Thirty years of research on high-growth entrepreneurship: bibliometric overview of its H-Classics

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Abstract

In recent years, high-growth entrepreneurship (HGE) research has gained increasing importance. For this reason, it is considered necessary to analyze papers that have had the most significant impact on the development of the discipline and that should be familiar to all researchers. Building new knowledge on these works is important because it provides legitimacy and coherence to the future development of this research field. Thus, this paper aims to identify and characterize the classic articles in the field of HGE, a line of research that has seen significant growth in the last 30 years. The H-Classics method is used to identify these papers. Subsequently, several bibliometric aspects of this collection are analyzed, such as the forums of journals where they have been published, the most productive authors, the patterns of collaboration, and an analysis of the conceptual structure through co-word analysis. Exhaustive content analysis is carried out to complement this vision, identifying the proposed objectives, methodologies, types of data, analysis techniques used, and their main contributions in three consecutive periods. The results are of value to researchers interested in high-growth firms because they allow us to understand the foundations on which this discipline has been built through its classics and to determine its main challenges for the future.

Keywords

Entrepreneurship; High growth; Rapid-growth firms; Gazelle companies; H-Classics; Highly cited papers; Citation classics; Bibliometrics; Biblioshiny; Co-word analysis; *WoS*; *Web of Science*; *Social Sciences Citation Index*; *SSCI*.

JEL codes: L26; M13; M21.

1. Introduction

The relationship between entrepreneurship and economic development is widely recognized, and has been analyzed in-depth in previous literature (**Audretsch**; **Belitski**; **Desai**, 2015; **Platzek**; **Pretorius**, 2020; **Urbano**; **Aparicio**; **Audretsch**, 2019). As part of this relationship, high-growth enterprises (HGEs) are key to economic growth in developed countries (**Acs**; **Parsons**; **Tracy**, 2008; *BERR*, 2008; **Henrekson**; **Johansson**, 2010). Moreover, there is empirical evidence on the impact of HGEs on economic development (**Kemp**; **Nieuwenhuijsen**; **Bruins**, 2000; **Mason**, 1985; **Wong**; **Ho**; **Autio**, 2005). HGEs have a greater impact on the business environment than other firms (**Martínez-Fierro**; **Biedma-Ferrer**; **Ruiz-Navarro**, 2020). They are seen as important drivers of employment and economic dynamics (**Friesenbichler**; **Hölzl**, 2020).

The concept of a high-growth firm can be ambiguous, as a standard definition has not yet been established (**Martínez-Fierro**; **Biedma-Ferrer**; **Ruiz-Navarro**, 2020). The *Organization for Economic Cooperation and Development* (*OECD*) considers HGEs to be firms with an annual growth rate of > 20% over three years and more than 10 employees at the beginning of this three-year period (*Eurostat-OCDE*, 2007). On the basis of this conceptualization, 2.7% of the entire firm population can be classified as HGEs, out of which only 3.9% can repeat their HGE status in two successive periods. Hence, only 0.11% of the entire population are repeatedly classified as HGEs, being firms with persistent high potential.

The importance of HGE for employment and, more generally, for economic development has led to a considerable increase in the number of papers published in high-impact journals within this discipline. Although there is a vast number of bibliometric papers in the field of entrepreneurship (**Baier-Fuentes** *et al.*, 2019; **Vallaster** *et al.*, 2019; **Xu** *et al.* 2021), hardly any scientific research has been carried out in the form of a bibliometric analysis of the HGE literature produced. Such analysis would provide a solid basis for discussion to estimate its degree of consolidation and development (**Ramos-Rodríguez**; **Ruiz-Navarro**, 2004). Therefore, a literature review with a quantitative approach, based on bibliometric methods and that is not conditioned by the subjectivity of the authors and allows for an inventory of the work carried out, would form a valuable contribution to this field of research.

In the field of bibliometrics, citation analyses are aimed at assessing highly cited articles in a given scientific field, on the basis of the assumption that articles with a high number of citations correspond to a more influential impact in the area (**De-la-Flor-Martínez** *et al.*, 2016). Recently, several specialties have analyzed their so-called citation classics by setting the threshold value at the number of citations received or according to the number of highly cited papers (**Cascón-Katchadourian**, 2020). However, these studies of "citation classics" suffer from certain shortcomings. For example, the articles with the maximum number of citations have been shown without calibrating factors such as time (in terms of scientific evolution of research areas), and citation patterns are not considered (**Chiang** *et al.*, 2018). Furthermore, such analysis is only quantitative and does not provide detailed information on the qualitative aspects of citations. Additionally, these approaches are not based on an objective criterion. Unanswered questions may arise, such as:

- "Why do we use a threshold of 100 or 500 citations and not another similar number?" (**Cascón-Katchadourian**, 2020);
- "Why do we use the 100 most cited articles and instead of 300?" (**Corbella** *et al.*, 2017; **Feijoo** *et al.*, 2014).

To overcome the drawbacks and problems related to these traditional approaches to identifying highly cited articles, **Martínez-Sánchez** *et al.* (2014) presented the concept of H-Classics. The concept is based on the popular H-index by **Hirsch** (2005), which allows the classical citation search procedure to be systematized for any field of research (**Martínez-Sánchez** *et al.*, 2014). According to **Martínez-Sánchez** *et al.* (2014) and **Chiang** *et al.* (2018), the main advantages of this index are that it provides an objective, transparent, and impartial criterion to identify highly cited articles in the scientific literature as it identifies –in a single procedure– the number of papers published in the field and the impact of those publications. The criterion it applies is sensitive to the characteristics and the evolution of all research disciplines, as well as to the citation pattern of all research areas. However, the H-index has some limitations, namely that H-index values are not comparable across different academic fields, considers self-citations, and rewards academic seniority over more recent works (**Alonso** *et al.*, 2009).

This methodology, which is becoming increasingly relevant in the literature on bibliometrics (**Martínez-Sánchez** *et al.*, 2015), has recently been used (**Cabeza-Ramírez**; **Sánchez-Cañizares**; **Fuentes-García**, 2018) in the field of entrepreneurship to identify the main scientific articles (using the term "knowledge base" for the most cited articles) in the discipline. In this paper, we use the H-Classics methodology as a way to retrospectively determine the most cited articles within *Web of Science* (*WoS*) HGE research, that are essential reference points (the most influential) in this field of study. This paper aims to provide an overview of the scientific structure of high-potential entrepreneurship publications, using the

H-Classics methodology to identify classic articles. Their bibliometric characteristics are then assessed, such as the research performance of the main authors in the area, the journals, the countries, the research trends, the nature of the articles in terms of the main topics addressed, the type of articles, the research methods used, the methodological procedures, the statistical techniques, and the research samples, as well as the knowledge base on which the published works are based.

> Highly cited papers are an essential reference point in a research field

This paper contributes to the literature on entrepreneurship by providing a comprehensive overview of the scientific structure of the high-potential entrepreneurship literature through a historical perspective of the evolution of this topic over time. The insights gained into this field illuminate the potential directions future research will follow. The article is structured as follows. Section 2 presents the basis of the methods used in the study and the procedure used to identify the primary papers for the analysis. Section 3 reports the results of our bibliometric analysis, and Section 4 presents the conclusions, limitations, and future lines of research.

2. Methodology

We followed the steps proposed by **Martínez-Sánchez** *et al.* (2014) to identify HGE H-Classics. First, we selected the bibliographic database to identify the scientific output in this field and citations received. In this study, we used the *Social Sciences Citation Index* (*SSCI*) of the *Web of Science* (*WoS*). Although other databases, such as *Scopus* or *Google Scholar*, report the number of citations received, many studies consider *WoS* to be the most reliable database for applying the bibliometric methodology to the field of management and organization (for a review, see **Zupic**; **Čater**, 2015).

Second, to establish the research area under study and to obtain a collection of papers representative of HGE research, the following *WoS* advanced search query was performed:

> TS = ("high-growth entrepreneur*" OR "high-growth firm*" OR "high-growth new firm*" OR "high-growth start-up" OR "high-growth SME*" OR "high-growth business" OR "high-growth venture*" OR "high-growth new venture*") OR TS = ("high-potential entrepreneur*" OR "high-potential firm*" OR "high-potential new firm*" OR "high-potential start-up" OR "high-potential SME*" OR "high-potential business" OR "high-potential venture*" OR "high-potential new venture*") OR TS = ("rapid-growth entrepreneur*" OR "rapid-growth firm*" OR "rapid-growth new firm*" OR "rapid-growth start-up" OR "rapid-growth SME*" OR "rapid-growth business" OR "rapid-growth venture*" OR "rapid-growth new venture*" OR "gazelle*."

The TS prefix performs a search of the title, abstract, and author keywords fields, and in *Keywords Plus*. Subsequently, we established a filter in the document type field to select only articles, discarding other types of documents such as reviews, editorial material, book chapters, proceedings papers, book reviews, or corrections. The search terms were consensually agreed upon by a group of experts belonging to the *Global Entrepreneurship Monitor* (*GEM*), which is the most important global network on entrepreneurship worldwide. We carried out the search in mid-March 2021.

As a result of this search, 343 articles were downloaded from *WoS*. These articles were reviewed, one by one, by entrepreneurship experts. By consensus, 107 articles were eliminated because they did not contain evidence of research on the object of study. Of the remaining 236 articles, four that were published in 2021 were removed because the year was not over yet. Among the remaining 232 papers, 20 early-access articles were identified. These documents have an empty year of publication (PY) field, as there was no printed edition available. Given that the bibliometric software used (*Biblioshiny*) automatically discards this type of record because this field is empty, it was decided to rescue these articles for use in the analysis. Thus, the year of publication as early access was considered as the year of final publication, and these data were manually entered in the database. Of these 20 early-access articles, two appeared in 2019 and two in 2021. The latter two were removed. With these changes, the final sample consisted of 230 articles. Next, analysis of the collaboration and co-citation networks was performed with the Louvain cluster logarithm, considering the interface default options –star layout and normalisation by association– using the *InfoMap* clustering algorithm with 50 nodes. Amongst the method parameters, we used a repulsion force of 0,1 and a minimum number of 2 edges. The isolated nodes were removed. Each circular node represents a keyword, and the thickness of the connection between the nodes indicates the frequency of the co-occurrence between them.

Third, it was necessary to calculate the H-index associated with the research area. Accordingly, the articles were sorted in decreasing order based on the number of citations received. By definition, the H-Classics of the field are those articles that are located above the H-index, i.e., those whose position in the ranking is lower than or equal to the number of citations received. In this case, the H-index was equal to 50. Therefore, following the recommendations of **Martínez-Sánchez** *et al.* (2014), the first 50 articles were considered the H-Classics in HGE, and are listed in Appendix A.

To characterize the H-Classics in HGE, we used the *Bibliometrix R-package* for calculation of citation metrics and analysis (**Aria**; **Cuccurullo**, 2017). In particular, the distribution of documents per year of publication, the most productive authors, journals, institutions, countries, and some collaboration indicators were calculated. In addition, a co-word analysis was performed using the *Biblioshiny* interface to identify the conceptual structure of this field of research. More specifically, to identify the thematic areas that can be found in the conceptual structure of this discipline, we used the co-occurrence network based on the authors' keywords.

Finally, following the recommendations of **Moral-Muñoz** *et al.* (2015) and **Köseoglu** *et al.* (2016), an exhaustive content analysis of H-Classics in HGE in three consecutive periods was carried out to identify the approaches adopted, the types of data and statistical techniques most used, and their evolution over the last thirty years.

3. Results

3.1. Distribution of high-growth entrepreneurship (HGE) H-Classics by year of publication

The scientific literature on HGE comprises 50 papers classified as H-Classics. The earliest two papers classified as H-Classics were published in 1992. **Larson** (1992) published one of these papers in the *Administrative science quarterly* journal, with the highest citation rate (1,278). The other was published by **Willard**, **Krueger** and **Feeser** (1992) in the *Journal of business venturing*, with 93 citations. In contrast, the most recent article within these H-Classics was published in the *Strategic entrepreneurship journal* by **Spigel** and **Harrison** (2018) with a reasonably high citation rate (111). Therefore, despite not being very common in the analysis of highly cited literature –because newly published articles require more time to accumulate citations– we find a highly cited paper from a recent year in this field of study. Furthermore, it is generally the case that highly cited papers tend to be published a longer time ago due to the citation window. However, in the field of HGE, we found that although the largest number of highly cited articles was published in the first decade of the 21st century (46% corresponding to 23 articles), the decrease in the second decade is not very significant (44% corresponding to 22 articles). This shows that HGE is currently a popular and contemporary topic.

3.2. Most productive authors, institutions, and countries with most published HGE H-Classics

One of the most important factors contributing to the structure and growth of any field (**Cuccurullo**; **Aria**; **Sarto**, 2016; **Ramos-Rodríguez**; **Ruiz-Navarro**, 2004) is its key authors. Authors such as **Furrer**, **Thomas** and **Goussevskaia** (2008) argue that author characteristics have the most explanatory power over the impact of an article. Although 106 different authors have written the 50 highly cited articles identified here, with an average of 2.12 authors per paper, Table 1 lists only the authors with two or more highly cited articles in HGE research. As can be seen, the authors who contributed most to the field are affiliated with European universities. The author with the highest number of H-Classics articles is Hölzl, from the *Austrian Institute of Economic Research* (*WIFO*). The other most productive, highly cited authors have published a total of two articles published in the area, and four of these authors belong to universities or research centers in Sweden. These results are not surprising given that HGE has been widely defined as the main driver of innovation (see, e.g., **Brown**; **Manson**, 2014), and Sweden, in turn, is considered one of the most highly innovative countries in the world (**Kander** *et al.*, 2019). Furthermore, in the results, we observe collaborations between the authors of the most cited papers. The author with the most collaborations is Johansson, from *The Ratio Institute* of Sweden, who collaborates with five other authors between the two papers. In the first of these (**Henrekson**; **Johansson**, 2010), together with Henrekson of the *Research Institute of Industrial Economics* of Sweden, Johansson carried out a meta-analysis of the empirical evidence regarding whether net employment growth is generated by a few fast-growing –not necessarily small and young– firms. The second study (**Coad** *et al.*, 2014) was carried out with Coad, Daunfeldt, Hölzl, and Nightingale, from the *University of Sussex* (UK), *Dalarna University* (Sweden), *Dalarna University* (Sweden), and the *Austrian Institute of Economic Research* (Austria). Specifically, they analyze the reasons for the academic community's increased interest in high-growth firms, summarize the existing literature, and highlight the methodological considerations that constrain and bias research. Both papers review previous results, applying meta-analysis and literature review as methodologies. Conceptual papers using these techniques tend to be widely cited.
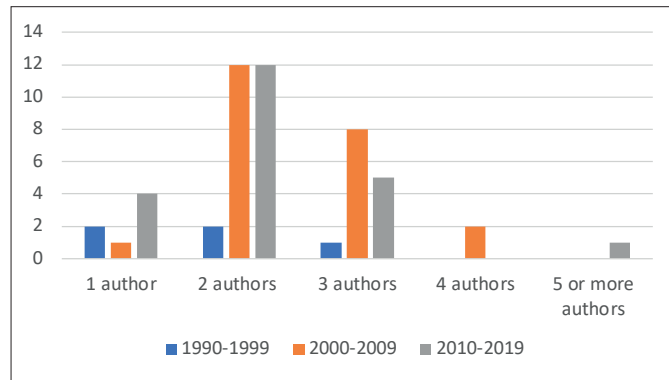
Table 1. Most productive highly cited authors in the field of HGE

Author	Institution	H-Classics	
		n	%
Hölzl, W.	*Austrian Institute of Economic Research* (*WIFO*); Austria.	3	6
Acs, Z. J.	*School of Policy and Government. George Mason University*; Virginia, USA.	2	4
Marron, R.	*School of Management*, *University of St Andrews*; Scotland, UK.	2	4
Daunfeldt, S. O.	*HUI Research*; Stockholm, Sweden.	2	4
Davidsson, P.	*Jönköping International Business School*; Sweden.	2	4
Henrekson, M.	*Research Institute of Industrial Economics*; Stockholm, Sweden.	2	4
Johansson, D.	*The Ratio Institute*; Stockholm, Sweden.	2	4
Mason, C.	*Hunter Centre for Entrepreneurship. University of Strathclyde*; Glasgow, Scotland.	2	4
Stam, E.	*Utrecht University School of Economics*; Utrecht, The Netherlands.	2	4

Following **Köseoglu** *et al.* (2016), articles were classified into four groups according to the number of authors: single author, two authors, three authors, and four or more authors. Based on the premise that co-authorship in the publication of research results is a clear exponent of scientific collaboration, we can say that single authorship does not seem to be common in HGE H-Classics, with collaboration between two authors (26 papers) and three authors (14 papers) being the most frequent among all research output (Graph 1). This consolidates the perception of **Ramos-Rodríguez**,

Lechuga-Sancho, and **Martínez-Fierro** (2021) and **Ramos-Rodríguez** and **Lechuga-Sancho** (2020) that in current times, scientific research needs to be undertaken collaboratively.

According to **Kalantari** *et al.* (2017), each author makes an individual and unique contribution to a paper. Therefore, the institution and country to which the author belongs could be considered important contributors when assessing research. Accordingly, the number of publications from each country was used to assess the research contribution of a given region/country in a related field. Table 2 lists the countries from which highly cited papers in the field of HGE originated. In the analysis of highly cited lite-

Graph 1. Collaboration/co-authors per article in HGE H-Classics research

rature (**Baltussen**; **Kindler**, 2004; **Paladugu** *et al.*, 2002), it is usual to find a small number of countries. However, in this particular discipline, we identified a high number of countries publishing highly cited articles. As can be seen, the USA (68%) was the most productive country with the highest number of publications. The USA was followed at a distance by the UK (34%); Sweden (28%); Netherlands (16%); Belgium and Germany (12% each); Spain (10%); Austria, Canada, and Finland (6% each); and Denmark, and New Zealand (2% each). The USA's dominance in this list of highly cited articles is not surprising given the top set of journals is biased in favor of journals of US origin, as is the case in other scientific fields and in the *WoS* itself (**Martínez-Sánchez** *et al.*, 2014; 2015).

There are collaborations between authors from different countries, the most frequent collaborations being between authors from the Netherlands and Germany, the UK and Belgium, or the UK and Finland. For example, the works of **Sternberg** and **Wennekers** (2005) and **Grimm**, **Knorringa**, and **Lay** (2012) correspond to collaborations between the Netherlands and Germany. Collaboration is also carried out between the following institutions: the *University of Cologne* (Germany), *EIM Business and Policy Research* (Netherlands), *Erasmus University Rotterdam* (Netherlands), the *Institute for the Study of Labor* (Germany), the *German Institute of Global and Area Studies* (Germany), and the *University of Göttingen* (Germany).

In-depth analysis focusing on the institutions at which the research is conducted offers additional interesting clues about the history and evolution of HGE H-Classics over the last 30 years. Table 3 shows the institutions that had at least two productions or more. The USA is the most productive country, and therefore it is not surprising that five of the 16 most productive universities are American. First and second places in the list are held by *Syracuse University*, with four H-Classics, and the *University of North Carolina*, with three H-Classics. Five institutions from Sweden also stand out, namely *The Ratio Institute*, *Dalarna University*, *Hui Research*, *Jönköping International Business School* and the *Stockholm School of Economics*.

Table 2. Most productive countries in terms of publication of HGE H-Classics

Country	H-Classics (%)	
	n	%
USA	34	68
UK	17	34
Sweden	14	28
Netherlands	8	16
Belgium	6	12
Germany	6	12
Spain	5	10
Austria	3	6
Canada	3	6
Finland	3	6
Denmark	1	2
New Zealand	1	2

Table 3. Most productive institutions in terms of publication of HGE H-Classics

Institution	Country	H-Classics	
		n	%
Syracuse University	USA	4	8
University of North Carolina	USA	3	6
The Ratio Institute	Sweden	3	6
Imperial College of Science, Technology and Medicine	UK	3	6
University of Utrecht	Netherlands	3	6
Aalto University	Finland	2	4
Austrian Institute of Economic Research (WIFO)	Austria	2	4
Dalarna University	Sweden	2	4
HUI Research	Sweden	2	4
Jönköping International Business School (JIBS)	Sweden	2	4
Stockholm School of Economics	Sweden	2	4
University of Central Florida	USA	2	4
University of Colorado Denver	USA	2	4
University of Ghent	Belgium	2	4
University of Sussex	UK	2	4
University of Utah	USA	2	4

3.3. Journals

Table 4 shows all the scientific journals that make up our HGE H-Classics database. With 19 papers out of 50, *Small business economics* is the journal with the most highly cited publications. The *Journal of business venturing* also stands out (with seven publications). The *Journal of small business management* and *Research policy*, with three papers each, have also contributed significantly to the development of this scientific area. However, in our area of study, there is a wide variety of journals (29.31% of the total output) containing only one H-Classic.

Table 4. Sources in which the highest number of HGE H-Classics are published

Sources	Papers	SSCI citations	Impact factor (JCR 2019)
Small business economics	19	975	4.803
Journal of business venturing	7	630	7.590
Journal of small business management	3	308	3.461
Research policy	3	1,525	5.351
Industrial and corporate change	2	208	1.981
Journal of finance	2	872	6.813
Strategic entrepreneurship journal	2	279	6.200
Administrative science quarterly	1	382	8.304
Entrepreneurship and regional development	1	251	2.885
Human resource management	1	3,910	2.476
Journal of applied psychology	1	1,053	5.818
Journal of banking & finance	1	912	2.269
Journal of business research	1	3,573	4.874
Journal of financial and quantitative analysis	1	471	2.707
Journal of financial economics	1	1,341	5.731
Organization science	1	345	2.782
Public administration review	1	520	4.063
Technovation	1	338	5.729
World development	1	2,472	3.869

3.4. Content of reviewed articles

3.4.1. Research themes

To establish the knowledge structure of these most cited works in the specific discipline of HGE, we developed clusters of the different scientific aspects. The co-word analysis provided sets of groups of textual information representing the conceptual basis of various topics in the field. Graph 2 shows the main research topics of the most cited articles within the HGE discipline. As the image shows, there are four main themes:

- determinants (26 articles, 52%),
- strategic management (10 articles, 20%),
- finance (nine articles, 18%), and
- innovation (five articles, 10%).

Determinants

Many studies have addressed the determinants of high-potential firm growth (**Delmar**; **Davidsson**; **Gartner**, 2003; **Barringer**; **Jones**; **Neubaum**, 2005; **Moreno**; **Casillas**, 2007). However, most studies report the same key characteristic of HGE firms within the determinants cluster, namely their ability to create employment and to be important drivers of economic and structural change (**Sternberg**; **Wennekers**, 2005; **Acs**; **Mueller**, 2008; **Henrekson**; **Johansson**, 2010; **Mason**; **Brown**, 2013; **Coad** *et al.*, 2014). Other important aspects of the articles within this central theme are aimed at

- studying how policy (initiative design) can foster HGE;
- determining appropriate and inappropriate policies for the promotion of venture capital and high-potential entrepreneurs;
- determining public policies to foster regional development through HGE.

The impact on job creation appears to have put HGE on the public policy agenda. Other papers within this cluster focus on identifying the attributes of entrepreneurs who tend to generate a significant number of HGEs or those factors that increase or decrease the entrepreneur's willingness to grow the firm (**Siegel**; **Siegel**; **Macmillan**, 1993; **Schindehutte**; **Morris**; **Allen**, 2006; **Baum**; **Bird**, 2010; **Goedhuys**; **Sleuwaegen**, 2010). Such factors include:

- the strategic origin of the firm (i.e., the methods and paths through which the firm was founded);
- the previous experience of the founder/owner; and
- the entrepreneur's ability to set realistic and measurable goals and to manage conflict effectively.

In general, the samples vary according to the sector, country, region of study analysis, firm size, use of high or low technology, and the stage of the firm's life cycle, i.e., start-ups versus more mature and consolidated firms.

> ' High-growth enterprises (HGEs) are key to economic growth in developed countries '

Strategic management

The next cluster comprises papers that mainly analyze the various strategies and environmental variables that have a predictable influence on the results of HGEs. In this regard, many studies argue that HGEs manage resources according to the specific requirements of the competitive environment. In particular, in the context of the companies in this group, we find gender-based research and other works that focus on the strategic management of human resources. More specifically, issues such as recruitment, training, and remuneration are addressed. Regarding remuneration, some papers link remuneration to top management, analyzing the negative consequences of pay disparity in family and non-family top management teams. As might be expected, the governance and management of HGEs are also issues that have been analyzed empirically. In this area, fast-growing start-ups quickly outgrow the management capacity of the founder. Therefore, the research literature finds that unless the founder is replaced or supplemented by professional management, firm performance is likely to stagnate or decline rapidly.

Financial perspective

In this cluster, we find papers of different types, namely those focusing on:

- finance sources used by high-growth entrepreneurs;
- empirical analysis of the relationship between firm value; leverage, and ownership;
- debt, debt maturity, and covenants;
- corporate governance/capital structure;
- venture capital analysis.

Venture capitalists (VCs) are considered experts in identifying high-potential start-ups. Additional studies analyze the differences in risk propensity between managers and entrepreneurs and between low- and high-growth entrepreneurs.

Innovation

Finally, in the innovation group, most papers provide empirical support for the recommendations of policymakers and business leaders to maintain R&D investments, especially in high-tech sectors, even when faced with a recession. Several papers show that high-potential firms are increasingly crucial to achieving innovation and formulating entrepreneurship policies. R&D is one of the innovation activities that is most often measured in the most cited papers in the discipline. Thus, among the main analyses carried out in these papers are those addressing the following questions: Are high-growth SMEs more active in R&D than comparable firms that are not growing as fast? In other words, what is the role of innovation in the probability of being a high-growth firm? To what extent do R&D activities affect the growth of new firms, directly or indirectly, through the development of new products and/or alliances with other firms? Is R&D more important for high-growth SMEs in countries that are closer to the technological frontier?
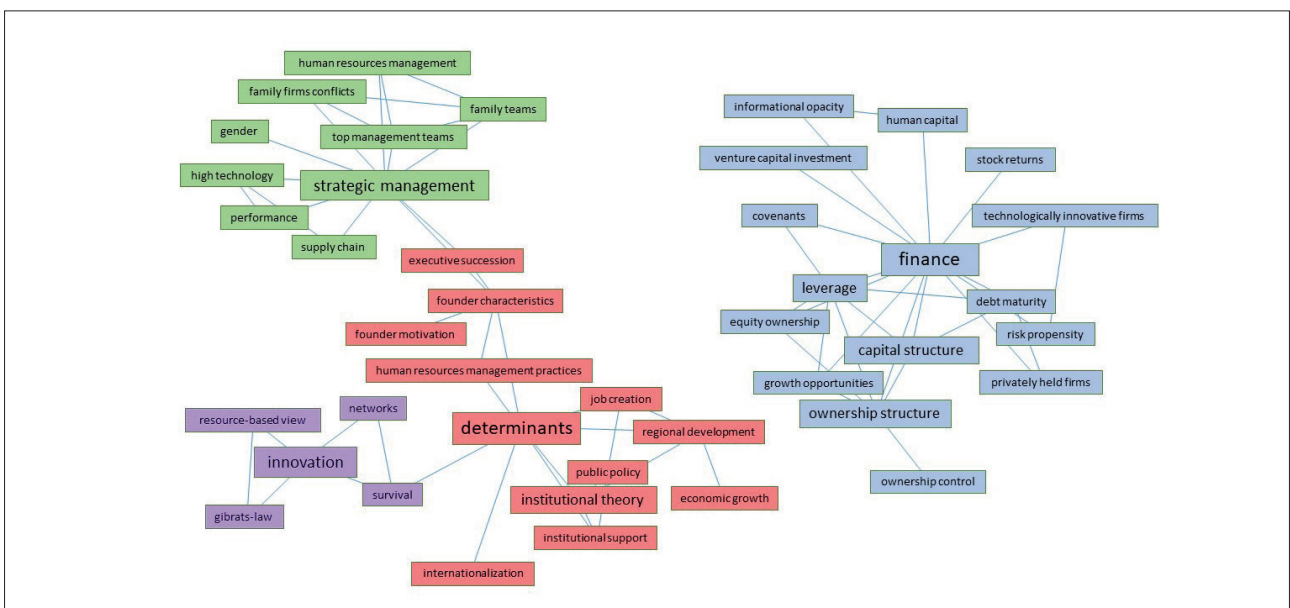
Graph 2. Main topics cited in keywords of HGE H-Classics documents

3.4.2. Nature of high-growth entrepreneurship (HGE) papers

The nature of the papers was examined depending on their approach, the research methods, the type of data, statistical techniques, and countries they report. The nature of the articles included in this study is presented by type in Table 5.

Table 5. Nature of H-Classic articles in HGE

Category	1992-1999		2000-2009		2010-2018		Total	
	n	%	n	%	n	%	n	%
Article type								
Empirical	5	100	21	91.3	16	72.7	42	84.0
Conceptual	0	0	1	4.4	5	22.7	6	12.0
Review	0	0	1	4.4	1	4.5	2	4.0
Research methods								
Quantitative	3	60.0	17	73.9	11	50.0	31	62.0
Qualitative	2	40.0	4	17.4	11	50.0	17	34.0
Hybrid	0	0	2	8.7	0	0	2	4.0
Primary or secondary data								
Primary- questionnaire	1	20.0	4	17.4	2	12.5	7	16.7
Primary-interview	0	0	3	13.0	3	18.8	6	14.3
Primary-case study	0	0	0	0	1	6.3	1	2.4
Primary hybrid	1	20.0	2	8.7	0	0	3	7.1
Secondary	3	60.0	11	47.8	7	43.8	21	50.0
Primary-Secondary	0	0	1	4.3	3	18.8	4	9.5
Statistical techniques								
Variance analysis [AN(C)OVA, MANOVA]	0	0	2	8.7	0	0	2	4.0
Descriptive/content	0	0	1	4.3	0	0	1	2.0
t-test, _2, correlation, Mann-Whitney U	1	25.0	0	0	1	7.1	2	4.0
Regression	2	50.0	9	39.1	10	71.4	21	42.0
Factor, cluster, discriminant	1	25.0	4	17.4	0	0	5	10.0
Structural equation model	0	0	1	4.3	2	14.3	3	6.0
Others	0	0	3	13.0	1	7.1	4	8.0
Samples								
Firms	4	100	8	34.8	9	81.8	21	42.0
Entrepreneurs	0	0	3	13.0	0	0	3	6.0
Territorial areas	0	0	1	4.3	0	0	1	2.0
Papers	0	0	1	4.3	1	9.1	2	4.0
Others	0	0	3	13.0	1	9.1	4	8.0
Country								
USA	3	100	3	13.0	0	0	6	12.0
Sweden	0	0	2	8.7	1	9.1	3	6.0
Finland	0	0	1	4.3	1	9.1	2	4.0
UK	0	0	0	0	2	18.2	2	4.0
Spain	0	0	0	0	2	18.2	2	4.0
European countries	0	0	1	4.3	1	9.1	2	4.0
African countries	0	0	0	0	2	18.2	2	4.0
Netherlands	0	0	1	4.3	0	0	1	2.0
Austria	0	0	0	0	1	9.1	1	2.0
Scotland	0	0	0	0	1	9.1	1	2.0

Primary methods

The primary methods used in the articles published were also identified. During the 27-year period from 1992 to 2018, 84% of the articles were empirical studies, 12% were conceptual studies, and 4% were reviews. Empirical studies account for 100% of the works in the first sub-period analyzed (1992-1999), decreasing to 72.7% for 2010-2018. In the latter period, the proportion of conceptual studies increased to 22.7%.

The evolution of research methods

The majority (62%) of articles published between 1992 and 2018 used a quantitative research method, and 34% used a qualitative research method. Approximately 4% used a hybrid research method. In the period before 2010, quantitative research was more frequent than qualitative research. Both forms of research were equally represented during the 2010-2018 period.

Data-gathering methods

During the 27-year period investigated, half of the empirical articles used secondary data, while 40.5% of the empirical articles used primary data, with almost 10% of the articles using both types of information for their research. It can be observed that over this period, the use of secondary data decreased from 60% in the first sub-period to 43.8% in the years 2010 to 2018.

Primary data-gathering methods

For the sourcing of primary data, questionnaires were the most commonly used method (16.7%), followed by interviews at 14.3%. Some papers used other techniques such as hybrid or multiple primary methods (7.1%) and case studies (2.4%). When the three sub-periods are considered separately, questionnaires and interviews were also the most frequently used data-collection tools. However, the use of questionnaires decreased in favor of interviews, and the emergence of case studies was observed in the last sub-period analyzed. The combination of primary and secondary information followed an increasing trend over the years, reaching 18.8% in 2010-2018.

> Most cited articles in HGE provide signals of the evolution and knowledge structure of the classic papers on the topic

Statistical techniques

Several different statistical techniques were represented in the articles examined in this study. The most common category of statistical methods included regression analysis (42.0%). The second most common category included factor, cluster, and discriminant analysis (10.0%). The third most common category included structural equation models (8.0%), and the fourth and fifth categories used variance analysis [AN(C)OVA, MANOVA] and t-tests, chi-square, correlation, and the Mann-Whitney U test, at 4.0%. It should be noted that 8.0% of the articles used other techniques that are not mentioned above. In the period analyzed, there was an increasing trend for the use of regression models from 50.0% in 1992-2000 to 71.4% in 2010-2018. In particular, there was an increase in the use of structural equation models. In the first sub-period, not a single article used structural equation models, whereas in 2010-2018, 14.3% of the articles used this statistical technique. There was a decrease in t-tests, chi-square, correlation, and Mann-Whitney U tests, from 25.0% to 7.1%. It is also noteworthy that in the sub-period 2010-2018, no articles employing factor, cluster, and discriminant analysis techniques were published.

Standard group sampling

The most common group sampled in the articles examined during the 27-year period of this study was that focused on firms, representing 42.0% of all articles. The second most common group was on entrepreneurs (6.0%), followed by researchers using other papers as units of analysis (4.0%) and those focused on territorial areas (2.0%). During the first sub-period, 1992-1999, all the articles used a sample of companies. From 2000 onwards, researchers began to produce empirical research based on other types of samples, such as entrepreneurs, territorial areas, and academic papers.

Countries in the samples

The country of origin of the sample is only provided in 22 of the papers analyzed. Articles using samples from the USA account for 12% of the total. Sweden accounts for 6%. Other countries follow, with smaller percentages of papers. In the sub-period 1992-1999, only samples from the USA were used. In the following sub-period, articles with samples from Sweden, Finland, Netherlands, and other European countries were added. From 2010-2018, papers were published with samples from African countries, Spain, UK, Austria, and Scotland.

4. Conclusions, limitations, and directions for future research

The academic field of entrepreneurship research has evolved from isolated groups of scholars researching small businesses, to an international community of departments, institutes, and foundations promoting research on start-ups and high-growth ventures (**Aldrich**, 2012).

This article provides a retrospective of the most cited articles published in *WoS* journals on high-potential entrepreneurship. To this end, the H-Classics methodology, based on the H-index, was applied, identifying the 50 most cited articles on the subject out of the total of 230 articles in the sample. Bibliometric characteristics, authors, journals, institutions, collaboration patterns, research trends, and the nature of the most cited articles from 1989 to 2020 are analyzed. Using H-Classics, new findings were discovered and more precise results were obtained on high-growth entrepreneurship (HGE) than previous work that has carried out bibliometric analyses without taking into account the most-cited papers.

Conclusions

- Research on high-potential firms is a current and hot topic.
- Of the most cited articles, 90% were published in the 21st century, and 44% were published in the second decade of this century.
- Collaboration between researchers is the most common way of researching this sub-area of entrepreneurship. Two or three authors have produced 80% of the 50 most cited articles. The most productive author is Hölzl from the *Austrian Institute of Economic Research (WIFO)*. Four of the most productive authors are from Swedish universities or research centers.
- Several countries are represented in the most-cited articles on HGE, with the USA being the most productive, followed by the UK and Sweden.
- The institutions with three or more of the top 50 most-cited publications are located in these countries and the Netherlands.
- Analysis of the knowledge structure of these 50 most cited articles on HGEs results in three clusters. The key themes in these clusters are the determinants of HGEs, strategic management, and finance. These research themes highlight that while all forms of entrepreneurship play a key role in the economy, there is growing evidence that HGEs are the main drivers of innovation and job creation.
- The vast majority (84%) of the papers were empirical in nature, although in recent years, there has been an increase in conceptual papers. The research method most commonly used was the quantitative method. The empirical studies mainly used primary data from questionnaires and interviews, with the combination of primary and secondary data becoming more and more frequent.
- The most commonly used statistical techniques were regression analysis, factor analysis, cluster analysis, and discriminant analysis. Over the years, there has been an increase in the use of regression analysis and in papers using structural equation modeling.

Contributions

This paper makes several contributions to the literature:

- First, an analysis of the most cited articles in HGE provides valuable insights into the evolution and knowledge structure of the classic articles on the topic.
- Second, this paper establishes HGE research as an important and current sub-area within entrepreneurship, to be explored even further in future research.
- Third, HGE is an area of knowledge whose development has been fostered by European countries, especially Sweden, given its high link with innovation, and by the United States. The present study confirms that there is a body of literature focused on HGE research. This finding supports the feasibility of creating a specific category for HGE within the main lines of research in the field of entrepreneurship.

Limitations

- First, the articles analyzed are derived from a single source, the *WoS*. Although *WoS* is one of the most relevant databases, other papers published in relevant journals not indexed in this database have been omitted.
- Second, more recent publications had less time to be cited, so citation counts as a measure of influence could be biased toward older publications (**Zupic**; **Čater**, 2014). Furthermore, both old and new articles receive citations and the citation scores are constantly changing (**Piwowar-Sulej**, 2021). Therefore, as established by **Aksnes**, **Langfeldt**, and **Wouters**, (2019), further analyses conducted in different periods, with the same methodology, are warranted.

Future research

Future research should include other data sources to validate the results obtained. In addition, this analysis could be complemented by another study exploring the knowledge structure of HGE research in recent decades through other bibliometric methodologies such as science mapping (**Cobo** *et al.*, 2012), to obtain a complete picture of this area of entrepreneurship. An analysis of the latest HGE research could explain future trends in the area. Finally, new studies with specific geographical foci (Europe, USA, etc.) would be interesting.

> HGE research is an important and current sub-area within entrepreneurship to be explored further in future research

Finally, the information provided in this study is invaluable to understanding the scientific structure within the field of research on high-growth firms, and could therefore serve as a reference for future research development in this field.

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Appendix A. High-growth entrepreneurship (HGE) core research documents list

Article	Cites
Larson, Andrea (1992). "Network dyads in entrepreneurial settings: a study of the governance of exchange relationships". *Administrative science quarterly*, v. 37, n. 1, pp. 76-104. *https://doi.org/10.2307/2393534*	1.278
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