relationships, and entrepreneurial orientation on organizational performance.

Zahra et al. (2007): use the knowledge-based theory to argue that transforming spin-off inventions into new products, goods, and services that create value, requires a knowledge conversion capability composed of three components: conceptualization and visioning of applications of that knowledge; configuration and design of potential products and other applications; and the embodiment and integration of knowledge into products.

### ***3.5.2 The main objectives of Engineering; Business & Economics; Information Science & Library Science; Science & Technology - Other Topics; Engineering; and Environmental Sciences & Ecology research areas***

Hayter et al. (2018): understand how academic entrepreneurship is conceptualized and the extent to which it adopts an ecosystem approach. The authors' results highlight that scholars have focused on individual ecosystem elements and characteristics, avoiding strategic and systemic conceptualizations of entrepreneurship ecosystems.

Mathisen & Rasmussen (2019): provides a systematic review of the recent research stream addressing the development, growth, and performance of university spin-offs. The results present a conceptual framework outlining the variety of outcomes used in the literature to assess the development, growth, and performance of university spin-offs, as well as the determinants of these outcomes at different levels of analysis.

Miranda et al. (2018): identify and evaluate the literature on university spin-offs to highlight what, by whom, where and how it has been researched. The review provides for the researched findings a classification into three levels (individual, firm, and institutional context) each concerning characteristics, antecedents, and outcomes of entrepreneurial activities.

Nsanzumuhire & Groot (2020): a systematic review of the literature to cover that gap by integrating the literature on University-Industry Collaboration implementation processes from a holistic and economic perspective in the context of developed and developing countries.

Pedersen et al. (2020): examine key methodological components used to assess research impact comparing the advantages and disadvantages of each method. The study explores the literature on 'research impact' in the social sciences and humanities by providing a comprehensive review of available literature, drawing on national and international experiences, and taking a systematic look at the impact agenda within social sciences and humanities.

Romero et al. (2021): identify the different theoretical approaches to entrepreneurial universities prevalent in the literature. From the bibliometric analysis, the authors identified six distinct approaches on entrepreneurial university: the triple helix model, the knowledge society model, the global perspective, the researcher-entrepreneur model, the dual personality approach, and the frenzied approach.



**3.5.3 The main objectives of Biochemistry & Molecular Biology; Chemistry; Biotechnology & Applied Microbiology; Research & Experimental Medicine; Endocrinology & Metabolism; General & Internal Medicine; Respiratory System; Obstetrics & Gynecology; Reproductive Biology; Oncology; Pharmacology & Pharmacy research areas**

Fleischmann-Struzek et al. (2018): provide a systematic review and meta-analysis of studies reporting population-based sepsis incidence in neonates and children published between 1979 and 2016. Thus, this article is unrelated to the subject in discussion.

Ismail et al. (2021): present a logical basis for the optimization of the forceps dimensions based on the findings of our previous systematic review and an original series of meant vertical and biparietal diameter measurements using laser scanning technology. This article is also unrelated to the subject in discussion.

Kinch et al. (2020): evaluate the role of academic entrepreneurship in general and the National Institutes of Health (NIH) as support for investigators in particular.

Nikitovic et al. (2018): discusses the roles of Proteoglycans in cancer progression, developing technologies utilized for defining the PG “signature” in disease, and how this may facilitate the generation of tailor-made cancer strategies. This article is also unrelated to the subject in discussion.

Schettini et al. (2021a): conduce a review of the most updated literature on the active chemotherapies in breast cancer and dissected the potential role of Non-pegylated liposomal doxorubicin in the evolving therapeutic algorithms. This article is also unrelated to the subject in discussion.

Schettini et al. (2021b): perform a systematic review and meta-analysis of the literature on endocrine-based treatments in clinically-relevant subgroups of hormone receptor-positive/negative metastatic breast cancer. This article is also unrelated to the subject in discussion.

Sferrazza et al. (2021): review the whole scientific production, with a special focus on the last decade, in order to update phytochemistry, biological activities, nutritional properties, toxicological aspect, and regulatory classification of *H. dulcis* extracts for its use in the European Union.

van Wenum et al. (2014): present an overview of HepaRG cells as a promising biocomponent for clinical Bioartificial livers application, based on their proliferative and differentiation capacity. This article is also unrelated to the subject in discussion.

**3.5.4 The main objectives of Education & Educational Research; History & Philosophy of Science; Social Sciences - Other Topics da based on WoS research areas**

Fellnhofer (2019): systematically explore and cluster the entrepreneurship education research literature to deliver a taxonomic scheme that can serve as a basis for future research.

Karpińska (2020): explores the relationship between the European Union’s innovation strategy and the Polish science policy.

Schnurbus & Edvardsson (2020): analyze the Third Mission of universities within Nordic countries and the universities' approach to implementing the mission into their strategy.

van Rooij (2014): uses the existing literature to answer several straightforward questions about the creation of innovations with university knowledge production: how does it happen, to what extent, and if it is desirable.

Walsh et al. (2021): provide a systematic review aiming to address the deficit of the literature on academic entrepreneurship within business schools and identify what business schools do to support academic entrepreneurship, as well as to outline a future research agenda.

#### **4. Conclusion**

None of the 40 Review Articles retrieved from the Web of Science database and examined had focused on parameters for evaluating the viability of intellectual property to create Academic Spin-offs. The contribution from the research areas of Biochemistry & Molecular Biology; Chemistry; Biotechnology & Applied Microbiology; Research & Experimental Medicine; Endocrinology & Metabolism; General & Internal Medicine; Respiratory System; Obstetrics & Gynecology; Reproductive Biology; Oncology; Pharmacology & Pharmacy on the studied subject had been shown to be limited and should be excluded in a future search.

Although it was found in the scope of some analyzed reviews the study of models that address technology transfer and empiric models in the academic scenario, in the selected collection was not identified any review paper that provided a search for models on academic entrepreneurship that is related to the viability of intellectual property as products to be commercialized. In addition, the word academic entrepreneurship stands out as the most frequent word to represent the research which can be utilized as the main keyword in future studies.

#### **5. Acknowledgement**

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).

#### **6. References**

- Abramo, G., & D'Angelo, C. A. (2014). How do you define and measure research productivity? *Scientometrics*, 101(2), 1129–1144. <https://doi.org/10.1007/s11192-014-1269-8>
- Agarwal, S., Ramadani, V., Gerguri-Rashiti, S., Agrawal, V., & Dixit, J. K. (2020). Inclusivity of entrepreneurship education on entrepreneurial attitude among young community: evidence from India. *Journal of Enterprising Communities*, 14(2), 299–319. <https://doi.org/10.1108/JEC-03-2020-0024>
- Allen, S. D., Link, A. N., & Rosenbaum, D. T. (2007). Entrepreneurship and human capital: Evidence of patenting activity from the academic sector. *Entrepreneurship: Theory and Practice*, 31(6), 937–951. <https://doi.org/10.1111/j.1540-6520.2007.00207.x>
- Almeida, F. L. (2018). Insights and Perspectives from a Literature Review on University Spin-Offs. *Management Research and Practice*, 10(2), 27–40. [www.mrp.ase.ro](http://www.mrp.ase.ro)

- Aria, M., & Cuccurullo, C. (2017a). 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. (2017b). Biblioshiny: Bibliometrix for no coders. *Bibliometrix.Org*. <https://www.bibliometrix.org/biblioshiny/assets/player/KeynoteDHTMLPlayer.html#0>
- Audretsch, D. B., Aldridge, T. T., & Sanders, M. (2011). Social capital building and new business formation: A case study in Silicon Valley. *International Small Business Journal*, 29(2), 152–169. <https://doi.org/10.1177/0266242610391939>
- Carlsson, B., Acs, Z. J., Audretsch, D. B., & Braunerhjelm, P. (2009). Knowledge creation, entrepreneurship, and economic growth: A historical review. *Industrial and Corporate Change*, 18(6), 1193–1229. <https://doi.org/10.1093/icc/dtp043>
- Cerver Romero, E., Ferreira, J. J. M., & Fernandes, C. I. (2021). The multiple faces of the entrepreneurial university: a review of the prevailing theoretical approaches. *Journal of Technology Transfer*, 46(4), 1173–1195. <https://doi.org/10.1007/s10961-020-09815-4>
- Chapman, D., Smith, H. L., Wood, P., Barnes, T., & Romeo, S. (2011). University Enterprise: The Growth and Impact of University-Related Companies in London. *Industry and Higher Education*, 25(6), 483–492. <https://doi.org/10.5367/ihe.2011.0066>
- Compagnucci, L., & Spigarelli, F. (2020). The Third Mission of the university: A systematic literature review on potentials and constraints. *Technological Forecasting and Social Change*, 161. <https://doi.org/10.1016/j.techfore.2020.120284>
- Davidsson, P., & Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of Business Venturing*, 18(3), 301–331. [https://doi.org/10.1016/S0883-9026\(02\)00097-6](https://doi.org/10.1016/S0883-9026(02)00097-6)
- 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>
- Egghe, L. (2006). Theory and practise of the g-index. *Scientometrics*, 69(1), 131–152. <https://doi.org/10.1007/s11192-006-0144-7>
- Etzkowitz, H. (1998). The norms of entrepreneurial science: Cognitive effects of the new university-industry linkages. *Research Policy*, 27(8), 823–833. [https://doi.org/10.1016/S0048-7333\(98\)00093-6](https://doi.org/10.1016/S0048-7333(98)00093-6)
- 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., Mack, A., Schaffer, T., Scopa, J., Guo, L., & Pospelova, T. (2020). Innovation by design: SPARK and the Overcoming of Stanford University’s Translational “Valley of Death” in Bio-Medicine. *Managerial and Decision Economics*, 41(6), 1113–1125. <https://doi.org/10.1002/mde.2966>
- Figueiredo, D. B., Paranhos, R., Silva, J. A. da, Rocha, E. C. da, & Alves, D. P. (2014). O que é, para que serve e como se faz uma meta-análise? *Teoria e Pesquisa*, 23(2), 205–228. <https://doi.org/10.4322/tp.2014.018>
- Fleischmann-Struzek, C., Goldfarb, D. M., Schlattmann, P., Schlapbach, L. J., Reinhart, K., & Kisson, N. (2018). The global burden of paediatric and neonatal sepsis: a systematic review. *The Lancet Respiratory Medicine*, 6(3), 223–230. [https://doi.org/10.1016/S2213-2600\(18\)30063-8](https://doi.org/10.1016/S2213-2600(18)30063-8)

- Fellnhofer, K. (2019). Toward a taxonomy of entrepreneurship education research literature: A bibliometric mapping and visualization. *Educational Research Review*, 27, 28–55. <https://doi.org/10.1016/j.edurev.2018.10.002>
- Fleischmann-Struzek, C., Goldfarb, D. M., Schlattmann, P., Schlapbach, L. J., Reinhart, K., & Kisson, N. (2018). The global burden of paediatric and neonatal sepsis: a systematic review. *The Lancet Respiratory Medicine*, 6(3), 223–230. [https://doi.org/10.1016/S2213-2600\(18\)30063-8](https://doi.org/10.1016/S2213-2600(18)30063-8)
- Guckenbiehl, P., Corral de Zubielqui, G., & Lindsay, N. (2021). Knowledge and innovation in start-up ventures: A systematic literature review and research agenda. *Technological Forecasting and Social Change*, 172. <https://doi.org/10.1016/j.techfore.2021.121026>
- 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>
- Hayter, C. S., Nelson, A. J., Zayed, S., & O'Connor, A. C. (2018). Conceptualizing academic entrepreneurship ecosystems: a review, analysis and extension of the literature. *Journal of Technology Transfer*, 43(4), 1039–1082. <https://doi.org/10.1007/s10961-018-9657-5>
- Hemmer, M., Cross, A. R., Cheng, Y., Kim, J. J., Kotosaka, M., Waldenberger, F., & Zheng, L. J. (2021). New venture entrepreneurship and context in East Asia: a systematic literature review. *Asian Business and Management*, 1–35. <https://doi.org/10.1057/s41291-021-00163-1>
- 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>
- Hmieleski, K. M., & Powell, E. E. (2018). The psychological foundations of university science commercialization: A review of the literature and directions for future research. *Academy of Management Perspectives*, 32(1), 43–77. <https://doi.org/10.5465/amp.2016.0139>
- IBGE. (2014a). Pesquisa de Inovação (PINTEC). In Pesquisa de Inovação 2014. [http://www.pintec.ibge.gov.br/downloads/PUBLICACAO/PUBLICAÇÃO PINTEC 2014.pdf](http://www.pintec.ibge.gov.br/downloads/PUBLICACAO/PUBLICAÇÃO%20PINTEC%202014.pdf)
- IBGE, I. B. de G. e E.-. (2014b). Demografia das Empresas. Estudos & Pesquisa - Informação Econômica. <https://agenciadenoticias.ibge.gov.br/agencia-sala-de-imprensa/2013-agencia-de-noticias/releases/25738-demografia-das-empresas-e-empreendedorismo-2017-taxa-de-sobrevivencia-foi-de-84-8>
- Ismail, A. Q. T., Fritze, A., Rüdiger, M., & Ismail, K. M. (2021). Obstetric forceps dimensions and the newborn head biometry: Time for an update. *European Journal of Obstetrics and Gynecology and Reproductive Biology*, 256, 270–273. <https://doi.org/10.1016/j.ejogrb.2020.11.046>
- Karpińska, A. (2020). Innovation and science dilemmas. Unintended consequences of innovation policy for science. Polish experience. *Cogent Social Sciences*, 6(1), 1718055. <https://doi.org/10.1080/23311886.2020.1718055>
- Kinch, M. S., Horn, C., Kraft, Z., & Schwartz, T. (2020). Expanding roles for academic entrepreneurship in drug discovery. *Drug Discovery Today*, 25(11), 1905–1909. <https://doi.org/10.1016/j.drudis.2020.09.004>

- Kobylińska, U., & Lavios, J. J. (2020). Development of research on the university entrepreneurship ecosystem: Trends and areas of interest of researchers based on a systematic review of literature. *Oeconomia Copernicana*, 11(1), 117–133. <https://doi.org/10.24136/oc.2020.005>
- Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *BMJ (Clinical Research Ed.)*, 339. <https://doi.org/10.1136/bmj.b2700>
- Maresova, P., Stemberkova, R., & Fadeyi, O. (2019). Models, Processes, and Roles of Universities in Technology Transfer Management: A Systematic Review. *Administrative Sciences*, 9(3), 67. <https://doi.org/10.3390/admsci9030067>
- Mascarenhas, C., Marques, C. S., Galvão, A. R., & Santos, G. (2017). Entrepreneurial university: towards a better understanding of past trends and future directions. *Journal of Enterprising Communities*, 11(3), 316–338. <https://doi.org/10.1108/JEC-02-2017-0019>
- Mathisen, M. T., & Rasmussen, E. (2019). The development, growth, and performance of university spin-offs: a critical review. *Journal of Technology Transfer*, 44(6), 1891–1938. <https://doi.org/10.1007/S10961-018-09714-9/TABLES/9>
- McNeill, M. (2020). About RStudio. *Rstudio (R)*. <https://rstudio.com/about/>
- Miller, K., McAdam, R., & McAdam, M. (2018). A systematic literature review of university technology transfer from a quadruple helix perspective: toward a research agenda. *R and D Management*, 48(1), 7–24. <https://doi.org/10.1111/radm.12228>
- Miranda, F. J., Chamorro, A., & Rubio, S. (2018). Re-thinking university spin-off: a critical literature review and a research agenda. *Journal of Technology Transfer*, 43(4), 1007–1038. <https://doi.org/10.1007/s10961-017-9647-z>
- Mmbaga, N. A., Mathias, B. D., Williams, D. W., & Cardon, M. S. (2020). A review of and future agenda for research on identity in entrepreneurship. *Journal of Business Venturing*, 35(6). <https://doi.org/10.1016/j.jbusvent.2020.106049>
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., Altman, D., Antes, G., Atkins, D., Barbour, V., Barrowman, N., Berlin, J. A., Clark, J., Clarke, M., Cook, D., D'Amico, R., Deeks, J. J., Devereaux, P. J., Dickersin, K., Egger, M., Ernst, E., ... Tugwell, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. In *PLoS Medicine* (Vol. 6, Issue 7). <https://doi.org/10.1371/journal.pmed.1000097>
- Neves, S., Brito, C. (2020). Academic entrepreneurship intentions: a systematic literature review. *Journal of Management Development* 645. <https://doi.org/10.1108/JMD-11-2019-0451>
- Nikitovic, D., Berdiaki, A., Spyridaki, I., Krasanakis, T., Tsatsakis, A., & Tzanakakis, G. N. (2018). Proteoglycans-Biomarkers and targets in cancer therapy. *Frontiers in Endocrinology*, 9(MAR). <https://doi.org/10.3389/fendo.2018.00069>
- Nsanzumuhire, S. U., & Groot, W. (2020). Context perspective on University-Industry Collaboration processes: A systematic review of literature. *Journal of Cleaner Production*, 258. <https://doi.org/10.1016/j.jclepro.2020.120861>



- OECD Environmental Indicators. (2001). OECD Environmental Indicators. <https://doi.org/10.1787/9789264193499-en>
- OECD, O. for E. C. and D. (2007). Survival and Growth 6 45 Eurostat – OECD Manual on Business Demography Statistics 6.1 Survival of newly born enterprises Typology of survival.
- 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>
- O’Shea, R. P., Chugh, H., & Allen, T. J. (2008). Determinants and consequences of university spinoff activity: A conceptual framework. *Journal of Technology Transfer*, 33(6), 653–666. <https://doi.org/10.1007/s10961-007-9060-0>
- O’Shea, Rory ; Allen, Thomas ; O’Gorman, Colm ; Roche, F. (2004). Universities and Technology Transfer : A Review of Academic Entrepreneurship Literature. *Irish Journal of Management*, 25(2), 11–29. <http://proquest.umi.com/pqdweb?did=886737421&Fmt=7&clientId=11502&RQT=309&VName=PQD>
- Pedersen, D. B., Grønvad, J. F., & Hvidtfeldt, R. (2020). Methods for mapping the impact of social sciences and humanities—A literature review. *Research Evaluation*, 29(1), 4–21. <https://doi.org/10.1093/RESEVAL/RVZ033>
- Perkmann, M., Salandra, R., Tartari, V., McKelvey, M., & Hughes, A. (2021). Academic engagement: A review of the literature 2011-2019. *Research Policy*, 50(1). <https://doi.org/10.1016/j.respol.2020.104114>
- Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D’Este, P., Fini, R., Geuna, A., Grimaldi, R., Hughes, A., Krabel, S., Kitson, M., Llerena, P., Lissoni, F., Salter, A., & 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>
- R Foundation. (2021). What is R? Web Page R Foundation. <https://www.r-project.org/about.html>
- Rubens, A., Spigarelli, F., Cavicchi, A., & Rinaldi, C. (2017). Universities’ third mission and the entrepreneurial university and the challenges they bring to higher education institutions. In *Journal of Enterprising Communities* (Vol. 11, Issue 3, pp. 354–372). <https://doi.org/10.1108/JEC-01-2017-0006>
- Schettini, F., Giuliano, M., Giudici, F., Conte, B., de Placido, P., Venturini, S., Rognoni, C., Leo, A. di, Locci, M., Jerusalem, G., Mastro, L. del, Puglisi, F., Conte, P., de Laurentiis, M., Puzsai, L., Rimawi, M. F., Schiff, R., Arpino, G., de Placido, S., ... Generali, D. (2021a). Endocrine-based treatments in clinically-relevant subgroups of hormone receptor-positive/her2-negative metastatic breast cancer: Systematic review and meta-analysis. *Cancers*, 13(6), 1–21. <https://doi.org/10.3390/cancers13061458>
- Schettini, F., Giuliano, M., Lambertini, M., Bartsch, R., Pinato, D. J., Onesti, C. E., Harbeck, N., Lüftner, D., Rottey, S., van Dam, P. A., Zaman, K., Mustacchi, G., Gligorov, J., Awada, A., Campone, M.,

- Wildiers, H., Gennari, A., Tjan-heijnen, V. C. G., Cortes, J., ... Generali, D. (2021b). Anthracyclines strike back: Rediscovering non-pegylated liposomal doxorubicin in current therapeutic scenarios of breast cancer. *Cancers*, 13(17), 4421. <https://doi.org/10.3390/cancers13174421>
- Schmitz, A., Urbano, D., Dandolini, G. A., de Souza, J. A., & Guerrero, M. (2017). Innovation and entrepreneurship in the academic setting: a systematic literature review. *International Entrepreneurship and Management Journal*, 13(2), 369–395. <https://doi.org/10.1007/s11365-016-0401-z>
- Schnurbus, V., & Edvardsson, I. R. (2020). The Third Mission Among Nordic Universities: A Systematic Literature Review. *Scandinavian Journal of Educational Research*. <https://doi.org/10.1080/00313831.2020.1816577>
- SEBRAE. (2010). Doze Anos de Monitoramento da Sobrevivência e Mortalidade de Empresas. In *Sistema Brasileiro de Apoio às Micro e Pequenas Empresas*. [http://www.sebraesp.com.br/arquivos\\_site/biblioteca/EstudosPesquisas/mortalidade/mortalidade\\_12\\_anos.pdf](http://www.sebraesp.com.br/arquivos_site/biblioteca/EstudosPesquisas/mortalidade/mortalidade_12_anos.pdf)
- Sebrae, S. B. de A. às M. e P. E. (2017). *Panorama dos Pequenos Negócios: 2017: SEBRAE-SP*. <https://www.sebrae.com.br/Sebrae/Portal>  
[Sebrae/UFs/SP/Pesquisas/Panorama\\_dos\\_Pequenos\\_Negocios\\_2018\\_AF.pdf](https://www.sebrae.com.br/Sebrae/Portal/Sebrae/UFs/SP/Pesquisas/Panorama_dos_Pequenos_Negocios_2018_AF.pdf)
- Sebrae, S. B. de A. às M. e P. E. (2019). *Panorama SEBRAE: Janeiro/2019*. [datasebrae.com.br/wp-content/uploads/2019/02/Panorama-Sebrae\\_012019.pdf](https://www.datasebrae.com.br/wp-content/uploads/2019/02/Panorama-Sebrae_012019.pdf)
- Secundo, G., Ndou, V., del Vecchio, P., & de Pascale, G. (2019). Knowledge management in entrepreneurial universities: A structured literature review and avenue for future research agenda. *Management Decision*, 57(12), 3226–3257. <https://doi.org/10.1108/MD-11-2018-1266>
- Secundo, G., Rippa, P., & Meoli, M. (2020). Digital transformation in entrepreneurship education centres: preliminary evidence from the Italian Contamination Labs network. *International Journal of Entrepreneurial Behaviour and Research*, 26(7), 1589–1605. <https://doi.org/10.1108/IJEER-11-2019-0618>
- Sferrazza, G., Brusotti, G., Zonfrillo, M., Temporini, C., Tengattini, S., Bononi, M., Tateo, F., Calleri, E., & Pierimarchi, P. (2021). *Hovenia dulcis thumberg: Phytochemistry, pharmacology, toxicology and regulatory framework for its use in the european union*. *Molecules*, 26(4). <https://doi.org/10.3390/molecules26040903>
- Silva, C. F. da, Ramos Filho, A. D. C., Renault, T. B., Fonseca, M. V. D. A., & Yates, S. (2021). Tipologias de Empreendedores Acadêmicos e Limites e Possibilidades da Integração com Empresas e o Estado. *Revista Administração Em Diálogo - RAD*, 23(2), 121–140. <https://doi.org/10.23925/2178-0080.2021v23i2.50713>
- Stal, E., & Fujino, A. (2006). Industry-University Relationship in Brazil Under the Innovation Act. *Review of Administration and Innovation - RAI*, 2(1), 5–19. <https://doi.org/10.5585/rai.v2i1.30>
- Terán - Pérez, B. M., Valdez Lafarga, C., & Miranda Félix, A. (2020). Emprendimiento académico y spin-off universitario: una revisión sistemática de la literatura. *Revista Perspectiva Empresarial*, 7(1), 87–103. <https://doi.org/10.16967/23898186.630>

- Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., ... 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>
- van Rooij, A. (2014). University Knowledge Production and Innovation: Getting a Grip. In *Minerva* (Vol. 52, Issue 2, pp. 263–272). <https://doi.org/10.1007/s11024-014-9254-1>
- van Wenum, M., Chamuleau, R. A., van Gulik, T. M., Siliakus, A., Seppen, J., & Hoekstra, R. (2014). Bioartificial livers in vitro and in vivo: Tailoring biocomponents to the expanding variety of applications. *Expert Opinion on Biological Therapy*, 14(12), 1745–1760. <https://doi.org/10.1517/14712598.2014.950651>
- Walsh, G. S., Cunningham, J. A., Mordue, T., McLeay, F., O'Kane, C., & Connolly, N. (2021). What business schools do to support academic entrepreneurship: a systematic literature review and future research agenda. *Studies in Higher Education*, 46(5), 988–999. <https://doi.org/10.1080/03075079.2021.1896805>
- Walter, A., Auer, M., & Ritter, T. (2006). The impact of network capabilities and entrepreneurial orientation on university spin-off performance. *Journal of Business Venturing*, 21(4), 541–567. <https://doi.org/10.1016/j.jbusvent.2005.02.005>
- 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>
- Zahra, S. A., van de Velde, E., & Larrañeta, B. (2007). Knowledge conversion capability and the performance of corporate and university spin-offs. *Industrial and Corporate Change*, 16(4), 569–608. <https://doi.org/10.1093/icc/dtm018>