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Venture capital: Analysis of its evolution and emerging research trends

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Abstract

Venture capital funds are crucial since they are a financing alternative for generating new companies. They also represent a series of critical resources that allow them to maintain improved performance in the target industry. The objective of this study is to carry out a bibliometric analysis on venture capital, through articles published within the Web of Sciences platform with indexing in the Journal Citation Reports, which identifies 1,653 research papers between 1980 and 2020. The results show the behavior and evolution of this topic in recent years, where there is a clear growing trend in venture capital research, as well as an overview of the authors and the most cited articles, including the production in terms of institutions, countries, and an analysis of the most used keywords by researchers, which represent an important area of opportunity for future studies related to this topic.

Keywords: Venture capital; emerging trend; bibliometrics analysis; financing business projects.

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Venture capital: Análisis de su evolución y de las nuevas tendencias de investigación

Abstract

Los fondos de capital riesgo son cruciales ya que son una alternativa de financiamiento para la generación de nuevas empresas. También representan una serie de recursos críticos que les permiten mantener un desempeño mejorado en la industria objetivo. El objetivo de este estudio es realizar un análisis bibliométrico sobre el capital riesgo, a través de artículos publicados dentro de la plataforma Web of Sciences con indexación en el Journal Citation Reports, que identifica 1.653 trabajos de investigación entre 1980 y 2020. Los resultados muestran el comportamiento y evolución de este tema en los últimos años, donde se aprecia una clara tendencia creciente en la investigación del capital riesgo, así como una reseña de los autores y los artículos más citados, incluyendo la producción en términos de instituciones, países, y un análisis de los más utilizados. palabras clave por parte de los investigadores, las cuales representan una importante área de oportunidad para futuros estudios relacionados con este tema.

Palabras clave: Venture capital; tendencia emergente; análisis bibliométrico; financiación de proyectos empresariales.

1. Introduction

Scientific research shows the importance of venture capital for financing business projects with a potential for scalability and high chances of success (Brinlee et al, 2004). In recent years, there has been a growing interest in the subject, and at the same time, countries around the world are highlighting the importance of venture capital funds among industries (Klonowki, 2006; Sander & Koomagi, 2007; Chung & Kang, 2018). Therefore, the interest in the topic of venture capital is nowadays relevant considering the existing evidence around the benefits in the regions where it takes place.

Venture capital funds refer to a non-bank financial intermediary institution. They represent a non-traditional financing alternative that obtains capital from investors who wish to offer this investment to those who require it, offering more effective and efficient incentives (Gompers & Lerner, 2004; Cornelius & Persson, 2006), compared to traditional banks loans. Research shows that newly created companies consider this an infeasible financing option for most newly created companies, since many of these companies do not have a sufficient financial background to support their ability to pay, which, together with interest rates, make them an expensive choice for this type of company (Hisrich et al, 2016; Fathonih et al, 2019).

Venture capital funds are an alternative among the different instruments that support the development of new businesses by providing financial resources as well as providing a series

of crucial business inputs such as mentoring, a wide network of contacts, and good management practices, that provide access to skills, experience, and specialized knowledge to support the development of companies in which they invest. At the same time, it promotes economic development and industrial innovation (Gompers & Lerner, 2001; Yasemin & Kor, 2008; Cancino et al, 2018; Li & Dutta, 2018; Zhang et al, 2019). Companies supported by venture capital funds are constantly monitored, to control their performance, without interfering in the decision-making process, to help companies overcome commercial obstacles that arise at the beginning of their activities (De Clercq & Manigart, 2007).

The articles considered in this research, from a bibliometric perspective, are some studies, such as the one from Cornelius and Persson (2006), that carry out an analysis of the literature through this methodology and reveal the growing interest in the subject of venture capital. In addition, Cancino et al, (2018), aimed to present the evolution of research on venture capital between 1990 and 2014, using the Web of Science database, and their findings allow us to observe that a growing rate of publications has been maintained over the last 25 years. One of the aspects to highlight in the study is that, through the methodology used, it was possible to have a general perspective of the leading journals in publications on venture capital. In future lines of research, they emphasize that different perspectives should be applied in the analysis and review of the subject, such as the analysis of authors with the highest number of publications, the most cited authors, and the production performed by universities and countries.

Therefore, the objective of this research is to investigate the state of the art of venture capital and to carry out an analysis of the articles published on the Web of Sciences (WoS) platform with indexing in the Journal Citation Reports (JCR). Based on what has been described above, this study aims to generate a bibliometric report that allows us to have a closer understanding of the growth in research on the subject. This way, some basic questions of bibliometrics can be answered, such as: What has been the scientific production on capital of risk over the years? Which are the researchers with the highest number of publications and who are the most cited authors? What are the most relevant publications that have the highest number of citations within the field of study? Which countries lead in terms of publications on the subject, and which are the most cited? Which are the educational institutions that lead the publications on venture capital? And which are the keywords researchers use the most?

The answer to these questions will allow a better understanding of the interrelationships between publications and citations, as it aims to confirm the growth of interest in venture capital within the field of scientific research. To achieve the goal, the article is structured as follows: the method describes the process to achieve the objective and the steps followed to carry out the bibliometric analysis; the results section shows the analysis of the behavior and its evolution over the years, and finally, the conclusions present the findings and comments and the main contributions to the study of this topic.

2. Method

In the methodology, a literature

review is used, which is relevant within the areas of scientific research, since it aims to describe what has been done previously and allows to map the approaches or theoretical issues and identify literature knowledge gaps (Snyder, 2019). The essence of the research is based on the search for primary literature sources, specifically, focused on academic articles indexed in high-impact databases. To achieve this, the Web of Sciences database was chosen, which has been reported to have the oldest and most complete citation indexes (Ellegaard & Wallin, 2015), to create a database of articles about the authors' analysis and their bibliometric studies, this search focused on the investigation of venture capital funds. In the configuration of the search profile in WoS, the keyword Venture Capital was used between 1980 and 2020, to obtain a considerable number of articles that delve into the subject of study. The search converged on a total of 1,653 elements considering those documents that were related to the topic and with special emphasis on those that were indexed in the Journal Citation Reports.

After processing the data, the files of the WoS platform were exported with the BibText (.bib) format, to generate a structure of each of the studies found that would allow their processing through the statistical software R, programming codes, and the use of the bibliometrix package to obtain a more efficient information analysis.

3. Results

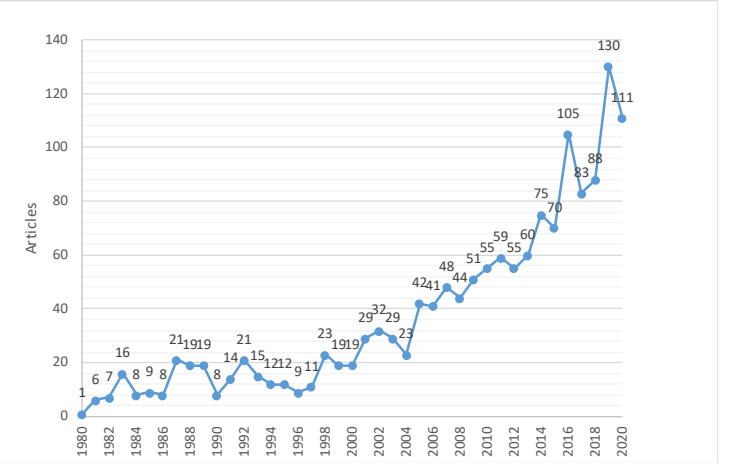
After processing the information through the statistical package R, this section presents the results. First, the information shows the evolution of scientific production about venture capital in years. The authors with the highest number of publications, as well as the most cited, and in the same way the results show the most relevant publications that have the largest number of citations in the field of study, as well as an interesting panorama of the countries that lead in terms of publication and citation, the educational institutions that lead the publication on venture capital, and at the end, the results show an analysis of keywords researchers used the most.

3.1. Scientific production per year between the period 1980-2020

Chart 1 shows the scientific production per year of publications dealing with venture capital, between 1980-2020. It is clear there is crucial evolution in the state of the art related to the subject. In the last 15 years, there is an increase in the trend of these studies. By 2004, the production of articles on the subject was 22 articles, however, by 2005, there were a total of 42 publications, showing a pattern of a growing trend in this type of scientific work. The highest peak in publications takes place in 2016 and 2019, with 105 and 130 publications respectively. By 2020, the graph shows a decline in production with 111 publications, since high-quality journals have a natural lag in their publication processes, so the total number of published articles may not be reflected in this specific year.

Therefore, expectations are that the trend will continue with publications constantly increasing within the scientific community due to the current interest in the subject.

Chart 1
Annual scientific production



Source: Developed by the authors with information from the Web of Sciences

3.2. Researchers with more publications

The following information shows the most relevant researchers in the study of venture capital, according to Table 1, the author with the most scientific dissemination with a total of 30 publications is Cumming D., followed by Lerner J. and Wright M. with 17 publications. The following two authors, Harrison R. and Mason C., with 15 and 14 publications respectively, present joint contributions in 10 publications, a similar situation to Colombo M., Bertoni F., and Grilli L. They have some collaborations since they shared their academic and professional career at the Politecnico di Milano at some point. Later in chart 7, this information shows that this is because this institution is framed within the most relevant universities that investigate the subject.

Table 1
Researchers with more publications

Author	Number of Publications
Cumming D.	30
Lerner J.	17
Wright M.	17
Harrison R.	15
Mason C.	14
Colombo M.	14
Bertoni F.	13
Grilli L.	12
Manigart S.	12
Gompers P.	12

3.3. Most Cited Researchers

After the analysis of the author's academic production and the analysis of the most cited researchers on the study of venture capital, the list features joint contributions from published articles, such as Lerner and Gompers, Hellman and Puri as well as Hochberg and Ljungqvist.

Table 2
Most cited researchers on the subject

Author	WoS Citations
Lerner J.	952
Gompers P.	910
Hellmann T.	684
Cumming D.	602
Puri M.	474
Sorenson O.	335
Wright M.	324
Sahlman W.	323
Hochberg Y.	316
Ljungqvist A.	285

3.4. Comparison between researchers with more publications and the most cited authors

Table 3 presents an interesting comparison between the researchers with the highest number of publications and those with the highest number of citations. An aspect to highlight is that only authors such as Cumming D., Lerner J., Wright M., and Gomppers P., who are the ones with the highest number of publications on the subject, are those that remain in the ranking of the most cited authors. This is the opposite situation to that of the remaining six authors, who are on the list of the authors with the highest number of published articles. Another relevant issue is that Sahlman W., Ljungqvist A., Puri M., and Sorenson O. are among the most cited researchers in the study of venture capital, they are, in fact among the first 10 most cited authors, despite having less than half of the publications that most of the authors with more products on the subject. This is an interesting dilemma since it can be inferred that the quality of their publications maintains a higher impact on the number of citations in more than half of those researchers with more publications within the scientific community related to the subject.

Table 3
Comparison between authors with more publications and the most cited

Authors with more publications				Most cited			
N°	Author	Publications	Cit	N°	Author	Cit	Publications
1	**Cumming D. ***	30	*602*	1	**Lerner J. ***	952	17
2	**Lerner J. ***	17	*952*	2	**Gompers P. ***	910	12
3	**Wright M. ***	17	*324*	3	Hellman T.	684	10
4	Harrison R.	15	*113*	4	**Cumming D. ***	602	30
5	Mason C.	14	*131*	5	Puri M.	474	4
6	Colombo M.	14	*186*	6	Sorenson O.	335	5
7	Bertoni F.	13	*215*	7	**Wright M. ***	324	17
8	Grilli L.	12	*194*	8	Sahlman W.	323	1
9	**Gompers P.***	12	*910*	9	Hochberg Y.	316	6
10	Manigart S.	12	*180*	10	Ljungqvist A.	285	3

* Present in both rankings

3.4. Most Cited Documents

One of the objectives of this research is to know the most relevant articles that have the highest number of citations within the field of study, and the 20 most cited articles were considered from the information provided by the Web of Sciences. Table 4 shows the records of the most cited publications in the WoS database.

Table 4
Most cited document, main author, and number of citations

N°	Author	Year	Article	Citations
1	Sahlman W.A.	1990	The structure and governance of venture-capital organizations	323
2	Hochberg Y.	2007	Whom you know matters: Venture capital networks and investment performance	222
3	Hellmann T.	2002	Venture Capital and the Professionalization of Start-Up Firms: Empirical Evidence	221
4	Gompers P.	1995	Optimal investment, monitoring, and the staging of venture capital	220
5	Sorenson O.	2001	Syndication Networks and the spatial distribution of venture capital investments	205
6	Lerner J.	1994	The syndication of venture capital investments	191
7	Kortum S.	2000	Assessing the contribution of Venture Capital to innovation.	181
8	Gompers P.	2001	The Venture Capital Revolution	165
9	Kaplan S.	2003	Financial contracting theory meets the real world: An empirical analysis of Venture Capital contracts	164
10	Hellmann T.	2000	The interaction between product market and financing strategy: The role of Venture Capital	148
11	Gompers P.	1996	Grandstanding in the venture capital	147
12	Black B.	1998	Venture capital and the structure of capital markets: banks versus stock markets	144
13	Hsu, D.	2004	What do entrepreneurs pay for venture capital affiliation	138
14	Brander J.	2002	Venture- Capital syndication: Improved venture selection vs. The value-added hypothesis	129
15	Barry Ch.	1990	The role of venture capital in the creation of public companies: Evidence from the going-public process	116

Source: Developed by the authors, with information from Web of Sciences.

As presented above, the article with the most citations is the work by Sahlman (1990), called *The structure and governance of venture-capital organizations*, who makes an interesting contribution, since in this article he provides basic notions and knowledge about venture capital. The author describes and analyzes how the structure of venture capital organizations is formed,

from an overview of the relationship that exists between investors, venture capital companies, and the institutions in which the resources collected are invested. Likewise, it places special emphasis on the agency problems that arise in these organizations, pointing out the importance of the evolution of contracts and operating procedures as a response to this type of circumstance.

Therefore, it can be interpreted that the publication performs a certain influence and fuels the interest in venture capital within the field of scientific research by providing the basic notions of the structure and governance of venture capital organizations, which has allowed it to be one of the most referenced publications to date.

3.5. Countries with the highest number of publications on venture capital

Table 5 shows the countries with the highest number of publications on venture capital. The United States of America (USA) heads the list with 546 publications, followed by China and the United Kingdom, with 158 and 106, respectively. A piece of information that was observed is the collaborations between the countries in Table 5, and it shows that the strongest collaboration networks are between the USA, Canada, China, and the United Kingdom, which in turn maintain collaboration with most of the countries with the most contributions in this area of knowledge.

Table 5
Contribution by country

Country	Number of Publications
USA	546
China	158
United Kingdom	108
Canada	82
Germany	75
France	54
Italy	51
India	28
Belgium	26
Korea	23

Source: Developed by the authors with information from the Web of Sciences

3.6. Countries with the highest production and the most cited

Table 6 details the countries with the highest number of publications on venture capital. It is crucial to mention that this information is obtained from the institutional affiliation of the author, since the countries may differ from the nationality of the researchers. Therefore, the element of institutional affiliation was considered. Similarly, the number of citations and the impact factor are presented, which shows the average number of citations per article. The results are seen below:

Table 6
Countries with the highest production and the most cited

Country-Research					*Citations by country*				
N°	***Country***	***Pub***	***Cit***	***Imp***	***N°***	***Country***	***Pub***	***Cit***	***Imp***
1	USA	546	*30323*	55.54	11	Australia	22	229	10.41
2	China	158	*1373*	8.69	12	Switzerland	22	805	36.59
3	United Kingdom	108	*3134*	29.02	13	Dutch	20	296	14.80
4	Canada	82	*3506*	42.76	14	Spain	20	608	30.40
5	Germany	75	*1218*	16.24	15	Sweden	20	224	11.20
6	France	54	*946*	17.52	16	Finland	20	507	33.80
7	Italy	51	*1413*	27.71	17	Brazil	15	4	0.40
8	India	28	*127*	4.54	18	Israel	10	439	54.88
9	Belgium	26	*819*	31.50	19	New Zealand	8	37	4.62
10	Korea	23	*194*	8.43	20	Singapore	8	125	15.62

Pub: Publications **Cit:** Citation **Imp:** Impact

Source: Developed by the authors with information from the Web of Sciences

It is interesting to observe that these 20 countries with the highest scientific production on the subject worldwide, are at the same time countries with the highest investment in venture capital (EY Global Venture Trends, 2015), like the USA, China, India, Israel, and Canada. According to this, the number of publications per country is given concerning the presence of venture capital funds. This is where interest in the subject and importance are related.

3.7. Universities with the most publications

In Table 7, the research results show the number of publications distinguished by the university related to venture capital, headed by Harvard University, with a total of 41 publications, followed by the Polytechnic of Milan with 29, and the University of Tsinghua with 25 publications.

Table 7
Publications by university

University	Number of Publications
Harvard University	41
Polytechnic of Milán	29
Tsinghua University	25
Pennsylvania University	24
York University	24
Emlyon Business School	23
Toronto University	22
Stanford University	21
Cambridge University	21
Ghent University	19

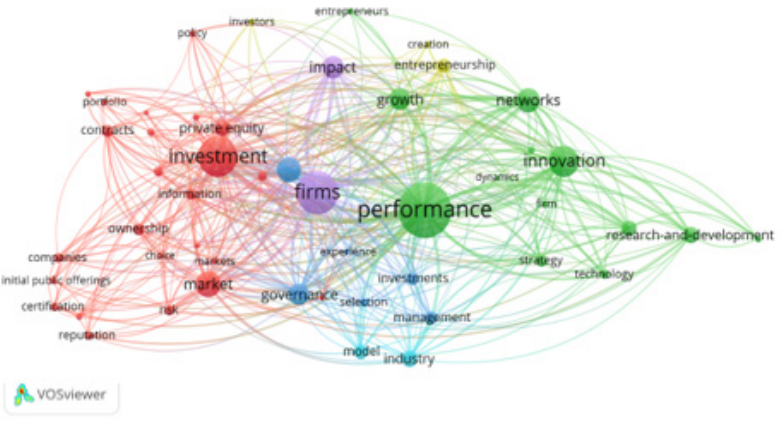
Source: Developed by the authors, with information from the Web of Sciences

3.8. Keywords network

Finally, within the methodological analysis, a process of identification of the most used words related to the study of the capital venture was performed; to be able to precisely know the terminology used to delimit the subject of study. In this specific case, the VOSViewer software (Van Eck & Waltman, 2010) was used, to perform the grouping and to visualize the results.

Chart 2 shows the network of most used keywords for the study of venture capital, in which it can be seen that the term performance is the one that stands out the most compared to the other terms used with a total of 315 mentions from the analyzed articles, followed by firms and investment, with a total of 240 and 220 mentions, respectively. Similarly, there is clarity in the concepts of innovation, market, syndication, and networks, concerning the time indicated in the keywords of the studies. Within the peripheral words or trends in the model related to the concept of innovation, the words *research and development, knowledge, and the absorption capacity of companies*, are a topic of interest in this type of study. This is not surprising, since venture capital is not only based on granting financial resources to organizations with technological developments with high scalability potential. It also implies financing, as they also provide a series of resources and intangible knowledge that through absorption capacity, allows companies to develop more efficiently, assimilating, transforming, and exploiting external knowledge, channeling and integrating elements to give greater prominence to the dynamics of knowledge and innovation.

Chart 2
Keywords network



Source: Developed by the authors, with information from VOSviewer.

4. Conclusions

The present research provides a general perspective of the evolution in the study of venture capital between 1980 and 2020. A series of analyses were performed to inquire about what has been investigated from different perspectives in the defined period.

Research on the scientific production per year shows that there is an increase and a positive trend towards the analysis of the subject, observing a critical evolution in research interest in venture capital in recent years. A second analysis made it possible to detect those researchers with the highest number of publications are not necessarily the most influential, since the analysis of the most cited authors allowed us to observe this important dilemma. It can be inquired that the quality of the publications perseveres on the number of those with more publications within the scientific community. However, it is necessary to emphasize that the analysis of the citations of the authors is given only considering the articles from the Web of Sciences platform, so, it would be interesting to extend the spectrum of study to other databases and observe the behavior of these specific metrics.

One of the important considerations is concerning the analysis of the countries where the largest number of publications on the subject is produced. The information shows that some of these are among the countries that invest the most in venture capital, therefore, it is the subject most studied by researchers in universities; and finally, an analysis of the keywords used by the authors was developed, which represents the

dynamics of venture capital, where the peripheral words allow to increase knowledge on the trends of venture capital and its relationship with these concepts.

This represents an area of crucial opportunity, since there are topics that maintain a link in venture capital research that show how this financing scheme is developed and operates jointly with elements such as performance and its link with companies of venture capital, innovation, and investment. According to these results, it can be inferred that venture capital allows development as it triggers the potential of organizations including entrepreneurs, creators, and their networks, considering elements such as strategy, markets, and experience, which are a means for organizations to succeed by implementing their business models in the market, representing an important area of opportunity for future studies related to this topic.

Undoubtedly, venture capital continues to be a field of interest within the scientific community, the findings of the bibliometric study allow to conclude in this aspect, that in the future, the study of this topic will continue to grow constantly. Therefore, it is considered necessary to be able to analyze it from another perspective, use other databases and be able to delve into the field of study with some other term or topic of interest that provides the key elements for its analysis so a general overview of the role of venture capital in the scientific community can be generated.

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