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Exploring entrepreneurial universities: a bibliometric analysis in the business and management fields

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Abstract. The following paper features a comprehensive bibliometric analysis of the available literature concerning entrepreneurial universities in the business and management fields. Through scientific databases of Web of Science, 511 papers were ensured and systematically compiled using Bibliometrix-an RStudio package for performance analytics and Science Mapping. It reveals the history of contributing authors, institutions, themes, and geographic focus of articles, published in the field of entrepreneurial universities. The findings show that the topic in question has been gaining more and more attention in recent decades and more publications have been increasingly produced. It revealed renowned writers including Henry Etzkowitz, Loet Leydesdorff, David Audretsch, and distinguished universities including Stanford University, Massachusetts Institute of Technology, and University of Cambridge. Qualitative content analysis identifies several broad research themes, such as university business relations, technology transfer and commercialization, entrepreneurship teaching, and policy. In addition, they emphasize the global significance of entrepreneurial universities based on the contributions of researchers and institutions from around the world. As demonstrated by the United States and Europe being the most productive and relevant regions, it is also imperative that the Asia-Pacific, Latin America, and Africa also offer impressive entrepreneurial output contributing to innovation and economic growth in various geographical environments. Consequently, the results of this study hold important implications for policymakers, educators, and practice in the areas of higher education and entrepreneurship. Policy makers can employ them to formulate better policies and frameworks that will be helpful for entrepreneurial universities and the development of innovation regimes. They can utilise the findings to enhance the curriculum and the programs which could foster the entrepreneurial disposition and skills among students. The study findings will be useful to practitioners such as university administrators and leaders from other sectors to understand and address the drivers of entrepreneurship and technology transfer. In sum, this research serves to extend the body of knowledge and guide policy/practice in the area of entrepreneurial universities.

Key words: bibliometric analysis, entrepreneurial universities, innovation, economic growth, university business relations, technology commercialization, entrepreneurship training.

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Изучение предпринимательских вузов: библиометрический анализ в сфере бизнеса и менеджмента

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Аннотация. В следующей статье представлен всесторонний библиометрический анализ доступной литературы, посвященной предпринимательским вузам в области бизнеса и менеджмента. Через научные базы данных Web of Science было получено и систематически скомпилировано 511 статей с использованием Bibliometrix — пакета RStudio для анализа производительности и построения научных карт. Он раскрывает историю авторов, учреждений, тем и географическую направленность статей, опубликованных в области предпринимательских вузов. Результаты показывают, что рассматриваемая тема в последние десятилетия привлекает все больше внимания и появляется все больше публикаций. В нем были представлены известные авторы, в том числе Генри Ицковиц, Лоэт Лейдесдорф, Дэвид

Одреч, а также выдающиеся университеты, включая Стэнфордский университет, Массачусетский технологический институт и Кембриджский университет. Качественный контент-анализ определяет несколько широких тем исследований, таких как деловые отношения вузов, передача и коммерциализация технологий, обучение предпринимательству и политика. Кроме того, они подчеркивают глобальное значение предпринимательских вузов, основанное на вкладе исследователей и учреждений со всего мира. Как показывает тот факт, что Соединенные Штаты и Европа являются наиболее продуктивными и значимыми регионами, также крайне важно, чтобы Азиатско-Тихоокеанский регион, Латинская Америка и Африка также предлагали впечатляющие предпринимательские результаты, способствующие инновациям и экономическому росту в различных географических средах. Следовательно, результаты этого исследования имеют важное значение для политиков, преподавателей и практиков в области высшего образования и предпринимательства. Политики могут использовать их для формулирования более эффективной политики и рамок, которые будут полезны для предпринимательских вузов и развития инновационных режимов. Они могут использовать полученные результаты для улучшения учебных программ и программ, которые могли бы способствовать развитию предпринимательских способностей и навыков среди студентов. Результаты исследования будут полезны специалистам-практикам, таким как администраторы вузов и руководители других секторов, для понимания и устранения движущих сил предпринимательства и передачи технологий. В целом, это исследование призвано расширить объем знаний и направить политику/практику в области предпринимательских вузов.

Ключевые слова: библиометрический анализ, предпринимательские вузы, инновации, экономический рост, деловые отношения вузов, коммерциализация технологий, обучение предпринимательству.

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1. Introduction

The idea of entrepreneurial universities has received much attention since the early 1990s highlighting a new perspective of the universities' roles in globalized, knowledge-based economies. Successful entrepreneurial universities are also thrusting to develop and market knowledge, to encourage students and academic staff to be innovative, and to establish strong links with business and administrative institutions. These institutions are not only playing educational functions but also playing their part to promote economic and technological growth. In the context of business and management, the exploration of entrepreneurial universities is particularly appropriate. These universities are on the forefront helping to spur regional and national economic development, technology transfer, and the fostering of entrepreneurial culture. They help start-ups and spin-offs to finance innovation through the provision of capital, employment generation, and enhancement of competitiveness in the global market. Analyzing the forces driving the evolution of entrepreneurial universities can equip policymakers, faculty, and other stakeholders interested in strengthening the linkages between universities

and the larger society with valuable insights. This paper intends to map out the current state of research on entrepreneurial universities focused in the business and management disciplines using bibliometrics. Thus, the specific aims are to map out the scholarly work published in this area over time, detect the concepts, social and intellectual frameworks of this research area, and pinpoint key topics under consideration and gaps within the field. Thus, the study provides both the state of the art and directions for the future research. This type of analysis was chosen because the present study uses bibliometrix, an RStudio package for performance analysis and science mapping. The dataset is made up of 511 documents sourced from the Web of Science to identify trends besides great influential scholars and academic institutions and prominent research areas.

2. Theoretical Background

The entrepreneurial university as a model of higher education is a shift from a conception of the university as a place for teaching and research that is involved in entrepreneurial activities to promote growth [Hutt 2021].

Definition and Characteristics

In fact, entrepreneurial universities are viewed as active promoters of knowledge development, transfer and utilization. It also develops an organizational culture of innovation that promotes

creativity, venture and interaction between students, faculty and other outside entities. Such institutions sometimes set up technology transfer offices, business incubation, and entrepreneurship hubs to aid with commercialization processes and collaboration between the business and academic worlds. Additionally, entrepreneurial universities are also focused on creating value for society as they undertake research and innovation that has the capacity to solve social problems locally and globally [Halloui 2022].

Historical Evolution

The idea of entrepreneurial universities has developed in the later part of the twentieth century in an increasing globalized economy. Originally, the main function of universities was mainly learning, and they did not directly participate in the formation of economic activity. However, the changes in the broader environment with elements like globalization, advances in technology and the emergence of the knowledge economy forced a rethink of the social responsibilities of universities. During the 1980s and 1990s there was an observed growth of activities aimed at strengthening the university-industry links, technology licensing, and integrating entrepreneurship concepts into the curriculum [Zerbino 2021].

Importance in Socio-Economic Development

Higher education institutions particularly universities have central responsibility in advancing socio-economic development at the regional, national, and global level through entrepreneurship. Through the promotion of innovation and entrepreneurship, these institutions support employment generation, wealth creation, as well as industrial prowess. They act as platforms for growth of innovation systems that aid in connecting participants such as researchers, business people, investors, and members of the government in the process of transforming ideas and innovations into businesses [Sahoo 2022].

Previous Studies and Findings

A significant number of contributions have analyzed the function and importance of entrepreneurial universities in essentially all environments, but specifically in the sphere of business and management. Previous studies have looked at antecedents of university

entrepreneurship including those pertaining to policy, culture, and academic start-up initiatives. Academics have also explored the consequences of entrepreneurship, including firm performance, innovation success, and development benefits. Also, research has reviewed the efficacy of varying structures of university-business interaction and technology commercialization channels [Easterby-Smith 2021].

3. Methodology

Description of the Bibliometric Analysis Method

Bibliographic analysis refers to the scientific study of the patterns, trends and associations of the textual records found in scholarly production. It refers to the process of extracting citation data from academic articles and using different measures and methods to measure the readership, visibility and organization of published research. In this research, the bibliometric analysis methodology is used to analyze the current state of research on entrepreneurial universities specifically in the business and management disciplines [Xolmirzaev 2021].

Data Collection Process

The data collection process involved retrieving relevant documents from the Web of Science database. A systematic search strategy was employed to identify scholarly articles, conference papers, and reviews related to entrepreneurial universities. Keywords such as «entrepreneurial universities,» «university entrepreneurship,» and «academic entrepreneurship» were used to narrow down the search results. After applying inclusion and exclusion criteria (e.g., publication date range, document types), a total of 511 documents were selected for analysis [Jena 2020].

Tools and Software Used for Analysis

The bibliometric analysis was conducted using Bibliometrix, an RStudio package for bibliometric analysis develop. Bibliometrix offers various features aimed at data acquisition, data cleansing, data analysis, and data visualization. The tool enables users to engage in performance analysis, co-citation analysis, and science mapping, providing them with the most effective and efficient means of identifying patterns or trends in bibliographic databases [Rane 2023].

Explanation of Performance Analysis and Science Mapping

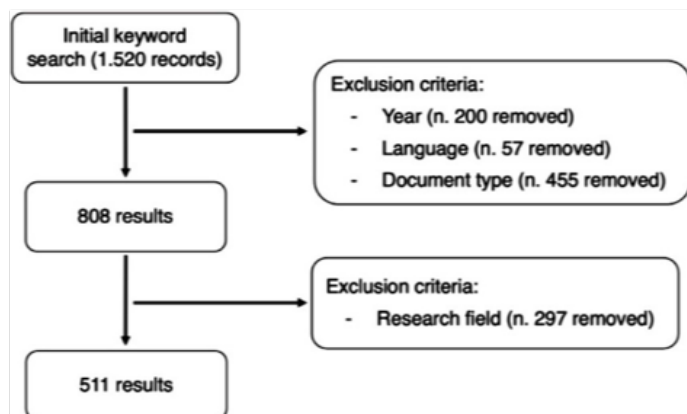


Figure 1. The different phases of the data extraction activity
 Source: [Thrassou 2021]

Performance evaluation requires assessing several parameters in order to determine the efficiency, output and times authors, institutions, and countries have on a particular field of research. This is in relation to the number of papers published, the number of citations that an individual/

organization has, the h-index, and collaboration networks. Science mapping, unlike bibliometrics, concerns the intellectual landscape of a research area using approaches such as co-citation analysis, bibliographic coupling and the analysis of co-occurrence of keywords [Thrassou 2021].

Criteria for Inclusion and Exclusion of Documents

Some factors that can be used to determine which documents to include for analysis may include; publication dates, document type among others. These include; type of publication, level of education, number of participants, and relationship to the concept of entrepreneurial universities. The following may be considered as exclusion criteria; the articles in languages other than English, articles from sources that are not peer-reviewed, and any document that does not concern the study focus [Gil-Doménech 2022].

4. Results of the Bibliometric Analysis Overview of the Dataset

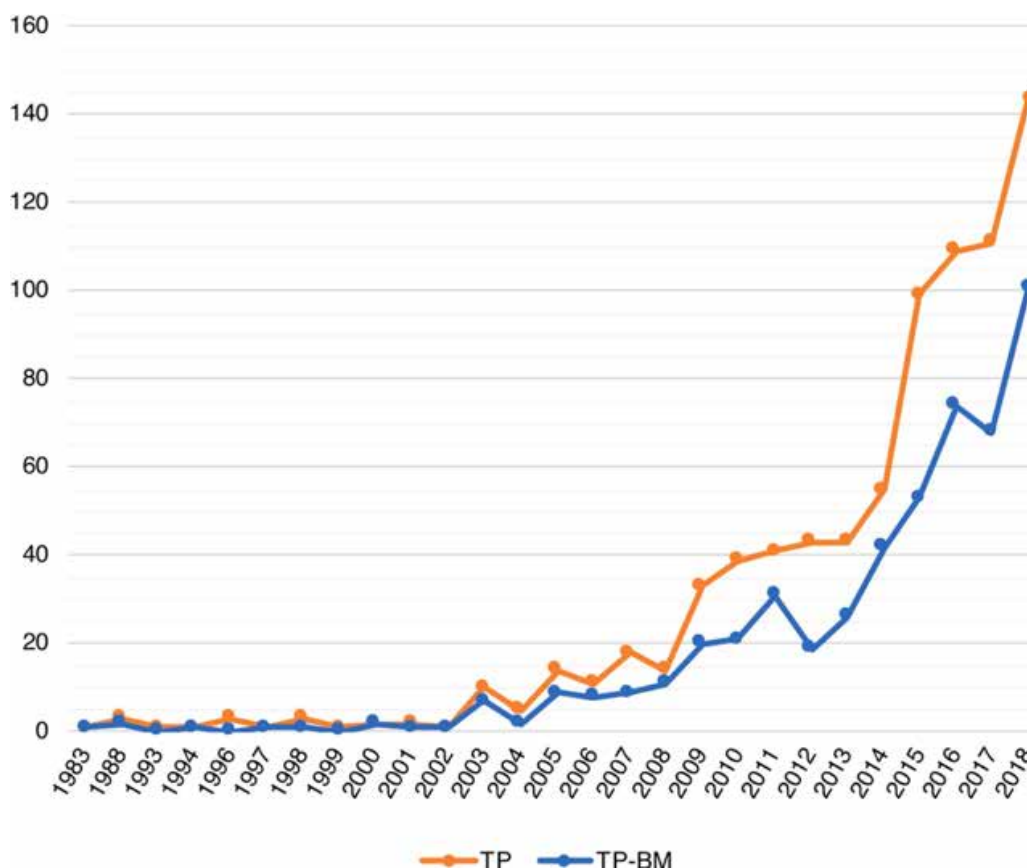


Figure 2. Distribution of publications over time in all research fields (TP) and in the business and management domain (TP-BM)
 Source: [Izagirre-Olaizola 2020]

The collection of articles explored in this research includes 511 scholarly publications in the area of entrepreneurial universities in business and management. These publications research articles, conference papers and review

articles. From the above commitments, it can be noted that the dataset spans over three decades in which captures the change in research on entrepreneurial universities over time [Izagirrecut across different document categories such as Olaizola 2020].

Publication Trends

#	Country	TP-BM	SCPs	MCPs	#	Country	MCP_Ratio
1	US	108	71	37	1	Belgium	0.778
2	UK	59	27	32	2	Russia	0.636
3	Italy	44	28	16	3	Netherlands	0.600
4	Germany	38	20	18	4	Ireland	0.600
5	Spain	35	24	11	5	Denmark	0.571
6	Sweden	25	17	8	6	UK	0.542
7	Netherlands	15	6	9	7	Canada	0.500
8	Canada	12	6	6	8	Brazil	0.500
9	Norway	12	8	4	9	Switzerland	0.500
10	Russia	11	4	7	10	Germany	0.474

Table 1. On the left, the top 10 countries ordered by the total number of publications in the dataset (TP-BM); on the right, the top 10 countries ordered by the ratio of inter- country collaborations (MCP/TP-BM)

Source: Self-created

Reviewing the last years' publications shows the upwards trend of the number of publications within the field of entrepreneurial universities. The trend line shows an increasing awareness and appreciation of other forms of enterprising behavior within universities. Notable journals in this field contain Journal of Business Venturing, Research Policy, and Entrepreneurship Theory and Practice, among others [Basri 2020].

the rise of entrepreneurial universities. Europe and United States are highlighted as the leading regions in terms of productivity and significance of contributions, although other areas such as Asia Pacific, Latin America, and Africa are also significant. This accords with emerging scholarship on the entrepreneurial university as an agent of innovation and economic change in different regional settings [Martínez-Jiménez 2021].

Geographic Distribution of Publications

#	Country	TC
1	US	6977
2	UK	3592
3	Italy	1206
4	Germany	1017
5	Norway	834
6	Sweden	828
7	Spain	772
8	Belgium	604
9	Ireland	530

Table 2. The top 10 countries ordered by the total number of citations received (TC)

Source: Self-created

The country-wise distribution of publications further underlines the global concern regarding

Analysis of Influential Authors and Institutions

Some authors and institutions can be identified as key contributors to the area of research focused on the entrepreneurial universities. Prominent contributors to the field are Henry Etzkowitz, Loet Leydesdorff, and David Audretsch whose research work was vital in enhancing the knowledge about entrepreneurial processes in the higher learning institutions. Likewise, successful universities like Stanford University, MIT, and University of Cambridge have been particularly appreciated for their leadership regarding entrepreneurial operations on campus and interaction with external parties [Chen 2021] (Figure 3 next page).

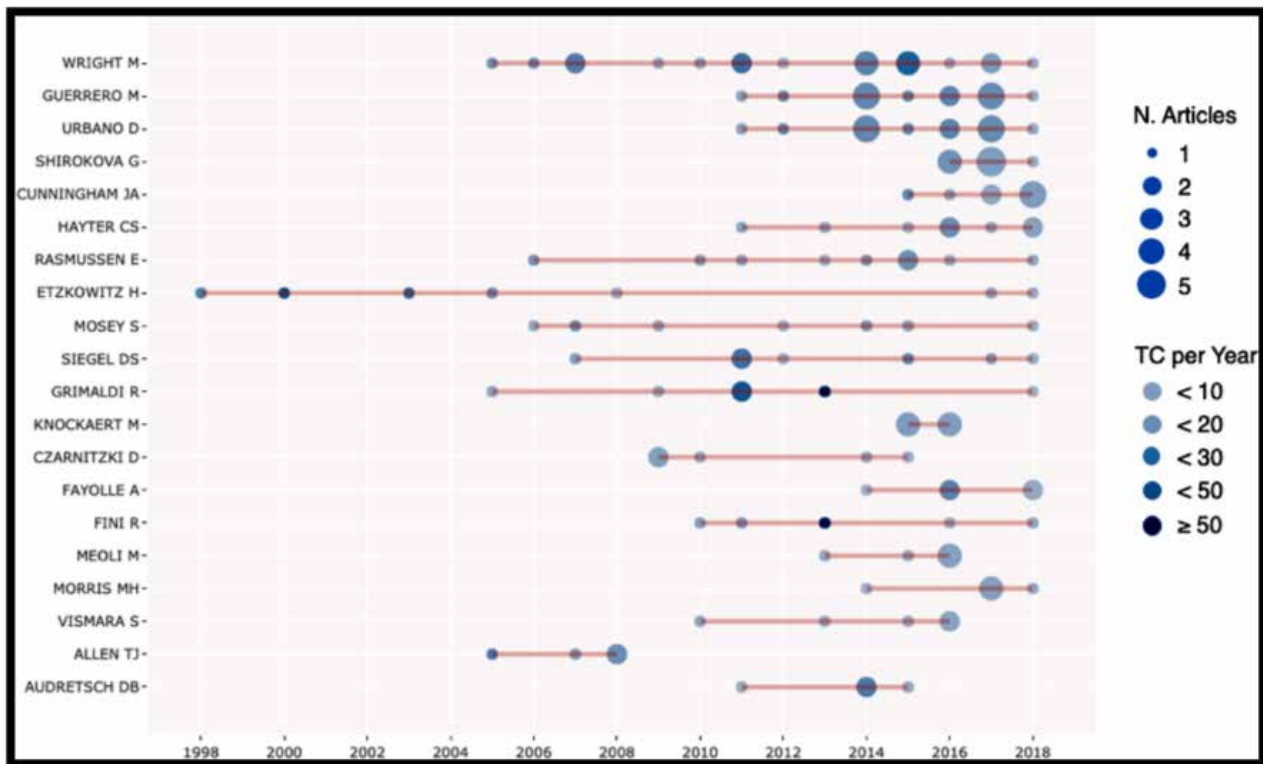


Figure 3. Top authors' production over time. Note that the bigger the circle is, the more articles have been published by the author in that year. The darker the circle is, the more citations have been received per year

Source: [Chen 2021]

Identification of Key Themes and Research Clusters

#	Author	Country	TC	h	TP-BM	TC-BM	h-BM	PY_start	m-BM
1	Wright, M.	UK	10,783	61	19	1695	15	2005	0.938
2	Guerrero, M.	UK	9700	45	14	675	10	2011	1
3	Urbano, D.	SPA	2598	28	14	675	10	2011	1
4	Shirokova, G.	RUS	238	9	9	119	5	2016	1
5	Cunningham, J.A.	IRL	8851	45	8	190	6	2015	1
6	Hayter, C.S.	US	366	10	8	228	7	2011	0.700
7	Rasmussen, E.	NOR	846	15	8	386	8	2010	0.727
8	Etzkowitz, H.	US	6460	23	7	2332	7	1998	0.304
9	Mosey, S.	UK	786	11	7	472	7	2006	0.467
10	Siegel, D.S.	US	13,456	53	7	567	6	2007	0.429
11	Grimaldi, R.	ITA	4978	36	6	1136	5	2005	0.313
12	Knockaert, M.	BEL	3422	24	6	103	5	2015	0.833
13	Czarnitzki, D.	BEL	2238	27	5	181	5	2009	0.417
14	Fayolle, A.	FRA	2581	26	5	121	4	2014	0.571
15	Fini, R.	ITA	1108	10	5	836	5	2010	0.455
16	Meoli, M.	ITA	505	14	5	89	5	2013	0.625
17	Morris, M.H.	US	2713	26	5	53	5	2014	0.714
18	Vismara, S.	ITA	1244	19	5	147	5	2010	0.455
19	Allen, T.J.	US	9952	56	4	759	4	2005	0.250
20	Audretsch, D.B.	US	16,203	63	4	224	4	2011	0.400

Table 3. The 20 most relevant authors ordered by the local number of publications (TP-BM)

Source: Self-created

- From the literature, this paper derives the following research themes or clusters through thematic analysis on entrepreneurial universities. These include:
 - University-Industry Collaboration: Exploring the dynamics and effects of university-industry partnerships with regards to innovation and entrepreneurship.
 - Technology Transfer and Commercialization: Exploring the processes and approaches of moving knowledge and technology from the academic setting to the business sector with a view to applying for commercialization.
 - Entrepreneurial Education and Ecosystems: Investigating the impact of the entrepreneurial education curricula and culture as well as the innovation environments on entrepreneurial thinking and new venture generation in universities.
 - Policy and Institutional Support: Exploring the factors affecting the enactment of government policies and institutional support systems on the establishment of entrepreneurial universities and the creation of innovation environments.
- Visualization of Conceptual, Social, and Intellectual Structures**

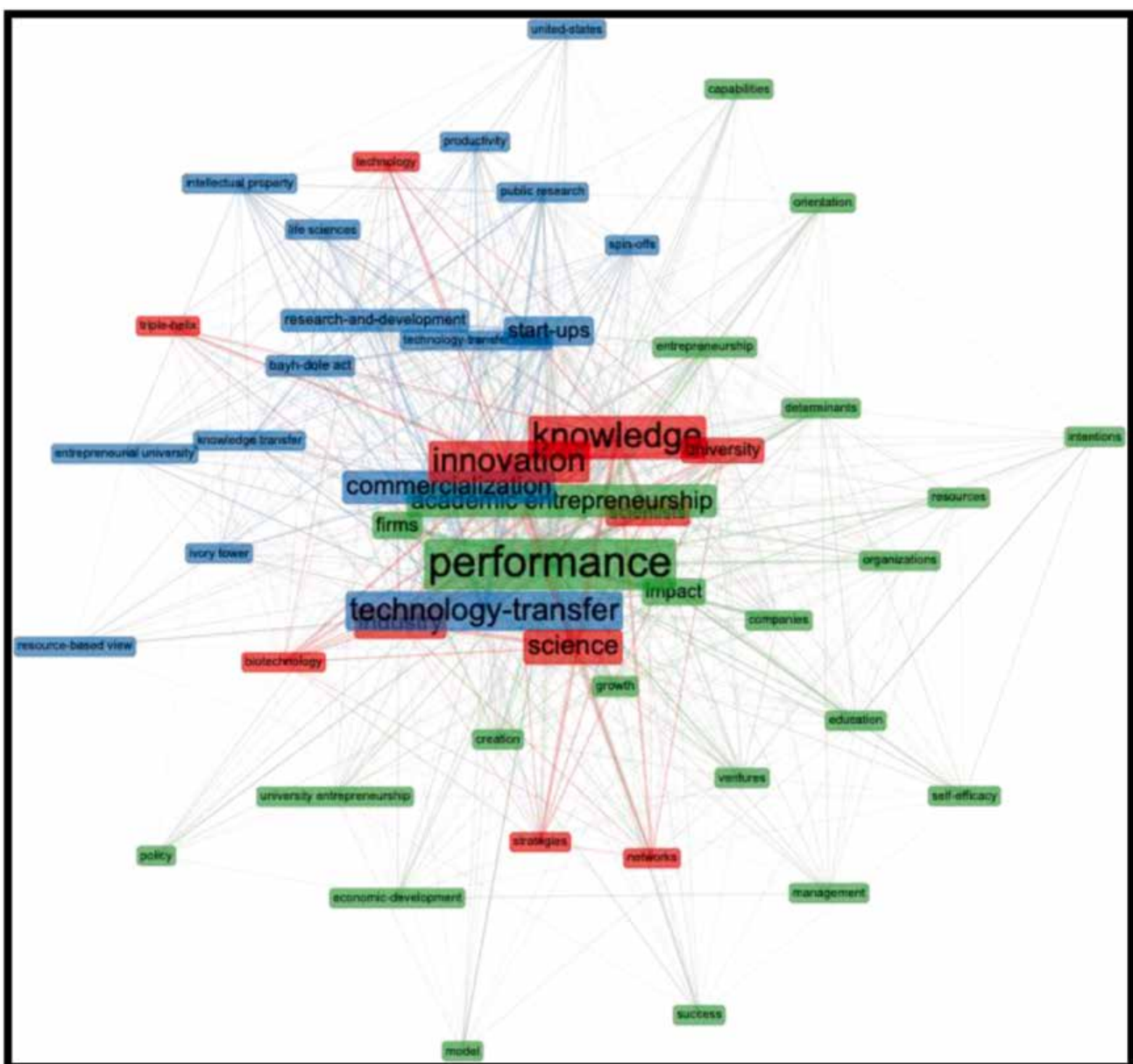


Figure 4. The conceptual structure of the dataset
Source: [Denton 2020]

Mapping of the conceptual, social and intellectual relations is done by use of visualization techniques like, co-citation analysis, bibliographic coupling, and keyword co-occurrence analysis. These maps make it easy to recognize areas of the research that are closely connected, central topics and trends can also be distinguished, which can be rather helpful in better understanding intellectual structure of the research on entrepreneurial universities. Lastly, the network analysis approach helps to establish relationships between authors, institutions, and geographic location, further emphasizing the dependency of the research environment [Alharahsheh 2021].

5. Content Analysis

Detailed Examination of Main Areas Addressed in the Literature

The body of knowledge on the entrepreneurial university relates to a wide spectrum of themes and scholarly disciplines. One of the most highlighted areas is how universities can help in the development of entrepreneurial culture and innovations. Research investigates the role and possibilities of the universities to support entrepreneurial initiatives of its students, members of teaching staff, and graduates through curriculum and specific programmers in the field of entrepreneurship, as well as through such services that includes incubators and accelerators. On the same note, another emergent research theme seeks to analyse the dynamics and practices of technology transfer and commercialization in entrepreneurial universities [Cole 2024].

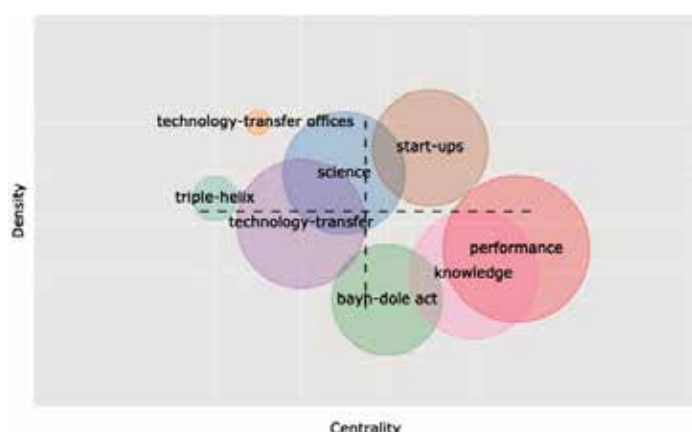


Figure 5. Thematic evolution of the topic: first time slice (1983–2009)
Source: [Lawrence 2021]

Furthermore, the literature also covers external environment factors such as policies affecting universities, role of region, and institutions. They consider the effects of policy measures in enhancing entrepreneurship at universities and the involvement of external actors like venture capitalists, angel investors,

and industries to develop and support innovative ecosystems [Lawrence 2021].

Key Findings from Analysis of Content

Looking at the selected documents in this study through content analysis, the following observations are made. Firstly, speaking about the functions of entrepreneurial universities, it is crucial to note that such institutions are aimed at supporting and promoting entrepreneurial culture and technology transfer. Literature reveals that entrepreneurial initiatives have a favorable effect in employment generation, industrial growth, and regional economic development. Secondly, the literature emphasizes on the need to build socio-cognitive relationships between universities, the industry, and government agencies. Literature proves usefulness of the strategic partnerships between the universities and the industries in accelerating the technological transfer, research and development commercialization, and solving a real-life problem through the joint research initiatives [Diaz 2020].

Discussion of Thematic Trends and Emerging Topics



Figure 6. The rate of collaboration between countries based on authors' affiliations
Source: [Thalmayer 2021]

Through thematic analysis, several trends and topics of interest that has been discussed in the literature on entrepreneurial universities are identified. An emerging domain of study that has attracted the focus of scholars is entrepreneurship and sustainability, particularly how Universities can nurture environmentally sustainable entrepreneurship and social enterprise. Two other trends are also coming to light: digital entrepreneurship and the calling of using technology to change higher education institutions [Thalmayer 2021]. Studies focus on the effects of digital learning on teaching and practice, definitions and discussions of online entrepreneurship education programs, and the benefits and risk factors of digital technologies to entrepreneurial practices in the university settings.

Highlighting Significant Contributions and Gaps

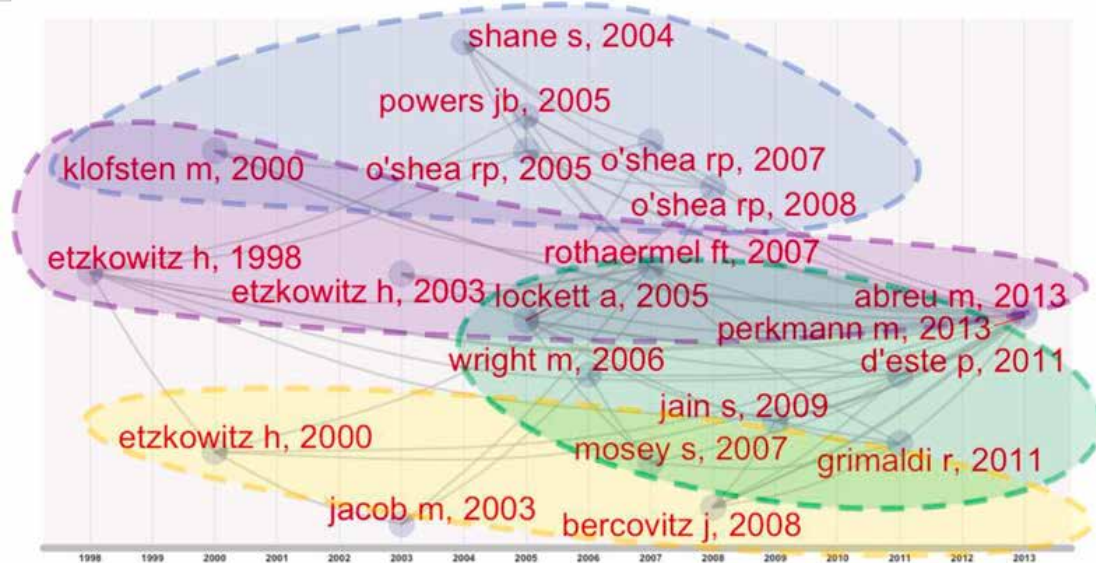


Figure 7. The historic evolution of co-citations amongst the 20 most relevant articles

Source: [Réale 2020]

Key contributions of the literature include developing theoretical models for future analysis of entrepreneurial universities, providing empirical support for their roles within innovation and economic development, and outlining recommendations and policy implications for future consideration. Nevertheless, there are also numerous limitations that have emerged from the existing literature and need to be addressed [Réale 2020]. They include the call for more long-term research regarding the outcomes of the entrepreneurial initiatives impacted by the universities, culture and context factors in the entrepreneurial ecosystems, and the diversity and inclusion factors supporting the entrepreneurial talent in universities.

6. Implications for Research: Avenues for Future Studies

Identification of Research Gaps and Underexplored Areas

However, the empirical analysis of entrepreneurial universities has revealed few gaps and modestly explored vistas. A rather significant knowledge void that can be identified is the lack of insight as to how the activities of entrepreneurship within universities can be sustained and grown in the future. Further research can be done to establish the reasons as to why attempts at entrepreneurship are deemed successful or otherwise and their effects on the culture and identity of schools. They argue that another area that may be receiving limited attention is the relationship between entrepreneurship and social change in higher learning institutions.

Suggestions for Future Research Directions

Future research on the entrepreneurial universities

might be done in the following directions. Firstly, thus, it is necessary to conduct the additional comparative research across the different institutional environments and geographical territories to explore the variations in the entrepreneurial university models and activities. Comparative investigation enables identification of the factors accelerating or slowing down entrepreneurial initiatives within a range of cultural, economic, and legal contexts.

Secondly, research could assess how various emergent technologies like artificial intelligence, blockchain technology, and biotechnology among others will impact the entrepreneurial university in the future. In what ways can these technologies improve universities innovation, increase knowledge transfer, and respond to social needs?

Potential Interdisciplinary Approaches

Large and extensive research questions can best be answered by employing interdisciplinary approaches which lends solution finding to the analysis of entrepreneurial universities. Drawing on scholars from different fields of study including business, economics, sociology, education and engineering will enhance understanding of entrepreneurship in higher learning institutions. Research from multiple fields also suggests that there are many aspects to both, and that interdisciplinary work could lead to innovative solutions to complex issues.

Importance of Addressing Socio-Economic Impacts, Especially in Developing Countries

Finally, there is a growing need to investigate on the social and economic effects of entrepreneurial universities particularly in the developing countries. The literature on entrepreneurship mainly examines

how the creation of new business propels developed economies, however, the new perspective in universities and their capabilities to foster inclusive development especially in emerging markets. Research might examine how developing country universities can overcome these institutional challenges, harness locally available resources, and help address poverty, unemployment, and sustainable development. Therefore, the future research on the entrepreneurial universities should focus on the following: To formulate the research questions that can address the current gaps; To identify the research avenues that are not well researched; To adopt the interdisciplinary approach; To enhance the socio-economic relevance of the research especially for the developing countries. In that way, scholars can bring more impact to the ways of knowing, policy, and practice in the areas of entrepreneurship and higher education.

7. Conclusion, Limitations, and Further Developments

Summary of Key Findings and Contributions

In conclusion therefore, this study has given a detailed insight on research on entrepreneurial universities in the business and management fields from a bibliometric perspective. Some insights include an increase in the number of articles published on this subject, the worldwide interest in entrepreneurial universities as well as established thematic patterns like university business cooperation and knowledge transfer. The present research contributes to the field of the entrepreneurial universities by making a bibliometric analysis and presenting the list of key authors and institutions, thematic topics, and research clusters, as well as future research prospects and challenges.

Limitations of the Bibliometric Analysis Approach

Nonetheless, it is worth mentioning that the bibliometric analysis approach comes with certain limitations as well. Bibliometric approaches allow insights into publication frequency and intellectual connections with proper literatures but may mask qualitative aspects of studies like context, depth and impact. Also, a focus on bibliographic databases can lead to publication selection bias and ignore other forms of scholarly outputs.

Future Developments in Research on Entrepreneurial Universities

In relation to the limitations of this study

outlined above, future research on entrepreneurial universities should consider them and examine new methodological approaches in addition to bibliometric analysis. Therefore, longitudinal investigations, qualitative research paradigms, and comparative case studies may offer more holistic understandings of the processes and consequences of delivering entrepreneurial processes to universities. Furthermore, cross-functional collaboration and intersectoral cooperation can broaden the understanding of entrepreneurial universities and develop new paradigms for solving multifaceted problems.

Practical Implications for Policymakers and Practitioners

From the results of this study, conclusions can be drawn for policymakers, educators, and practitioners working on the development of entrepreneurship and innovation within the context of HE institutions. This work may provide policy makers with valuable information and recommendations on how to implement effective policies and programs that will help to promote the establishment of entrepreneurial universities and effective collaboration between academia, industry and government. These themed areas and research clusters, therefore, can be used by educators and practitioners to guide curriculum development, program implementation, or strategic plan efforts that target the development of entrepreneurial talent and culture on the campus.

Final Remarks

Finally, it is possible to assert that entrepreneurial universities and their key profiles contribute significantly to innovation, economic development, and social change. Through addressing the aforementioned gaps and exploring the proposed directions for future research, scholars can help to further develop the literature on entrepreneurship and higher education and enrich the practice. Therefore, the sustained interest and expansion of entrepreneurial universities suggest the potential for building a more innovative, robust, and equitable future. With the issues highlighted in this study, scholars, policymakers and practitioners can effectively tackle the emerging challenges and fully exploit on the opportunities of developing entrepreneurial universities for the much-needed innovation for advancement of socio-economic growth.

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