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Thematic Review

Toward a taxonomy of entrepreneurship education research literature: A bibliometric mapping and visualization

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ABSTRACT

The retrospective amount of research literature dedicated to entrepreneurship education (EE) is overwhelming, which makes producing an overview difficult. However, advanced bibliometric mapping and clustering techniques can help visualize and structure complex research literature. Thus, the objective of this mapping study is to systematically explore and cluster the EE research literature to deliver a taxonomic scheme that can serve as a basis for future research. The analyzed data, which were drawn from the Web of Science and Scopus, consist of 1773 peer-reviewed documents published between 1975 and 2014. On the one hand, this taxonomy should create stronger ties to educational research; on the other, it can foster international research collaboration to boost both interdisciplinary EE and its impact on a global basis. This work reinforces our understanding of current EE research by identifying and distilling the most powerful intellectual relationships among its contributions and contributors. Consequently, this study addresses not only the academic community but also entrepreneurship educators and policy-makers in an effort to boost entrepreneurial spirit, design effective policy instruments, and, ultimately, improve societal welfare.

1. Introduction

Despite the crucial role that entrepreneurship education (EE) plays in economic progress and the growing prominence of EE in many societies (O'Connor, 2013; EC, 2013), overviews of this rapidly growing research area is limited. In particular, the latest literature reviews (e.g., Althoff, 2012; Baxter, Chapman, DeJaeghere, Pekol, & Weiss, 2014; Lorz, Mueller, & Volery, 2013; Pittaway & Cope, 2007a; Rasmussen, 2011; Rideout & Gray, 2013) and meta-analyses (e.g., Bae, Qian, Miao, & Fiet, 2014; Martin, McNally, & Kay, 2013) on EE have illustrated the impressive development of the scholarship in this complex and diverse research literature while stressing gaps related to controversies and paradoxes. For instance, a meta-analysis has been conducted on the relationship between EE and entrepreneurial intentions (Bae et al., 2014), several literature reviews have focused on impact studies (e.g., Lorz et al., 2013; Mwasalwiba, 2010) or teachable competences in EE (e.g., Albornoz, 2008; Thomas & Barra, 1994), others have examined social orientations within EE (e.g., Mars & Garrison, 2009) or EE for small business management (e.g., Gorman, Hanlon, & King, 1997), and still others have been dedicated exclusively to tertiary education (e.g., Pittaway & Cope, 2007a; Rideout & Gray, 2013) or youth unemployment (e.g., Baxter et al., 2014). There are also several book reviews (e.g., Althoff, 2012; Daim, 2011; Rasmussen, 2011; Tan, 2008).

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Despite these many literature reviews, Pittaway and Cope (2007a) recommended more than a decade ago a more systematic taxonomy scheme to provide the full overview of the EE research literature that is essential for its evolution. However, to the best of our knowledge, no study has yet been published that explores and structures the EE research literature according to a systematic taxonomic scheme. Moreover, EE scholarship has not hitherto benefited from an in-depth systematic bibliometric metrics analysis that includes clustering techniques; only two published studies use bibliographic mapping and visualization techniques to review the EE literature (Kakouris & Georgiadis, 2016; Yu & Yang, 2013). Yu and Yang's (2013) conference paper appears to still be in a developmental stage, and Kakouris and Georgiadis (2016) chose to analyze a Scopus sample of 7726 abstracts containing only the search term “entrepreneurship” by means of word frequencies and text mining in corpuses of titles, author or index keywords, abstracts, and citation analyses. Meeting this need by providing a systematic taxonomy scheme for the EE research literature based on bibliometric metrics will not only provide an overview of the literature for scholars but also be of use for policymakers in terms of impact of policy measures to encourage EE. Thus, this background serves as the motivation for this study.

The term *bibliometric* refers to the application of mathematical and statistical techniques and quantitative measurements to bibliographic information (Braun, 2005; Pritchard, 1969; van Leeuwen, 2004, pp. 373–388). In this context, bibliometric mapping applies quantitative methods to bibliographic data to present scientific knowledge visually in a deductive way based to form research clusters (Börner, Chen, & Boyack, 2003). While most scholars, including those in entrepreneurship research (e.g., Teixeira, 2011), focus on bibliographic mapping, visualized representations of these bibliometric maps and clustering techniques that provide an overview of the influential relationships in the literature (e.g., van Eck & Waltman, 2009) have been neglected so far in the EE literature. Thus, this study's objective is to combine bibliographic metrics with analytic techniques for mapping networks of linked contributions and contributors to visualize the most powerful relationships and open possibilities for future research recommendations (Cronin, 2001; Ding, 2011; Moya-Anegón et al., 2004).

This study provides an overview of clusters in the EE research literature through 2014 by means of quantitative and qualitative investigations in order to contribute to future EE research literature. As a systematic mapping study (SMS), it delivers recommendations for future research resulting from a taxonomic scheme constructed by analytically exploring and visually structuring the literature through both co-citation analyses and bibliometric coupling techniques. The goal of this SMS is to aid scholars in undertaking further EE studies. The research question addressed is as follows: *Based on a systematic taxonomic scheme, what is important for future EE research?*

The SMS is structured as follows. Section 2 provides an elaboration of the theoretical framework, and section 3 details the methods applied to explore and structure the contributors to and contributions in the research literature. The bibliometric analysis and results are presented in section 4. These results feed section 5's critical reflection and discussion, which lead to research recommendations. The conclusion in section 6 summarizes this study without neglecting its limitations; practical and theoretical implications are also discussed.

2. Theoretical framework

The research provides both narrow and broad definitions of EE as a teaching field and what it implies for educators and for students in the entrepreneurship context. The educational methods for teaching entrepreneurship are as diverse as the definitions of EE (Neck & Greene, 2011). However, consensus has been reached on two elements for defining EE: one is a wider concept that comprises the development of the personal qualities, attitudes, and skills crucial for entrepreneurship and the other is dedicated to specific training to set up the entrepreneurial (ad)venture (Fayolle & Gailly, 2008). This study acknowledges and even celebrates the diversity of EE through the different contexts, perspectives, definitions, and methods found in the research literature.

EE has enjoyed global attention and rapid growth in scholarship in recent decades (Bae et al., 2014; Kuratko, 2005; Lorz et al., 2013). Even with such significant attention paid by the academic community, the reality of EE topics' complexity and diversity represents a double-edge sword that brings challenges along with demonstrable, accretive progress:

The systemic nature of entrepreneurship education is, however, complicated by the fact that there is little clarity about what the outputs are designed to 'be'. This lack of clarity about the intended outputs leads to significant diversity surrounding the inputs. (Pittaway & Cope, 2007a, p. 486, p. 486)

Pittaway and Cope stressed that taxonomies are necessary for promoting the development of the EE research literature (2007a). Earlier, Davidsson and Wiklund (2001) had argued for studies investigating research clusters in EE. However, these scholars' calls have been answered by only a few efforts (e.g., Bechard & Gregoire, 2005; Hisrich, Langan-Fox, & Grant, 2007; Joshi, 2014; Mário, Arminda do, & João, 2008; Naia, Baptista, Januário, & Trigo, 2015; Zhen, Heng, Kong, & Qian, 2006); there are also open calls for innovation-driven approaches that explore and seek to structure EE's complex nature (e.g., Antonaci et al., 2015; Fonseca et al., 2014; Lyons, Lynn, & Bhaird, 2015; Vanevenhoven & Liguori, 2013).

Bechard and Gregoire (2005) conducted a review of the EE literature that classified the research under seven areas in EE, using only the number of articles to measure research volume. Zhen et al. (2006) focused on teaching cases in EE and clustered experimental research by means of an analytic knowledge network process. While Hisrich et al. (2007) classified different entrepreneurial profiles to present open research questions before issuing a call to action for more intensive research in psychology, Mário et al. (2008) elaborated a taxonomy of the attributes and motivations of university students, based on a sample of 316 individuals, profiling entrepreneurs by the means of bivariate and multivariate statistics. Joshi (2014) identified and classified challenges, issues, and different models of EE. Later, Naia et al. (2015) worked toward a taxonomy of the EE literature to analyze theoretical contributions, but used only the number of articles as impact measurement, which is a serious limitation when dealing with such a wide-ranging

research literature.

There have also been only a few efforts toward a taxonomy in the entrepreneurship literature. For instance, [Helm and Andersson \(2010\)](#) applied a taxonomic focus to an empirical validation of social entrepreneurship in the nonprofit sector based on information from 145 nonprofit organizations, and [Nica, Grayson, and Gray \(2015\)](#) discussed various factors impacting entrepreneurship based on a theoretically driven classification method.

In reviewing past taxonomical efforts in EE and entrepreneurship more generally that have applied traditional techniques, it is worth quoting [Kuratko's \(2005\)](#) thoughts from more than ten years ago; he called on entrepreneurship educators to show innovative and entrepreneurial drive and provide convincing evidence of the authenticity, from a pedagogical point of view, of what they were writing about the entrepreneurial world:

As entrepreneurship educators, we must be the guardians of the true meaning and intent of the word “entrepreneurship.” ([Kuratko, 2005](#), p. 588, p. 588)

A wide variety of methods to investigate a large volume of research literature are available. Techniques related to systematic reviews are used to explore and structure research literature because of their objectivity and unobtrusiveness ([Garfield, 1979](#); [Pilkington & Teichert, 2006](#)). This leads to more clarity than controversy ([Chiru, Tachiciu, & Ciuchete, 2012](#); [Gordon, Hamilton, & Jack, 2012](#); [Mojab, Zaefarian, & Azizi, 2011](#)). Specifically, an SMS is a secondary study carried out to thematically explore and classify earlier research and bring structure to diverse research literature. A systematic literature review (SLR), meanwhile, seeks to summarize and evaluate previous research results. If search terms are more general and a classification of the research literature needs to be provided for a taxonomy scheme, an SMS is appropriate. Thus, in reference to the four levels of inquiry based on the amount of information and guidance provided ([Bunterm et al., 2014](#)), a structured inquiry has been adopted for this study; according to [Llewellyn \(2012\)](#), in a structured inquiry the executive individual is responsible for processing and presenting the data. A structured inquiry also enables comparability with the previous reviews of EE research cited above.

Moreover, because the EE research literature consists of different publication types in both general and specialized journals of lower and higher impact, an SMS based on bibliometric data reveals research clusters and helps provide a taxonomy that respects that diversity. A taxonomy is an empirical tool for structuring complex information to allow both the ordering and retrieval of large amounts of data to stimulate future research. A taxonomy is more than merely placing items into clusters; it is a classification scheme that stresses the similarity between items in a systematic way. Thus, a structured exploration of research related to EE with empirical bibliometric information will provide valuable insights into the EE literature. The first move in a taxonomy is to recognize elementary similarities, which are grouped into clusters. The taxonomy is built of sets of similar groups (taxa) that are developed into broader clusters. Subsequently, the characteristics of the clusters are discussed. Through algebraic clustering techniques, taxa emerge that incorporate items into groups based on advanced algorithms ([Rich, 1992](#)), creating clusters that are as internally homogeneous and as distinct from one another as possible. Consequently, this research study provides a structural overview—a synopsis of the intellectual relationships among the publications, prominent authors, cited references, prominent journals, and organizations—that facilitates a discussion of the research clusters that emerge. This enables a systematic description of the contributions and contributors in each cluster that can serve to derive recommendations for future research.

Based on this theoretical framework, the systematic taxonomy of the EE research literature follows four steps: (1) peer-reviewed publications are mapped and visualized to (2) identify the research clusters. Supportive visualization software programs like VOSviewer, CitNetExplorer (www.citnetexplorer.nl; the abbreviation stands for “citation network explorer”) and RapidMiner (www.rapidminer.com) are used. Next, (3) each cluster is discussed in reference to its most powerful relationships among publications, prominent authors, cited references, prominent journals, and organizations, which leads to (4) recommendations for future research.

Notably, this work does not advocate reducing the variety of techniques, concepts, or theories used in EE research. Instead, a systematic taxonomy of EE studies is elaborated to provide recommendations for future research. Based on a visualized, bibliometric-driven taxonomy, we are able to explore, structure, and recommend specific questions for further study. By applying the latest methods and algorithms from bibliometric and scientometric research, mapping and clustering techniques are jointly employed to analyze and study networks of documents, citations, references, authors, journals, and organizations with the aim of delivering insights into the intellectual structure of the research literature in a given field ([Waltman, van Eck, & Noyons, 2010](#)). The taxonomy is built by means of the complementarity environment of mapping and clustering in a unified framework. Through mapping peer-reviewed documents, a detailed depiction of the intellectual structure of the EE bibliometric literature is achieved. These mappings and visualizations enable us to present a systematic and structured overview and synthetic taxonomy of the current state of the EE literature. Advanced bibliometric and scientometric technologies are applied to not only enhance existing review EE studies but also to structure the current EE research literature so as to derive future research recommendations. Given the variety and sheer volume of the material, a systematic research technique with advanced bibliometric mapping, visualization, and clustering techniques is a highly appropriate way to explore the EE research literature.

3. Methodology

3.1. A systematic mapping study with bibliometric information

To achieve the SMS objectives, this paper adopts and enhances the methodology for literature reviews recommended in the management research field ([Tranfield, Denyer, & Smart, 2003](#)). Generally, co-citation and bibliographic coupling analyses are the most accurate techniques in research literature mapping ([Boyack & Klavans, 2010](#); [Gmür, 2003](#)). Together, bibliographic coupling,

co-citation, and direct citation analyses are the most effective way to distill the EE research literature. Boyack and Klavans (2010) emphasize that each of these techniques is capable of successfully clustering more than 90% of the scientific corpus on its own. Used jointly, a reliably accurate overview of the research literature can be provided.

Co-citation analysis is outperformed by bibliographic coupling; however, as a bibliometric technique, co-citation analysis is able to accurately map intellectually structured information (Bayer, Smart, & McLaughlin, 1990; White & Griffith, 1981). In a co-citation analysis, paired or co-cited documents from an explicit research topic are counted, accumulated, and statistically scaled with a matrix structure to capture the picture of a given knowledge network (Osareh, 1996; Pilkington & Teichert, 2006). Co-citation analyses presume that citations are valid and reliable indicators of interactions among scientific contributors and contributions. Furthermore, overlaps of clusters that occur can highlight especially strong links between these clusters. Overall, citations represent intellectual relationships that indicate the “distances” between contributions (White & Griffith, 1981). A citation analysis examines the relationships among citing and cited authors, publications, and sources to identify the most influential contributions.

Co-citation analyses have high degrees of reliability. Additionally, co-citation networks identify “invisible colleagues” (Gmür, 2003), a term that refers to debating investigators who discuss linked subjects (Crane, 1972; Teigland, 2003). Despite these advantages, the EE research literature has thus far seen only limited use of co-citation analyses (e.g., Gregoire, Noel, Déry, & Béchar, 2006). This SMS applies bibliographic coupling and co-citation maps using quantitative and qualitative bibliographic techniques to provide a taxonomic scheme of the EE research literature.

3.2. Data processing

This SMS relies on review methods and processes that have already been implemented in entrepreneurship research (e.g., Kraus, Filser, Eggers, Hills, & Hultman, 2012; Tranfield et al., 2003). The bibliographic mapping and visualization analysis was performed by means of the subsequent steps:

1. *Data collection and identification of documents.* The dataset was determined by publications in the primary database Web of Science (WoS) containing the terms (entrepreneur*) AND (educ*) OR (entrepreneur*) AND (teach*) OR (entrepreneur*) AND (learn*) in either topic or title. Overall, 2974 peer-reviewed articles were identified. Following the initial collection of articles, a quality review of every abstract was conducted to ensure that all remaining articles were actually related to EE. This step yielded 2066 articles.
2. *Dataset quality checks.* In the next step, the dataset was analyzed for consistency to identify missing papers. The dataset was double-checked against additional databases, such as Scopus (2222 peer-reviewed articles), EBSCO (1886 peer-reviewed articles), ABI Inform/ProQuest (2721 peer-reviewed articles), and ScienceDirect (305 peer-reviewed articles).
3. *Creation of networking maps and cluster identification based on bibliographic coupling using VOSviewer.* Algorithms implementing a unified approach to the well-known mapping technique of multidimensional scaling and a weighted and parameterized variant of modularity-based clustering were incorporated based on the same underlying principle (Waltman et al., 2010). The clustering algorithm used by VOSviewer is discussed in detail by Waltman et al. (2010). van Eck, Waltman, Dekker, and van den Berg (2010b) report that maps using VOSviewer provide more satisfactory depictions of data than maps created with other well-known techniques. Previous studies have shown that the applied algorithm and its functionality yield reliable and valid results (van Eck et al., 2010b; van Eck & Waltman, 2009, 2014b; Waltman & van Eck, 2013). The more equal the references cited in two publications are, the more robust the degree of bibliographic coupling between these publications will be (e.g., Boyack & Klavans, 2010; Zhao & Strotmann, 2008), so strongly connected publications indicate closely interconnected schools of thought and are located near one another on the visualized map (van Eck, Waltman, Noyons, & Buter, 2010a). Given these criteria, VOSviewer eliminated publications that were not connected to the EE research literature. This step yielded 1773 analyzed documents, which were classified into 14 clusters. Of these clusters, cluster 9 consisted only of 12 documents, cluster 10 consisted only of 11 documents, and clusters 11 to 14 consisted only of 3 documents each; thus, clusters 8 to 14 were merged.
4. *Creation and analysis of further network maps using Scopus analysis, VOSviewer, and CitNetExplorer.* The evolution of EE was analyzed with a focus on citations per year and author. EE research was also mapped into different networks through co-citation maps of cited references, authors, and journals and bibliographic coupling maps of organizations. The research areas as defined by WoS were also employed. The most prominent contributors and contributions characterize each cluster in the taxonomy scheme.
5. *Topic cluster interpretation.* VOSviewer is particularly valuable for exhibiting outsized bibliometric maps in a coherent way as a basis for qualitative interpretation (van Eck & Waltman, 2009). The related thoughts in each cluster were interpreted and defined on a qualitative level by screening the abstract of each document. The VOS mapping method, with its weighted and parameterized variation of modularity-based clustering (Van Eck & Waltman, 2007), is linked to traditional, durable techniques of multidimensional scaling in the statistical literature (see Borg & Groenen, 2005 for an example). The VOSviewer modularity-based clustering applied was drawn from the physics literature (Newman, 2004a, 2004b, 2004c; Newman & Girvan, 2004). It ensures that all applied techniques and algorithms are constructed to follow similar designs, rules, and assumptions (Waltman et al., 2010). Each cluster was analyzed and interpreted for content similarities related to prominent papers, cited references, research areas, authors, journals, and organizations. To identify a name and an appropriate definition for each cluster, all titles, keywords, and abstracts for each cluster were analyzed by means of advanced text mining techniques (e.g., term extraction, term filtering, term phrases, and association rules) in RapidMiner. A similar strategy for generating a concept taxonomy from a document corpus has already been implemented to develop a taxonomy of career studies (Lee, Felps, & Baruch, 2014) and studies of management and economics (de Knijff, Frasinca, & Hogenboom, 2013). An epistemological orientation was applied. The presented clusters

Table 1
Characteristics of the bibliometric study.

Search terms	(entrepreneur*) AND (educ*) OR (entrepreneur*) AND (teach*) OR (entrepreneur*) AND (learn*)	
Mentioned at least once in	Topic or Title (WoS)/Abstract, Title, or Keyword (Scopus)	
Time period	1968–2014	
Primary databases (document type)	Database	Records
	WoS (core publication article)	2974
	Scopus (article/review)	2222
Quality cross-checks with	EBSCO	1886
	ABI Inform/ProQuest	2721
	ScienceDirect	305
Records after manually reading all abstracts to ensure that all articles were related to EE	2066	
Final analyzed records, following the exclusion of unrelated documents via VOSviewer	1773	
Primary analysis tools	VOSviewer, CitNetExplorer, and RapidMiner	

were interpreted with a focus on complexity, while patterns were inductively discovered and interpreted (Orlikowski & Baroudi, 1991).

- The analyzed information was merged into a taxonomic scheme that presents an overview of the clusters in the EE research literature to facilitate discussion that will lead to suggestions for future research.

The combination of different visualized networking maps, clusters, and text mining techniques with a systematic analysis yielded a research taxonomy that offers ample recommendations for future EE research literature.

3.3. Data

Based on recommendations for SMS methodologies, databases—which provide the most essential information for bibliometric analysis in the social sciences—were selected as the information sources. The literature is analyzed based on the Social Science Citation Index, which is supplied by the Institute for Scientific Information (ISI) Web of Knowledge (Garfield & Merton, 1979; ThomsonReuters, 2015). Past contributions concerning bibliometric studies have stressed noted disadvantages of this index. For instance, the authors of some bibliometric studies have argued that using ISI data to analyze social science research results in incomprehensive coverage, both in terms of the types of literature covered and the scope of journals (Glänzel, 1996a, 1996b; Hicks, 1999; Nederhof, 2006). Furthermore, ISI's low reliability with respect to different languages and geographies has been criticized (Harzing & Van Der Wal, 2009; Kousha & Thelwall, 2008; Nederhof, 2006). However, Franceschet's (2010) comparison of WoS and Google Scholar illustrates that citation-based rankings for both journals and authors do not differ significantly. Even so, to address the criticisms raised about relying on the ISI, quality checks with other databases—Scopus, EBSCO, ProQuest, and ScienceDirect—were performed. Given the reliance on ISI source serials, the dataset consists exclusively of publications intended for a scholarly audience. Table 1 summarizes the characteristics of the dataset underlying this bibliometric study.

3.4. Applied analysis

The broad definition and wide scope of this review necessitate that we start with a diverse range of research, which are then ranked based on importance and addressed in greater detail in the results of this study. Most contributions dedicated to entrepreneurship (e.g., Reader & Watkins, 2006; Volery & Mazzarol, 2015) or education (e.g., Biancani & McFarland, 2013; Cheng & Wang, 2011) that implement bibliometric methods rely on visual presentations developed with SPSS or Pajek, which yield satisfactory results for small maps. However, these programs are inadequate for drawing larger maps (van Eck & Waltman, 2009). Thus, to guarantee comprehensive coverage of the EE research literature, we not only took advantage of primary software programs like VOSviewer, CitNetExplorer, and RapidMiner, but also conducted further analyses and checks using additional tools such as Bibexcel, Pajek, Publish, and Perish and an analysis of the Scopus results as an additional robustness test. These extensive additional evaluations did not change the results.

This SMS uses the freely available program VOSviewer to construct and view the bibliometric data on a set of maps (van Eck & Waltman, 2009; Waltman et al., 2010, 2011a, 2011b). This web-based toolkit applies a mapping technique that has been shown to deliver adequate performance in several academic discussions (van Eck et al., 2010a). Unlike SPSS and Pajek, VOSviewer devotes significant effort to the graphical depiction of bibliometric maps. This functionality is particularly valuable for illuminating large bibliometric maps (van Eck & Waltman, 2009), as is the case with this SMS. The multidimensional scaling conducted using the specific mapping techniques of VOSviewer has been successfully used in other educational papers (e.g., Kosmützky & Krücken, 2014; Tseng, Chang, Tutwiler, Lin, & Barufaldi, 2013; Zohar & Barzilai, 2013). In addition, several colleagues have already applied this advanced science mapping and visualization tool. While a few contributions have been dedicated to mathematics (e.g., Leydesdorff, Kushnir, & Rafols, 2014; Leydesdorff & Rafols, 2012), medicine (e.g., Grigore, Adi, & Theofilou, 2015, pp. 221–239; Khalil & Gotway Crawford, 2015; Zeraatkar, 2013), and decision sciences (e.g., Jamali, 2013), the majority of publications have focused on social

science (e.g., Barth, Haustein, & Scheidt, 2014; Waaijer, 2013) and computer science (e.g., Pinto, Isabel Escalona, Pulgarín, & Uribe-Tirado, 2014; Prashant Nagarkar & Kumbhar, 2015).

Distance-based maps have been created that depict the relationships among different publications. The distance between two publications on a map is a sign of their relatedness, such that the stronger the relationship between the publications, the shorter the distance between the publications on the map will be. On a VOSviewer map, a fragmented distribution of publications based on their relationship strengths automatically identifies different clusters of closely related documents. Clusters that are positioned near one another point to closely related literature. Although such visualizations are based on a fairly quantitative technique that involves the application of text mining techniques and algorithms to large amounts of textual data, the resulting visualized bibliographic maps provide insights into the EE research literature that allow us recognize, deduce, and interpret the clusters using a qualitative technique, in this case the text mining techniques in RapidMiner (Hair, Black, Babin, Anderson, & Tatham, 2006).

CitNetExplorer is another web-based tool for visually analyzing citation networks of publications to study the evolution of research literature (Hong, 2014; van Eck & Waltman, 2014a). This program explores the temporal breadth of research literature and a scholar's publication track record with respect to community detection in networks in order to identify and formulate research recommendations (van Eck & Waltman, 2014a). Table 2 outlines the applied method pipeline, including the steps, databases or programs, and justifications.

4. Bibliometric analyses of the literature and results

4.1. Bibliographic maps and clusters

The results of our bibliometric analysis are presented visually in Fig. 1 by means of a map comprising the research clusters. The figure illustrates, through a unified method of mapping and clustering combined with bibliographic coupling techniques, the 1773 most frequently cited publications in the EE research literature published between 1975 and 2014. Publications are referenced by the last name of the first author, and each cluster is indicated by a specific color. Cluster 1 is “Social and policy-driven EE” (dark blue), cluster 2 is “Human capital studies related to self-employment” (light blue), cluster 3 is “Organizational EE” (green), cluster 4 is “Triple helix” (cyan), cluster 5 is “(Re)design and evaluation of EE initiatives” (red), cluster 6 is “Entrepreneurial learning” (orange), cluster 7 is “EE impact studies” (pink), and cluster 8 is “EE opportunity-related environment at the organizational level” (black). Table 3 provides the taxonomy scheme with more details regarding the eight identified EE research clusters.¹

In Table 3, cluster titles and definitions are presented in the second and third columns, respectively. Research areas—research topics based on the number of peer-reviewed documents in WoS (shown in square brackets)—are illustrated in the fifth column. The five most influential publications within each cluster, as ranked by bibliographic coupling links and shown in square brackets, are presented in the sixth column. Column seven lists prominent authors, ranked by co-citations links across the EE research literature. Although prominent references are ranked by documents within the cluster, co-citation links within the EE literature are shown in square brackets in column eight. In column nine, prominent journals are shown for each cluster, ranked by co-citation links in the EE literature (shown in square brackets). Finally, the last column of the taxonomic scheme ranks prominent organizations by both total number of bibliographic coupling links within the cluster and by bibliographic coupling links within the EE literature (displayed in square brackets). Each cluster is discussed in detail after the table. Detailed maps are also online available for a),² b),³ c),⁴ and d),⁵ as indicated in Table 3 heading.

4.1.1. Cluster 1—Social and policy-driven EE research

Overall, out of the 1773 analyzed articles, 477 documents are categorized in this first cluster, with the main research areas of Business & Economics (29.86%), Education & Educational Research (19.42%), Public Administration (7.68%), Geography (4.49%) and Sociology (4.49%). In terms of documents, this is the biggest cluster, with the most documents in the areas of business and

¹ The clustering of the EE research literature is also available in a spreadsheet file as a supplementary document. Further inspection of the visualized results can be performed with the VOSviewer application. In order to run the software, version 6 of Java needs to be installed on the system. Detailed link address: http://www.vosviewer.com/vosviewer.php?map=http://www.feldundhof.at/div/bib_doc_map.txt&network=http://www.feldundhof.at/div/bib_doc_network.txt&cluster_colors=http://www.feldundhof.at/div/color.txt.

² a) Visualized supplementary data on the co-citation analysis analyzing 36,835 authors (524 of whom meet the threshold of 20 citations) can also be found for (a) via this map: http://www.vosviewer.com/vosviewer.php?map=http://www.feldundhof.at/div/co-cit-auth-map.txt&network=http://www.feldundhof.at/div/co-cit-auth-network.txt&cluster_colors=http://www.feldundhof.at/div/co-cit-auth-gray.txt.

³ b) Visualized supplementary data on the co-citation analysis analyzing 63,255 cited references (208 of which meet the threshold of 20 citations) can also be found for (b) via this map: http://www.vosviewer.com/vosviewer.php?map=http://www.feldundhof.at/div/co-cit-ref-map.txt&network=http://www.feldundhof.at/div/co-cit-ref-network.txt&cluster_colors=http://www.feldundhof.at/div/co-cit-ref-gray.txt.

⁴ c) Visualized supplementary data on the co-citation analysis analyzing 30,568 sources (427 of which meet the threshold of 20 citations) can also be found for (c) via this map: http://www.vosviewer.com/vosviewer.php?map=http://www.feldundhof.at/div/co-cit-sources-map.txt&network=http://www.feldundhof.at/div/co-cit-sources-network.txt&cluster_colors=http://www.feldundhof.at/div/co-cit-sources-gray.txt.

⁵ d) Visualized supplementary data on the bibliographic coupling maps analyzing 1506 organizations (148 of which meet the threshold of at least 5 bibliographic coupling links) can also be found for (d) via this map: http://www.vosviewer.com/vosviewer.php?map=http://www.feldundhof.at/div/co-cit-orga-map.txt&network=http://www.feldundhof.at/div/co-cit-orga-network.txt&cluster_colors=http://www.feldundhof.at/div/co-cit-orga-gray.txt.

Table 2

Method pipeline—Overview of the steps, databases or applications, and further justification.

Steps	Used databases or programs	Justification necessary toward the taxonomy and recommendations for future research
1 Data collection	WoS: 2974 core publication articles	Search period through 2014 with search terms (entrepreneur*) AND (educ*) OR (teach*) AND (entrepreneur*) OR (entrepreneur*) AND (learn*); <i>These terms have been used in prior research reviews (e.g., Kraus et al., 2012; Tranfield et al., 2003).</i>
2 Quality checks	Scopus, EBSCO, ABIInform/ProQuest, ScienceDirect	To guarantee that documents are related to EE, all abstracts were read: 2066 final documents.
3 SMS analysis and cluster identification	VOSviewer	Networking map of 1773 documents based on bibliographic coupling; eight core clusters were automatically identified. <i>The applied techniques enable the illumination of large research literature (van Eck & Waltman, 2009) and have already been used in educational papers (e.g., Kosmützky & Krücken, 2014; Tseng et al., 2013; Zohar & Barzilai, 2013).</i>
4 Further analysis and maps	WoS, VOSviewer, RapidMiner, Scopus and CitNetExplorer	Co-citation maps of cited references, authors, and journals; bibliographic coupling maps of organizations and WoS research areas; development of the EE research literature. <i>These additional maps provide further detail to the taxonomy scheme and a cross-check of the results.</i>
5 Cluster interpretation	RapidMiner and qualitative interpretations	Text mining techniques (e.g., term extraction, term filtering, term phrases, and association rules) to name and define the eight EE clusters. <i>Reveal knowledge allow to recognize, deduce, and interpret the clusters using text mining techniques, as suggested by prior reviews (e.g. Hair et al., 2006).</i>
6 Taxonomy scheme		All analyses were merged into a taxonomy scheme; each cluster was analyzed and discussed to identify future research recommendations

economics. Within this cluster, the most prominent authors, as ranked by co-citations across the EE literature, are Fayolle [2111], Miller [1945], Stevenson [1293], Morris [1210], and Gibb [1151]. Additionally, as ranked by the bibliographic couplings across the EE research literature, the most prominent peer-reviewed documents are Townsend (2012), with the contribution “Captains of Their Own Destiny? Toward a Theory of Entrepreneurial Agency in Firm Survival;” Zhang, Duysters, and Clodt (2014), with “The Role of Entrepreneurship Education as a Predictor of University Students' Entrepreneurial Intention;” Martin et al. (2013), with “Examining the Formation of Human Capital In Entrepreneurship: A Meta-Analysis of Entrepreneurship Education Outcomes;” Morris, Webb, Fu, and Singhal (2013), with “A Competency-Based Perspective on Entrepreneurship Education: Conceptual and Empirical Insights;” and Stinchfield (2013), with “Learning from Levi-Strauss' Legacy: Art, Craft, Engineering, Bricolage, and Brokerage in Entrepreneurship.”

Given the diverse set of top publications in this cluster, a closer look at the cluster clarifies the nature of this social and policy-driven research. Several scholars (e.g., Jordan, Wurzel, Zito, & Bruckner, 2003; Nambissan & Ball, 2010; Su & Gaughan, 2014; Verger, 2012; Windle, 2011) highlight the role of policy entrepreneurs, which appear to be crucial in the development of educational frameworks. Additionally, creating favorable conditions, “educating the minds of caring hearts” (Miller, Wesley, & Williams, 2012, p. 349), and facing challenges with social entrepreneurship (e.g., Elmes, Jiusto, Whiteman, Hersh, & Guthey, 2012; Howorth, Smith, & Parkinson, 2012; Murphy & Coombes, 2009; Nga & Shamuganathan, 2010) are all discussed within this research. Social capital is discussed in this sphere with respect to policy issues (e.g., Bagley & Ackerley, 2006; Karlsson & Wigren, 2012; Malecki, 2012), including social entrepreneurship (Fletcher, 2007a; Murphy & Coombes, 2009) and the influence of education on immigrant entrepreneurship (Carbonell, Hernandez, & Garcia, 2014; Kloosterman & Rath, 2014; van Tubergen, 2005).

Studies in cluster 1 build on theory of entrepreneurial agency (e.g., Townsend, 2012), Ajzen's (1991) theory of planned behavior (TPB), and Shapero and Sokol's (1982) entrepreneurial event model, as well as entrepreneurial cognition theory (e.g., Zhang et al., 2014), human capital theory (e.g., Martin et al., 2013), structuration theory (e.g., Morris et al., 2013), experiential learning theory (e.g., Yu, Chen, & Nguyen, 2014), social entrepreneurship theory (e.g., Murphy & Coombes, 2009), career socialization theory specific to entrepreneurial settings (e.g., Greene & Saridakis, 2008), institutional theory (e.g., Karlsson & Wigren, 2012), human capital theory and the resource-based view (e.g., Johansson & Malmstrom, 2013; Kenworthy & McMullen, 2014), actor-network theory (e.g., Farquharson, Ortenblad, & Hsu, 2014), and feminist theory (e.g., Ahl, 2007, who applied a narrative analysis of a rather unique teaching case related to the sex business in toy stores). Fletcher (2007b) also applied a narrative technique. In this context, the most prominent references, based on co-citation links across the EE literature but ranked by documents within the first cluster, are Shane (2003), with his “A General Theory of Entrepreneurship: The Individual Opportunity Nexus” [388]; Shane and Venkataraman (2000), with “The Promise of Entrepreneurship as a Field of Research” [1181]; Shane (2000), with “Prior Knowledge and the Discovery of Entrepreneurial Opportunities” [600]; Shane (2004), with “Academic Entrepreneurship: University Spinoffs and Wealth Creation” [132]; Clark (1998), with “Creating Entrepreneurial Universities: Organizational Pathways of Transformation” [154]; and Chen (1998), with “Does Entrepreneurial Self-Efficacy Distinguish Entrepreneurs from Managers?” [446].

Prominent journals within the cluster, ranked by co-citations across the EE literature, are the *Journal of Business Venturing* [107,859], *Entrepreneurship Theory & Practice* [84,729] *Organization Science* [33,556], *Research Policy* [33,114], and the *Journal of Small Business Management* [29,291]. Prominent organizations, ranked by cumulative bibliometric coupling links in the cluster [bibliographic couplings in the EE literature] are Indiana University Bloomington [9893], University of Amsterdam [5230], Copenhagen Business School [3641], the University of Edinburgh [3117], and Erasmus University Rotterdam [6206].

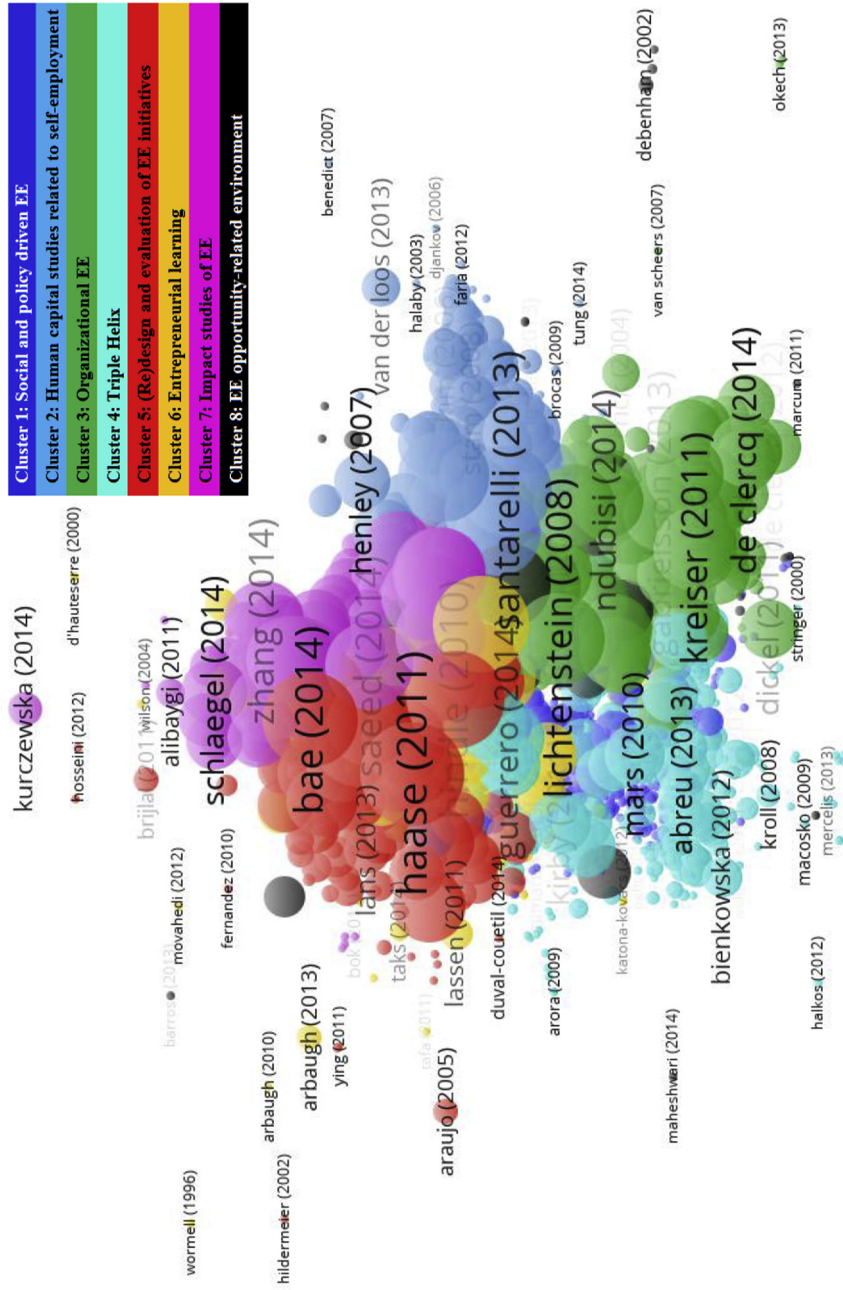


Fig. 1. Bibliographic EE map featuring the eight clusters based on bibliometric coupling of documents.

Table 3
Taxonomic scheme—overview of the clusters in the EE research literature.

Cluster	Definition	Articles (out of 1773)	WoS Research Areas [number of peer-reviewed documents]	Publications [ranked by bibliographic coupling links]	Prominent authors [ranked by co-citations across the EE literature] ^a	Prominent references ranked by documents in the cluster [co-citations across the EE literature] ^b	Prominent journals [ranked by co-citations across the EE literature within the cluster] ^c	Prominent organizations ranked by cumulative bibliographic coupling links [bibliographic coupling across the EE literature] ^d
1	Social and policy-driven EE research, including policy entrepreneurs and social entrepreneurs	477	Business & Economics [206] Education & Educational Research [134] Public Administration [53] Geography [31]	Townsend (2012) [1352] Zhang (2014) [1259] Martin (2013) [1119] Morris (2013) [1108] Stinchfield (2013) [981]	Fayolle [2111] Miller [1945] Stevenson [1293] Morris [1210] Gibb [1151]	Shane (2003) [388] Shane and Venkataraman (2000) [1181] Shane (2000) [600] Clark (2004) [132] Clark (1998) [154] Chen (1998) [446]	Journal of Business Venturing [107,859] Entrepreneurship Theory & Practice [84,729] Organization Science [33,556] Research Policy [33,114] Journal of Small Business Mgmt. [29,291]	Indiana University Bloomington [9893] University of Amsterdam [5230] Copenhagen Business School [3641] The University of Edinburgh [3117] Erasmus University Rotterdam [6206] Stockholm School of Economics [6037] Erasmus University Rotterdam [6206] University of Amsterdam [5230] Ghent University [6193] Institute for the Study of Labor [847]
2	Human capital studies related to self-employment performance, and growth	243	Business & Economics [205] Public Administration [25] Education & Educational Research [17] Engineering [8]	Ucbasaran (2008) [1533] Santarelli (2013) [1500] Mayer-Haug (2013) [1396] Honig (2012) [1384] Marvel (2007) [1226]	Fayolle [2111] Aldrich [1894] Westhead [1654] Honig [1511] Bates [1344]	Evans (1989a) [342] Evans (1989b) [218] Blanchflower (1998) [129] Bates (1995) [219] Shane (2003) [388]	Journal of Business Venturing [107,859] Entrepreneurship Theory & Practice [84,729] Academy of Management Journal [52,117] Small Business Economics [35,402] Research Policy [33,114]	University of Amsterdam [5230] Ghent University [6193] Institute for the Study of Labor [847]
3	Organizational EE with a focus on entrepreneurial orientations, capabilities, strategic and management issues	229	Business & Economics [196] Engineering [22] Education & Educational Research [18] Public Administration [12]	Lichtenstein (2008) [1526] Kreiser (2011) [1368] Ravasi (2005) [1338] Dutta (2005) [1327] Craig (2013) [1297]	Zahra [3657] Audreusch [2587] Covin [2104] Autio [1709] Chandler [1670]	Zahra (2000) [233] Shane and Venkataraman (2000) [1181] Shane (2000) [600] Cohen (1990) [550] Shane (2003) [388]	Journal of Business Venturing [107,859] Entrepreneurship Theory & Practice [84,729] Strategic Management Journal [69,786] Academy of Management Review [61,171] Small Business Economics [35,402]	University of Vaasa [4831] University of Glasgow [5755] University of Minnesota [6684] Universidad de Sevilla [9158] Michigan State University [3252]
4	Triple helix EE, entrepreneurial universities, technology, and innovation-driven EE in higher education, incl. knowledge transfer	199	Business & Economics [112] Education & Educational Research [45] Public Administration [27] Engineering [26]	Guerrero (2014) [1144] Guerrero (2014) [1113] Rasmussen (2006) [1071] Huggins (2012) [992] Kirby (2011) [874]	Erzkowitz [1774] Siegel [566]	Erzkowitz (2000) [130] Shane (2003) [388] Clark (1998) [154] Shane and Venkataraman (2000) [1181] Shane (2000) [600]	Journal of Business Venturing [107,859] Entrepreneurship Theory & Practice [84,729] Small Business Economics [35,402] Administrative Science Quarterly [34,373] Organization Science [33,556]	Autonomous University of Barcelona [5301] The University of Arizona [2360] The University of Nottingham [7501] University of Amsterdam [5230] Vrije Universiteit Amsterdam [4860]
5	(Re)design and evaluation of EE initiatives	190	Business [137] Education & Educational Research [63]	Haase (2011) [1869] Hindle (2010) [1702]	Gartner [3645] Vesper [2490] Mitchell [2372]	Katz (2003) [457] Kuratko (2005) [478] Vesper (1997) [302] Shane (2003) [388]	Journal of Business Venturing [107,859] Entrepreneurship Theory & Practice [84,729] Small Business Economics [35,402]	Babson College [5816] University of Southern California [3504] Saint Louis University [1731]

(continued on next page)

Table 3 (continued)

6	Entrepreneurial learning and the acquisition of competences through an interdisciplinary technique (e.g., engineering)	157	Engineering [12] Social Sciences [10]	Bae (2014) [1637] Edelman (2010) [1507] Diaz-Casero (2012) [1393] Politis (2008) [1679] Sardana (2010) [1021] White (2014) [995] Rae (2006) [961] Dimov (2007) [933]	Katz [2325] Fayolle [2111] Cope [1680] Rae [1509] Evans [1412] Morris [1210] Pittaway [991]	Shane and Venkataraman (2000) [1181] Kolb (1984) [130] Gibb (2002) [121] Shane (2000) [1181] Shane (2000) [600] Shane (2004) [132]	Journal of Small Business Mgn. [29,291] Intern. Small Business Journal [16,195] Journal of Business Venturing [107,859] Entrepreneurship Theory & Practice [84,729] Small Business Economics [35,402] University of Florida [1909] University of Southern Denmark [2499], Wageningen University & Research Center [1559] Universidad de Sevilla [9158] Brock University [6414] Universidad de Salamanca [2257] Max Planck Institute of Economics [2535] Universiti Putra Malaysia [2022]	Indiana University Bloomington [9893], Universidad de Sevilla [9158] Wageningen University [4627] Indiana University Bloomington [9893], University of Florida [1909] University of Southern Denmark [2499], Wageningen University & Research Center [1559] Universidad de Sevilla [9158] Brock University [6414] Universidad de Salamanca [2257] Max Planck Institute of Economics [2535] Universiti Putra Malaysia [2022]
7	Impact studies on entrepreneurial intentions and self-efficacy	163	Business & Economics [112] Education & Educational Research [22] Psychology [12] Social Sciences [6]	Verheul (2005) [1570] Ramos-Rodriguez (2010) [1512] Gonzalez (2011) [1485] Saeed (2014) [1460] Wurthmann (2014) [1446] Corbett (2007) [1123] Fiet (2007) [973] DeTienne (2012) [910] Gruber (2013) [858] DeTienne (2004) [831]	Shane [6720] Baron [2977] Cooper [2175] Fayolle [2111] Linan [1888]	Krueger (2000) [593] Krueger (1994) [335] Shane and Venkataraman (2000) [1181] Shane (2000) [600] Shane (2003) [388]	Journal of Business Venturing [107,859] Entrepreneurship Theory & Practice [84,729] Small Business Economics [35,402] Organization Science [33,556] Research Policy [33,114]	Journal of Business Venturing [107,859] Entrepreneurship Theory & Practice [84,729] Small Business Economics [35,402] Organization Science [33,556] Research Policy [33,114]
8	EE opportunity-related environment opportunities and financial issues	115	Business & Economics [78] Education & Educational Research [25] Social Sciences [14] Engineering [8]	Shepherd [1906] Evans [1412] Fiet [1254] Barney [1196] Gruber (2013) [858] DeTienne (2004) [831]	Shane and Venkataraman (2000) [1181] Shane (2000) [600] Cooper (1994) [259] Shane (2003) [388] Hayek (1945) [208]	Journal of Business Venturing [107,859] Strategic Management Journal [69786] Academy of Small Business Economics [35,402] Organization Science [33,556]	Journal of Business Venturing [107,859] Strategic Management Journal [69786] Academy of Small Business Economics [35,402] Organization Science [33,556]	University of Pennsylvania [3236] The University of Maryland [2966] University of Colorado Boulder [3836], Indiana University Bloomington [9893], Rensselaer Polytechnic Institute [2911]

The dominant forefather of each cluster's "family tree" from Fig. 3 is bolded. Visualized supplementary data of several co-citation analyses and bibliographic coupling maps are provided in the Appendix.

The main “schools of thought” found in cluster 1 are actor-network theory (e.g., Farquharson et al., 2014), Ajzen's (1991) TPB (e.g., Zhang et al., 2014), career socialization theory (e.g., Greene & Saridakis, 2008), experiential learning theory (e.g., Yu et al., 2014), feminist theory (e.g., Ahl, 2007), human capital theory (e.g., Johansson & Malmstrom, 2013; Kenworthy & McMullen, 2014; Martin et al., 2013), institutional theory (e.g., Karlsson & Wigren, 2012), the RBV (e.g., Johansson & Malmstrom, 2013; Kenworthy & McMullen, 2014), Shapero and Sokol's (1982) entrepreneurial event model (e.g., Zhang et al., 2014), structuration theory (e.g., Morris et al., 2013), social entrepreneurship theory (e.g., Murphy & Coombes, 2009), and the theory of entrepreneurial agency (e.g., Townsend, 2012).

4.1.2. Cluster 2—Human capital studies related to self-employment

In the research community, EE has also been addressed as a human capital topic for growth and development. The second cluster comprises 243 peer-reviewed studies at the intersection of self-employment and human capital, for which the dominating WoS research area is Business & Economics (65.92%). Only a few articles were published in the areas of Public Administration (8.04%), Education & Educational Research (5.47%), Engineering (2.57%) and Environmental Sciences & Ecology (2.57%). Within this cluster, prominent authors, ranked by co-citations across the EE literature, are Fayolle [2111], Aldrich [1894], Westhead [1654], Honig [1511], and Bates [1344]. Within this cluster the most prominent publications, ranked by bibliographic coupling, were written by Ucbasaran (2008), with the article “Opportunity Identification and Pursuit: Does an Entrepreneur's Human Capital Matter?” [1533]; Santarelli (2013), with the article “The Interplay of Human and Social Capital in Shaping Entrepreneurial Performance: The Case of Vietnam” [1500]; Mayer-Haug (2013), with the article “Entrepreneurial Talent and Venture Performance: A Meta-Analytic Investigation of SMEs” [1396]; Honig and Samuelsson (2012), with the article “Planning and the Entrepreneur: A Longitudinal Examination of Nascent Entrepreneurs in Sweden” [1384]; Marvel and Lumpkin (2007), with the article “Technology Entrepreneurs' Human Capital and its Effects on Innovation Radicalness” [1226]; Colombo (2005), with the article “Founders' Human Capital and the Growth of New Technology-Based Firms: A Competence-Based View” [1207]; and Marvel (2013), with the article “Human Capital And Search-Based Discovery: A Study Of High-Tech Entrepreneurship” [1096].

Given these top publications, several EE scholars focused on analyses with particular emphases on the self-employment entry phase (e.g., Aidis & van Praag, 2007; Aldrich & Yang, 2014; Arenius & De Clercq, 2005; Bates, 1995; Lofstrom, Bates, & Parker, 2014) or choices and motivations for potential entrepreneurs (e.g., Knorr, Alvarez, & Urbano, 2013; Raffiee & Feng, 2014) with respect to educational background (e.g., Baumann & Brandle, 2012; Block, Hoogerheide, & Thurik, 2013) and role models (Mungai & Velamuri, 2011). Additionally, in line with Mayer-Haug (2013) and Toft-Kehler, Wennberg, and Kim (2014), Eesley and Roberts (2012) also discussed entrepreneurial talent at the border of entrepreneurial-experience curves. Furthermore, new technology-based firms (NTBFs) were intensively discussed by several scholars (e.g., Amit, MacCrimmon, Zietsma, & Oesch, 2001; Marvel, 2013; Marvel & Lumpkin, 2007). Fundamentally, several studies addressed and built on the theory of legitimacy (Honig & Samuelsson, 2012), the real options theory with logic from the individual differences literature (Raffiee & Feng, 2014), the social cognitive theory (Ucbasaran, Shepherd, Lockett, & Lyon, 2013), the resource-based view (Ganotakis, 2012), prospect theory (Wennberg, Wiklund, DeTienne, & Cardon, 2010), TPB (Kibler, 2013; Yang, 2013), attribution theory (Franco & Haase, 2010), and Sarasvathy's (2001) theory of effectuation (Honig, Davidsson, & Karlsson, 2005).

The most prominent references, ranked by documents in the cluster [co-citations across the EE literature], include Evans and Leighton (1989), with “Some Empirical Aspects of Entrepreneurship” [342]; Evans and Jovanovic (1989), with “An Estimated Model of Entrepreneurial Choice under Liquidity Constraints” [218]; Blanchflower and Oswald (1998), with “What Makes an Entrepreneur?” [129]; Bates (1995), with “Entrepreneur Human Capital Inputs and Small Business Longevity” [219]; Shane (2003), with his “A General Theory of Entrepreneurship: The Individual Opportunity Nexus” [388]; and Shane and Venkataraman (2000), with “The Promise of Entrepreneurship as a Field of Research” [1181].

Prominent journals within the cluster [ranked by co-citations in the EE literature] are the *Journal of Business Venturing* [107,859], *Entrepreneurship Theory & Practice* [84,729], the *Academy of Management Journal* [52,117], *Small Business Economics* [35,402], and *Research Policy* [33,114]. Prominent organizations, ranked by cumulative bibliometric coupling links in the cluster [bibliographic coupling in the EE literature] are the Stockholm School of Economics [6037], Erasmus University Rotterdam [6206], the University of Amsterdam [5230], Ghent University [6193], and the Institute for the Study of Labor [847].

The main “schools of thought” found in cluster 2 are attribution theory (Franco & Haase, 2010), the RBV (Ganotakis, 2012), real options theory (Raffiee & Feng, 2014), Sarasvathy's (2001) theory of effectuation (Honig et al., 2005), social cognitive theory (Ucbasaran et al., 2013), the theory of legitimacy (Honig & Samuelsson, 2012), the TPB (Kibler, 2013; Yang, 2013), and prospect theory (Wennberg et al., 2010).

4.1.3. Cluster 3—Organizational EE

Cluster 3, comprising 229 documents, focuses on the organization with respect to entrepreneurial orientation, capabilities, and strategic and management issues from an international perspective. In this cluster, most documents are published in the research area of Business & Economics (65.12%); only a few are published in Engineering (7.31%), Education & Educational Research (5.98%), Public Administration (3.99%), and Environmental Sciences & Ecology (2.33%). The most prominent authors [ranked by co-citations across the EE literature] are Zahra [3657], Audretsch [2587], Covin [2104], Autio [1709], Chandler [1670] and Dess [1045].

Within this organizational context, the most prominent publications [ranked by bibliographic coupling] were written by Lichtenstein (2008), with “The Role of Organizational Learning in the Opportunity Recognition Process” [1526]; Kreiser (2011), with “Entrepreneurial Orientation and Organizational Learning: The Impact of Network Range and Network Closure” [1368]; Ravasi and Turati (2005), with “Exploring Entrepreneurial Learning: A Comparative Study of Technology Development Projects” [1338]; Dutta

(2005), with “The Nature of Entrepreneurial Opportunities: Understanding the Process Using the 41 Organizational Learning Framework” [1327]; Craig, Maggitti, and Clark (2013), with “Knowledge Flows and Constraints to the Entrepreneurial Process” [1297]; and Audretsch and Monsen (2007), with “Entrepreneurship Capital: A Regional, Organizational, Team And Individual Phenomenon” [1284].

Several academics (e.g., Cai, Hughes, & Yin, 2014; Deligianni, Voudouris, & Lioukas, 2014; FladmoeLindquist, 1996; Gabrielsson & Gabrielsson, 2013; Grande, 2011; Kropp, Lindsay, & Shoham, 2006; Ndubisi & Agarwal, 2014; Pisano, Ireland, Hitt, & Webb, 2007; Todorovic, 2007) in this research relied on the resource-based view (RBV) as their theory. In this light, not only Lichtenstein (2008), Kreiser (2011), Dutta (2005), and Craig et al. (2013), but also Real, Roldán, and Leal (2012) and, earlier, Hara and Kanai (1994) discussed organizational learning or market orientation (see also Lin, Peng, & Kao, 2008; Rhee, Park, & Lee, 2010) that facilitates performance in entrepreneurial organizations. In this context, learning theories (e.g., Almeida, Dokko, & Rosenkopf, 2003; Bruneel, Yli-Renko, & Clarysse, 2010; Evers, Andersson, & Hannibal, 2012; Pisano et al., 2007; Real, Roldán, & Leal, 2014; Sapienza, De Clercq, & Sandberg, 2005; Smith & Cao, 2007; Zahra, 2012), the “attention-based” view (e.g., Sapienza et al., 2005), cognitive theory (e.g., Palich & Bagby, 1995), agency theory (e.g., FladmoeLindquist, 1996), dynamic theory (e.g., Craig et al., 2013; Dickel & Andree, 2011), and the knowledge-based view (e.g., Real et al., 2014) have been debated.

In this cluster, absorptive capacity (e.g., Dushnitsky & Lenox, 2005; Ernst, Lichtenthaler, & Vogt, 2011; Hughes, Morgan, Ireland, & Hughes, 2014; Newey & Zahra, 2009), entrepreneurially alert information systems (e.g., Simsek, Lubatkin, Veiga, & Dino, 2009) and strategic decision-making in entrepreneurial companies (West & Wilson, 1995) are all introduced. Corporate entrepreneurial activities within product development (Srivastava & Hun, 2005) are presented. In addition, cognitive theories for understanding decision-making in entrepreneurial ventures are presented and explored (Palich & Bagby, 1995; Zacharakis & Shepherd, 2001). Another characteristic of this cluster appears to be its discussion on the impact of prior entrepreneurial experience with respect to education (Chandler & Jansen, 1992; Zheng, 2012). More precisely, in the words of Chandler and Jansen (1992, p. 223), “it appears that a business education and experience in general managerial positions lays the ground work for a successful entrepreneurial career.”

Prominent references, ranked by documents in the cluster [co-citations across the EE literature] were written by Zahra (2000), with “International Expansion by New Venture Firms: International Diversity, Mode of Market Entry, Technological Learning, and Performance” [233]; Shane and Venkataraman (2000), with “The Promise of Entrepreneurship as a Field of Research” [1181]; Shane (2000), with “Prior Knowledge and the Discovery of Entrepreneurial Opportunities” [600]; Cohen and Levinthal (1990), with “Absorptive Capacity: A New Perspective on Learning and Innovation Administrative” [550]; Shane (2003), with “A General Theory of Entrepreneurship: The Individual Opportunity Nexus” [388]; and Lumpkin and Dess (1996), with “Clarifying the Entrepreneurial Orientation Construct and Linking It to Performance” [599]. Prominent journals within the cluster are the *Journal of Business Venturing*, *Entrepreneurship Theory & Practice*, the *Strategic Management Journal*, the *Academy of Management Review*, and *Small Business Economics*. The most valuable contributors [ranked by cumulative bibliometric coupling links] are the following institutions: the University of Vaasa [4831], the University of Glasgow [5755], the University of Minnesota [6684], the Universidad de Sevilla [9158], and Michigan State University [3252].

The main “schools of thought” found in cluster 3 are agency theory (e.g., FladmoeLindquist, 1996), the “attention-based” view (e.g., Sapienza et al., 2005), cognitive theory (e.g., Palich & Bagby, 1995), dynamic theory (e.g., Craig et al., 2013; Dickel & Andree, 2011), the knowledge-based view (e.g., Real et al., 2014), organizational learning theories (e.g., Almeida et al., 2003; Bruneel et al., 2010; Evers et al., 2012; Pisano et al., 2007; Real et al., 2014; Sapienza et al., 2005; Smith & Cao, 2007; Zahra, 2012), and the RBV (e.g., Cai et al., 2014; Deligianni et al., 2014; FladmoeLindquist, 1996; Gabrielsson & Gabrielsson, 2013; Grande, 2011; Kropp et al., 2006; Ndubisi & Agarwal, 2014; Pisano et al., 2007; Todorovic, 2007).

4.1.4. Cluster 4 — Triple helix

Cluster 4, which comprises 199 peer-reviewed documents. The cluster is influenced by the entrepreneurial university and by entrepreneurial technology and innovation related to higher education and knowledge transfer. Like the other clusters, cluster 4 shows a high number of documents dedicated to the research area of Business & Economics (36.96%), followed by Education & Educational Research (14.85%), Public Administration (8.91%), Engineering (8.58%) and Social Sciences (2.97%). Prominent authors are Etzkowitz (1,774) and Siegel (566), as ranked by co-citations across the literature of EE research. Overall, Etzkowitz and Leydesdorff (2000) built the foundation of this cluster by introducing the concept of the Triple Helix of university-industry-government relationships, which was used as an underlying theory by several authors within the cluster (e.g., Guerrero & Urbano, 2012b; Kim, Kim, & Yang, 2012; Nelles & Vorley, 2011; Sam & van der Sijde, 2014; Sharifi, Liu, & Ismail, 2014). Furthermore, social capital theory (e.g., Mosey & Wright, 2007; Scillitoe & Chakrabarti, 2010), institutional theory (e.g., Ensley & Hmieleski, 2005; Mosey, Wright, & Clarysse, 2012), learning theory (e.g., Clarysse, Bobelyn, & Aguirre, 2013), and Slaughter and Rhoades’ (2004) theory of academic capitalism (e.g., Mars, Slaughter, & Rhoades, 2008) also represent core cluster theories.

Important publications [based on bibliographic coupling links] were authored by Guerrero (2014), with “Academics’ Start-Up Intentions and Knowledge Filters: An Individual Perspective of the Knowledge Spillover Theory of Entrepreneurship” [1144]; Guerrero (2014), with “The Internal Pathways that Condition University Entrepreneurship in Latin America: An Institutional Approach” [1113]; Rasmussen and Sorheim (2006), with “Action-Based Entrepreneurship Education” [1071]; Huggins and Thompson (2012), with “Entrepreneurship and Community Culture: A Place-Based Study of their Interdependency” [992]; Kirby, Urbano, and Guerrero (2011), with “Making Universities More Entrepreneurial: Development of a Model” [874]; and Sam and van der Sijde (2014), with “Understanding the Concept of the Entrepreneurial University from the Perspective of Higher Education Models” [834]. Crucial topics in this research literature include the academic debate related to understanding the concept of the entrepreneurial

university and its development (e.g., Feser, 2013; Guerrero & Urbano, 2012a; Nelles & Vorley, 2011; Sam & van der Sijde, 2014), the discussion around academic entrepreneurship from a resource-based view (Powers & McDougall, 2005), and the process study of entrepreneurial team formation through an example of a research-based spin-off (Clarysse & Moray, 2004). In an earlier study, Kourilsky and Walstad (1998) devoted commendable effort to the discourse of entrepreneurship and female youth, considering knowledge, attitudes, gender differences, and educational practices. In this regard, knowledge transfer has received significant scholarly attention (e.g., Guerrero & Urbano, 2012b; Sharifi et al., 2014). Mars and Rios-Aguilar (2010) (re)defined academic entrepreneurship while drawing our attention to its significance and implications for the scholarship of higher education. Later, Abreu and Grinevich (2013) enlightened the nature of academic entrepreneurship in the context of the United Kingdom. Shah and Pahnke (2014) coined the phrase “Parting the Ivory Curtain” to describe and improve our understanding of how startups can be supported by universities. Finally, still other colleagues discussed industry-academic relationships (e.g., Khorsheed & Al-Fawzan, 2014; Ojewale, Ilori, Oyebisi, & Akinwumi, 2001) and the commercialization of technology (e.g., Agarwal & Sonka, 2010; Levie, 2014; Libaers, 2012; Powers & Campbell, 2011; van Burg & van Oorschot, 2013).

Well-cited references that characterize this cluster include works by Etzkowitz and Leydesdorff (2000), with “The Dynamics of Innovation: From National Systems and ‘Mode 2’ To A Triple Helix of University-Industry-Government Relations” [130]; Shane (2003), with “A General Theory of Entrepreneurship: The Individual Opportunity Nexus” [388]; Clark (1998), with “Creating Entrepreneurial Universities: Organizational Pathways of Transformation” [154]; Shane and Venkataraman (2000), with “The Promise of Entrepreneurship as a Field of Research” [1181]; Shane (2000), with “Prior Knowledge and the Discovery of Entrepreneurial Opportunities” [600]; Shane (2004), with “Academic Entrepreneurship: University Spinoffs and Wealth Creation” [132].

Vital journals for this include the *Journal of Business Venturing* [107,859], *Entrepreneurship Theory & Practice* [84,729], *Small Business Economics* [35,402], *Administrative Science Quarterly* [34,373], and *Organization Science* [33,556]. Furthermore, the Autonomous University of Barcelona [5301], the University of Arizona [2360], the University of Nottingham [7501], the University of Amsterdam [5230], and Vrije Universiteit Amsterdam [4860] are the cluster's most prolific contributing organizations, ranked by cumulative bibliometric coupling links within the cluster [and taking bibliographic coupling links across the EE literature into account].

The main “schools of thought” found in cluster 4 are institutional theory (e.g., Ensley & Hmieleski, 2005; Mosey et al., 2012), learning theory (e.g., Clarysse et al., 2013), social capital theory (e.g., Mosey & Wright, 2007; Scillitoe & Chakrabarti, 2010), the theory of academic capitalism (e.g., Mars et al., 2008), and the Triple Helix (e.g., Guerrero & Urbano, 2012b; Kim et al., 2012; Nelles & Vorley, 2011; Sam & van der Sijde, 2014; Sharifi et al., 2014).

4.1.5. Cluster 5—(Re)design and evaluation of EE initiatives

In cluster 5, 190 articles focus on programs dedicated to EE prior to the university level. The majority are related to the research areas of Business & Economics (52.09%), Education & Educational Research (23.95%), Engineering (4.56%), Social Sciences (3.80%) and Public Administration (2.28%). The most prominent authors are [ranked by co-citations in the EE literature] Gartner [3645], Vesper [2490], Mitchell [2372], Katz [2325], Fayolle [2111], and Kolvereid [2041].

The most important publications in this cluster [ranked by bibliographic couplings] include works by Haase and Lautenschlager (2011), with “The ‘Teachability Dilemma’ of Entrepreneurship” [1869]; Hindle (2010), with “How Community Context Affects Entrepreneurial Process: A Diagnostic Framework” [1702]; Bae et al. (2014), with the “Relationship Between Entrepreneurship Education and Entrepreneurial Intentions: A Meta-Analytic Review” [1637]; Edelman and Yli-Renko (2010), with “The Impact of Environment and Entrepreneurial Perceptions on Venture-Creation Efforts: Bridging the Discovery and Creation Views of Entrepreneurship” [1507]; Diaz Casero, Hernandez-Mogollon, and Roldan (2012), with “A Structural Model of the Antecedents to Entrepreneurial Capacity” [1393]; and Patzelt, Williams, and Shepherd (2014), with “Overcoming the Walls That Constrain Us: The Role of Entrepreneurship Education Programs in Prison” [1347].

Cluster 5 concentrates heavily on programs in the EE milieu. Within this research literature dedicated to academic EE initiatives, several scholars discuss the topics of foundations for designing entrepreneurship programs or retooling existing ones (Duval-Couetil, Reed-Rhoads, & Haghighi, 2012; Lobler, 2006; Morris & Kuratko, 2014), critical factors for successful programs (Kingma, 2014), common threads (Lehman, 2013), the traditional importance of a business plan (Botha & Robertson, 2014), blended value frameworks (Kickul, Janssen-Selvadurai, & Griffiths, 2012; Maritz, Brown, & Shieh, 2010), best practices (Klofsten, Heydebreck, & Jones-Evans, 2010), program evaluations (Vesper & Gartner, 1997), instructors' beliefs and teaching practices (Zappe, Hochstedt, Kisenwether, & Shartrand, 2013), the effects of an entrepreneurship programs on retention (Ohland, Frillman, Zhang, Brawner, & Miller, 2004), the influence of entrepreneurship programs (Ho, Low, & Wong, 2014), and, finally, proposals of action research (Winkler, 2014).

Cluster 5 is characterized by such theories as the grounded theory (e.g., Maritz et al., 2010; Patzelt et al., 2014), the social cognitive theory (e.g., Vanevenhoven & Liguori, 2013), Ajzen's (1991) TPB (e.g., Asenjo & Barbera, 2013; Fretschner & Weber, 2013; Ho et al., 2014), the institutional economy theory (e.g., Toledano & Urbano, 2008), the action regulation theory (e.g., Glaub, Frese, Fischer, & Hoppe, 2014), and the learning/constructivist theory (Lobler, 2006).

Ranked by documents in the cluster [with co-citations across the EE literature], prominent references in this research literature were authored by Katz (2003), with “The Chronology and Intellectual Trajectory of American Entrepreneurship Education: 1876–1999” [457]; Kuratko (2005), with “The Emergence of Entrepreneurship Education: Development, Trends, and Challenges” [478]; Vesper and Gartner (1997), with “Measuring Progress in Entrepreneurship Education” [302]; Shane (2003), with his “A General Theory of Entrepreneurship: The Individual Opportunity Nexus” [388]; Shane and Venkataraman (2000), with “The Promise of Entrepreneurship as a Field of Research” [1181]; and Shane (2000), with “Prior Knowledge and the Discovery of Entrepreneurial

Opportunities” [600].

Key contributing journals in this cluster [based on an in-cluster ranking by co-citations across the EE literature] relating to academic EE initiatives include the *Journal of Business Venturing* [107,859], *Entrepreneurship Theory & Practice* [84,729], *Small Business Economics* [35,402], the *Journal of Small Business Management* [29,291], and *International Small Business Journal* [16,195]. Furthermore, ranked by cumulative bibliometric coupling links within the cluster [and including bibliographic couplings across the EE literature], the institutions of Babson College [5816], the University of Southern California [3504], Saint Louis University [1731], Indiana University Bloomington [9893], and the Universidad de Sevilla [9158] have strong track records within this research.

The main “schools of thought” found in cluster 5 are Ajzen's (1991) TPB (e.g., Asenjo & Barbera, 2013; Fretschner & Weber, 2013; Ho et al., 2014), action regulation theory (e.g., Glaub et al., 2014), grounded theory (e.g., Maritz et al., 2010; Patzelt et al., 2014), institutional economy theory (e.g., Toledano & Urbano, 2008), social cognition theory (e.g., Vanevenhoven & Liguori, 2013), learning/constructivist theory (Lobler, 2006).

4.1.6. Cluster 6—Entrepreneurial learning

Cluster 6 contains 157 peer-reviewed articles discussing business development and entrepreneurial competences through an interdisciplinary technique (i.e., engineering). In this framework, 34.89% of articles focus on the research area of Business & Economics, 25.11% focus on Education & Educational Research, 9.79% focus on Engineering, 5.11% focus on Social Sciences, and 3.40% focus on Psychology. Prominent authors [ranked by co-citations across the EE literature] are Cope [1680], Rae [1509], Evans [1412], Morris [1210], and Pittaway [991].

Important publications [ranked by bibliographic couplings] were contributed by Politis (2008), with “The Process of Entrepreneurial Learning A Conceptual Framework” [1679]; Sardana and Scott-Kemmis (2010), with “Who Learns What? A Study Based on Entrepreneurs from Biotechnology New Ventures” [1021]; White and D'Souza (2014), with “Links Between Learning Speed and Opportunity Recognition” [995]; Rae (2006), with “Entrepreneurial Learning: A Conceptual Framework for Technology-Based Enterprise” [961]; Dimov (2007), with “From Opportunity Insight to Opportunity Intention: The Importance of Person-Situation Learning Match” [933]; and Izquierdo (2010), with “What Entrepreneurial Competencies Should Be Emphasized in Entrepreneurship and Innovation Education at the Undergraduate Level?” [927].

In cluster 6, scholars rely on such theories as Kolb's (1984) experiential learning theory (e.g., Corbett, 2005), the institutional theory (e.g., Politis, Winborg, & Dahlstrand, 2012), the organizational learning theory (e.g., Lans, van Galen, Versteegen, Biemans, & Mulder, 2014), the affective events theory (AET) (e.g., Morris, Kuratko, Schindehutte, & Spivack, 2012), institutional theory (e.g., Homburg, Hahn, Bornemann, & Sandner, 2014), learning theory (e.g., le Roux & Steyn, 2007), motivation theory (e.g., Thietart, 1977), activity theory (e.g., Seppanen, 2002), and practice and management and systems theory (e.g., Davenport & Wormell, 1997; Wormell & Davenport, 1996).

While most studies focus on success (e.g., Itkonen, 2009; Izquierdo & Deschoolmeester, 2010; Krauss, Frese, Friedrich, & Unger, 2005; Lans, Versteegen, & Mulder, 2011; St-Jean & Audet, 2012) as a context for learning, Cope (2011) provides an interpretative analysis for entrepreneurial learning from failure. In line with the top-cited publication in this cluster (e.g., Politis, 2008; Rae, 2006; Scott-Kemmis, 2010; White & D'Souza, 2014), through its framework (Pittaway & Thorpe, 2012) and in combination with heterogeneous groups (Lans, Oganisjana, Taks, & Popov, 2013), entrepreneurial learning plays a role in supporting programs (St-Jean & Audet, 2012). Furthermore, through its influence on entrepreneurs (Lans, Biemans, Versteegen, & Mulder, 2008), entrepreneurial learning influences networking activities (Pittaway & Cope, 2007b; Pittaway, Rodriguez-Falcon, Aiyegbayo, & King, 2011), critical reflection (Cope, 2003), and a myriad of different contexts, such as multifunctional agriculture (Seuneke, Lans, & Wiskerke, 2013).

This cluster is characterized by well-cited references, such as the works of Kolb (1984), with “Experiential Learning: Experience as The Source of Learning and Development” [130]; Gibb (2002), with “In Pursuit of a New ‘Enterprise’ and ‘Entrepreneurship’ Paradigm for Learning: Creative Destruction, New Values, New Ways of Doing Things and New Combinations of Knowledge” [121]; Shane and Venkataraman (2000), with “The Promise of Entrepreneurship as a Field of Research” [1181]; Shane (2000), with “Prior Knowledge and the Discovery of Entrepreneurial Opportunities” [600]; Shane (2004), with “Academic Entrepreneurship: University Spinoffs and Wealth Creation” [132]; and Shane (2003), with “A General Theory of Entrepreneurship: The Individual Opportunity Nexus” [388].

Prominent journals within this cluster [ranked by co-citations across the EE literature] are the *Journal of Business Venturing* [107,859], *Entrepreneurship Theory & Practice* [84,729], *Small Business Economics* [35,402], the *Journal of Small Business Management* [29,291] and the *International Small Business Journal* [16,195]. Additionally, vital suppliers, ranked by cumulative bibliometric coupling links within the cluster [bibliographic couplings across the EE literature] are Wageningen University [4627], Indiana University Bloomington [9893], the University of Florida [1909], the University of Southern Denmark [2499], and Wageningen University and Research Center [1559].

The main “schools of thought” found in cluster 6 are activity theory (e.g., Seppanen, 2002), affective events theory (AET) (e.g., Morris et al., 2012), institutional theory (e.g., Homburg et al., 2014; Politis et al., 2012), Kolb's (1984) experiential learning theory (e.g., Corbett, 2005), motivation theory (e.g., Thietart, 1977), organizational/learning theory (e.g., Lans et al., 2014; le Roux & Steyn, 2007), and practice and management and systems theory (e.g., Davenport & Wormell, 1997; Wormell & Davenport, 1996).

4.1.7. Cluster 7—Impact studies of EE

The impact studies in cluster 7 center on entrepreneurial intentions and entrepreneurial self-efficacy (including women entrepreneurs). Of the 163 documents, 56.85% focus on Business & Economics, 11.17% focus on Education & Educational Research, 6.09% focus on Psychology, 3.05% focus on Social Sciences, and 2.54% focus on Engineering. Prominent authors [ranked by co-

citations across the EE literature] are Shane [6720], Baron [2977], Cooper [2175], Fayolle [2111], Linan [1888], Krueger [1501], and Peterman [1167].

In the psychological academic discourse, intentions have been shown to be the most accurate predictors of planned behavior (Krueger, Reilly, & Carsrud, 2000). Thus, cluster 7 is characterized by such theories as Ajzen's (1991) TPB (e.g., BarNir, Watson, & Hutchins, 2011; Diaz-Garcia & Jimenez-Moreno, 2010; Jaen & Linan, 2013; Krueger et al., 2000; Liñán & Chen, 2009; Linan, Nabi, & Krueger, 2013; Nitu-Antonie, Sirghi, Hategan, Feder, & Socoliuc, 2014; Romero, Petrescu, & Balalia, 2011; Sanchez, 2011; Schlaegel & Koenig, 2013; Shneor, Camgoz, & Karapinar, 2013; Souitaris, Zerbini, & Al-Laham, 2007). Furthermore, applied work in psychology and sociology has stressed that gender differences in career choices are explained primarily by differences in self-efficacy (ESE) (Krueger et al., 2000). Accordingly, entrepreneurial ESE, as an explanatory variable, dominates this cluster regarding EE impact studies (e.g., Diaz-Garcia & Jimenez-Moreno, 2010; Gonzalez-Alvarez & Solis-Rodriguez, 2011; Liñán & Chen, 2009; McGee, Peterson, Mueller, & Sequeira, 2009; Peterman & Kennedy, 2003; Pihie & Bagheri, 2012, 2013; Shneor et al., 2013; Wurthmann, 2014). However, other theories, such as the construal level theory (e.g., Tumasjan, Welpel, & Spörle, 2013), focus theory (e.g., Bryant, 2007), and social learning theory (e.g., Chlosta, Patzelt, Klein, & Dormann, 2012), have also received attention.

Important publications [ranked by bibliographic couplings] are authored by Verheul, Uhlaner, and Thurik (2005), with “Business Accomplishments, Gender and Entrepreneurial Self-Image” [1570]; Ramos-Rodriguez, Medina-Garrido, Lorenzo-Gomez, and Ruiz-Navarro (2010), with “What You Know or Who You Know? The Role of Intellectual and Social Capital in Opportunity Recognition” [1512]; Gonzalez-Alvarez et al. (2011), with “Discovery of Entrepreneurial Opportunities: A Gender Perspective” [1485]; Saeed, Muffatto, and Yousafzai (2014), with “A Multi-Level Study of Entrepreneurship Education Among Pakistani University Students” [1460]; Wurthmann (2014), with “Business Students' Attitudes Toward Innovation and Intentions to Start their Own Businesses” [1446]; and Diaz-Garcia et al. (2010), with “Entrepreneurial Intention: The Role of Gender” [1313].

Additional powerful studies were contributed by Krueger et al. (2000), with “Competing Models of Entrepreneurial Intentions” [593]; Krueger and Brazeal (1994), with “Entrepreneurial Potential and Potential Entrepreneurs” [335]; Shane and Venkataraman (2000), with “The Promise of Entrepreneurship as a Field of Research” [1181]; Shane (2000), with “Prior Knowledge and the Discovery of Entrepreneurial Opportunities” [600]; Shane (2003), with “A General Theory of Entrepreneurship: the Individual Opportunity Nexus” [388]; and Shane (2004), with “Academic Entrepreneurship: University Spinoffs and Wealth Creation” [132].

Journals facilitating the cluster 7 EE research literature are the *Journal of Business Venturing* [107,859], *Entrepreneurship Theory & Practice* [84,729], *Small Business Economics* [35,402], *Organization Science* [33,556] and *Research Policy* [33,114]. Academic institutions [ranked by cumulative bibliometric coupling links] are the Universidad de Sevilla [9158], Brock University [6414], the Universidad de Salamanca [2257], Max Planck Institute of Economics [2535], and the Universiti Putra Malaysia [2022].

The main “schools of thought” found in cluster 7 are construal-level theory (e.g., Tumasjan et al., 2013), focus theory (e.g., Bryant, 2007), social learning theory (e.g., Chlosta et al., 2012), and the TPB (e.g., BarNir et al., 2011; Diaz-Garcia & Jimenez-Moreno, 2010; Jaen & Linan, 2013; Krueger et al., 2000; Liñán & Chen, 2009; Linan et al., 2013; Nitu-Antonie et al., 2014; Romero et al., 2011; Sanchez, 2011; Schlaegel & Koenig, 2013; Shneor et al., 2013; Souitaris et al., 2007).

4.1.8. Cluster 8—EE opportunity-related environment

The rather fragmented research cluster 8, comprising 115 peer-reviewed manuscripts, considers topics ranging from entrepreneurial financing (i.e., venture capital) to opportunity identification in the market. Within this framework, the dominating research areas are Business & Economics (46.71%), Education & Educational Research (14.97%), Social Sciences (8.38%), Engineering (4.79%) and Family Studies (4.19%). Prominent authors [ranked by co-citations across the EE literature] are Shepherd [1906], Evans [1412], Fiet [1254], and Barney [1196].

Important publications [ranked by bibliographic couplings] are contributed by Corbett (2007), with “Learning Asymmetries and the Discovery of Entrepreneurial Opportunities” [1123]; Fiet (2007), with “A Prescriptive Analysis of Search and Discovery” [973]; DeTienne and Cardon (2012), with “Impact of Founder Experience on Exit Intentions” [910]; Gruber, MacMillan, and Thompson (2013), with “Escaping the Prior Knowledge Corridor: What Shapes the Number and Variety of Market Opportunities Identified Before Market Entry of Technology Start-Ups?” [858]; DeTienne and Chandler (2004), with “Opportunity Identification and its Role in the Entrepreneurial Classroom: A Pedagogical Approach and Empirical Test” [831]; Gruber (2007), with “Uncovering the Value of Planning in New Venture Creation: A Process And Contingency Perspective” [786]; and Gruber, MacMillan, and Thompson (2008), with “Look Before You Leap: Market Opportunity Identification in Emerging Technology Firms” [774]. In addition to these top publications based on bibliographic coupling, which emphasize the importance of entrepreneurial opportunities in EE, several further scholars highlight the significance (e.g., Fiet, Piskounov, & Patel, 2005; Green & Barbe, 2013; Paik, 2014; Sorenson & Sorensen, 2001; Steffensen, Rogers, & Speakman, 2000; Yusuf, 2012) of financial issues (e.g., Barney, Busenitz, Fiet, & Moesel, 1996; Cumming, 2005; Fiet, 1995; Kirsch, Goldfarb, & Gera, 2009).

This cluster is founded on the following theories: threshold theory (e.g., DeTienne & Cardon, 2012), information-processing and decision-making theory (e.g., Gruber, 2007), Sarasvathy's (2001) theory of effectuation (e.g., Williams Middleton & Donnellon, 2014), Schumpeter's (1934) theory of entrepreneurship (e.g., Shepherd & Woods, 2014), social cognitive theory with psychological theories (e.g., Shepherd, Covin, & Kuratko, 2009), prototype theory (e.g., Kirsch et al., 2009), contingency theory, social learning theory (e.g., Wijbenga & van Witteloostuijn, 2007), agency theory (e.g., Dalziel, Gentry, & Bowerman, 2011; Nygaard & Myrtveit, 2000), and Hayek's (1945) (Zizka & Rydvalová, 2014) cognitive theory (e.g., Strong, 2013).

Powerful references include Shane and Venkataraman (2000), with “The Promise of Entrepreneurship as a Field of Research” [1181]; Shane (2000), with “Prior Knowledge and the Discovery of Entrepreneurial Opportunities” [600]; Cooper, Gimeno-Gascon, and Woo (1994), with “Initial Human and Financial Capital as Predictors of New Venture Performance” [259]; Shane (2003), with “A

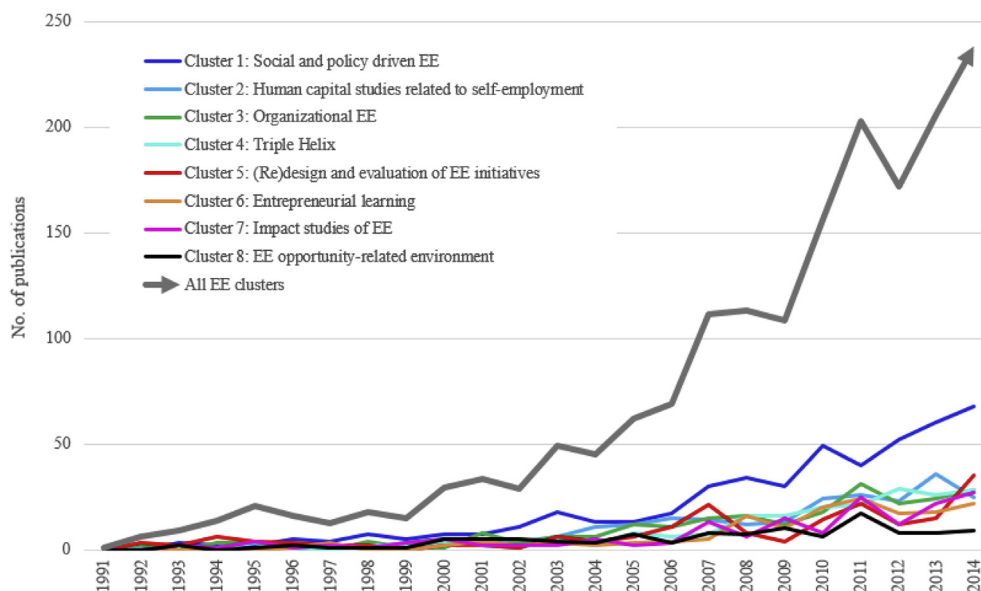


Fig. 2. Publications per year between 1991 and 2014.

General Theory of Entrepreneurship: The Individual Opportunity Nexus” [388]; Hayek (1945), with “The Use of Knowledge in Society” [208]; and Zahra, Ireland, and Hitt (2000), with “International Expansion by New Venture Firms: International Diversity, Mode of Market Entry, Technological Learning, and Performance” [233].

Journals enabling the EE research literature of cluster 8 include the *Journal of Business Venturing* [107859], the *Strategic Management Journal* [69,786], the *Academy of Management Review* [61171], *Small Business Economics* [35,402], and *Organization Science* [33,556]. In addition, such organizations [ranked by cumulative bibliometric coupling links] as the University of Pennsylvania [3236], the University of Maryland [2966], the University of Colorado Boulder [3836], Indiana University Bloomington [9893], and Rensselaer Polytechnic Institute [2911] have contributed important insights to this framework.

The main “schools of thought” found in cluster 8 are agency theory (e.g., Dalziel et al., 2011; Nygaard & Myrtveit, 2000), contingency theory (e.g., Wijbenga & van Witteloostuijn, 2007), information-processing and decision-making theory (e.g., Gruber, 2007), Hayek’s (1945) cognitive theory (e.g., Strong, 2013), Sarasvathy’s (2001) theory of effectuation (e.g., Williams, Middleton and Donnellon, 2014), Schumpeter’s (1934) theory of entrepreneurship (e.g., Shepherd & Woods, 2014), social cognitive theory with psychological theories (e.g., Shepherd et al., 2009), social learning theory (e.g., Wijbenga & van Witteloostuijn, 2007), threshold theory (e.g., DeTienne & Cardon, 2012), and prototype theory (e.g., Kirsch et al., 2009).

4.2. The emergence clusters in the entrepreneurship education research literature

Since 1991, productivity in the EE research literature has progressively increased. This bibliometric analysis also outlines the timeline of the emergence of EE and its leading authors in specific time periods. Fig. 2 presents the evolution of publications in EE across the research literature and the specific clusters and reveals that the social and policy-driven EE particular attracted particular attention from scholars in the past.

In order to identify each cluster’s key ancestor in its “family tree” in the history of EE research, Fig. 3 illustrates a citation network visualization derived from the CitNetExplorer software and based on citation scores. As indicated, the authorship position pattern stresses authors’ impacts on the foundations of EE literature. Schumpeter (1934) provides the basis for Shane’s (2000) work, and this contribution has strong ties to earlier work by scholars like McClelland (1961), Kirzner (1973), Evans and Jovanovic (1989), and Chen, Greene, and Crick (1998). The oft-cited work by Kuratko (2005) followed. As Fig. 3 indicates, Schumpeter (1934) also inspired Souitaris et al. (2007), who was also affected by authors like Gimeno, Folta, Cooper, and Woo (1997), Vesper and Gartner (1997), Krueger et al. (2000), Peterman and Kennedy (2003), and Shane (2003), the last of whom has been cited in a majority of EE publications that appear in this SMS. Overall, it is Schumpeter (1934) and Shane (2003) who laid the foundations of the EE research literature as a whole. Each cluster’s “family tree” and its key ancestor is circled with the cluster’s colors in Fig. 3.

5. Discussion

Advanced bibliometric and scientometric techniques led to a taxonomy scheme with eight clusters: “Social and policy-driven EE”, “Human capital studies related to self-employment”, “Organizational EE”, “Triple helix”, “(Re)design and evaluation of EE initiatives”, “Entrepreneurial learning”, “EE impact studies” and “EE opportunity-related environment at the organizational level”. Information such as leading research areas, most prominent references, and most influential authors, journals, and organizations for

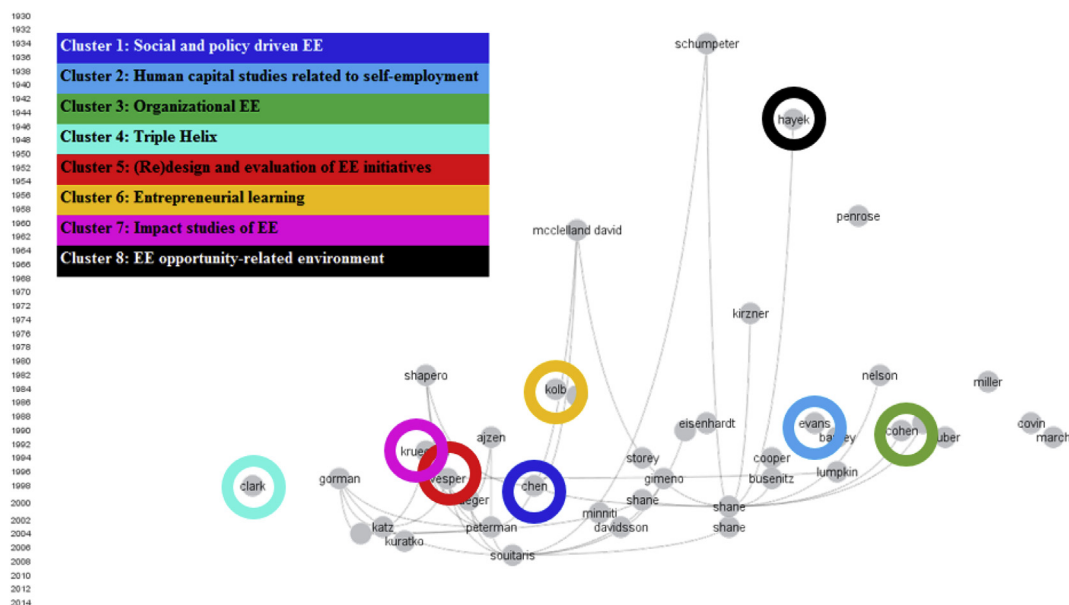


Fig. 3. Key ancestor of each cluster based on citation scores (CitNetExplorer).

each cluster based on both co-citation and bibliographic coupling algorithm has been incorporated into the taxonomy. These mappings and visualizations present a systematic and structured overview of the EE research literature and enable us to derive the research recommendations that follow.

5.1. Recommendation—Increase in interdisciplinarity and stronger ties to education

Since the work by [Bechard and Gregoire \(2005\)](#), who argued that EE is focused primarily on economic and business content, the EE research literature has not progressed significantly from an interdisciplinary perspective, based on the results presented in the taxonomy scheme. The present SMS identifies unexplored potential for increasing the interdisciplinarity of EE research. Interdisciplinarity could be enriched through strengthening opportunities for co-authorship, cooperation, and synergy-building collaboration among established organizations and maturing institutions.

Overall, according to the taxonomy, the EE research needs a broader scope than business and economics. For instance, studies on how health and medicine (e.g., [Shepherd & Patzelt, 2015](#)) or social and cognitive psychology ([Haynie, Shepherd, Mosakowski, & Earley, 2010](#)) can be related to entrepreneurial education should be more carefully considered. It is also still unclear how entrepreneurial values like independence, ownership, and overall self-employment affect people's (mental) health or personal and career satisfaction. Are entrepreneurs (or more entrepreneurial individuals) happier and healthier than others? Filling in these gaps in the research will help lay a foundation for teaching entrepreneurial mindsets, which has called “the ability to be dynamic, flexible, and self-regulating in one's cognitions given dynamic and uncertain task environments” ([Haynie et al., 2010](#), p. 218). Furthermore, other research, such as engineering, agriculture, and information technology, offer the potential to enrich EE research.

The taxonomy highlights, based on citation scores, [Schumpeter \(1934\)](#) and [Shane \(2003\)](#) as laying the foundations of the EE research literature. Moreover, almost all clusters derive from [Shane's \(2003\)](#) entrepreneur-opportunity nexus theory. This highlights opportunities for theoretical input from the educational literature. Overall, based on our taxonomy, the EE research literature appears to be heavily biased toward entrepreneurship rather than education. For instance, no leading education journal discusses EE successfully, if bibliometrics is taken as the indicator of success. Consequently, the EE research literature's link to the education literature need to be strengthened for the field to progress.

Across EE clusters, we face educational challenges that have been identified more than 10 years. Overall, as [Bechard and Gregoire \(2005\)](#) stress, entrepreneurship educators need knowledge of both entrepreneurship and education research. [Fiet \(2001a\)](#) argues that we need an effective strategy for teaching entrepreneurship theory in a genuinely and deeply interesting way. Educators must increase the amount of theoretical content in their programs to develop individuals' cognitive skills to encourage informed entrepreneurial decisions ([Fiet, 2001b](#)). Individuals acquire experiences through practice with theory-based activities by delegating tasks and responsibilities to learners. Thus, EE educators should not ask, “What am I going to *teach* today?” but, “What am I going to have my students *do* today?” ([Fiet, 2001a](#), p. 101). Future research dedicated to the educational element of EE should focus more heavily on including key research questions that start with “How to ... ?”.

Additionally, with respect to research on entrepreneurial talent ([Easley & Roberts, 2012](#); [Mayer-Haug, 2013](#)) and entrepreneurial experience curves ([Toft-Kehler et al., 2014](#)), it would be interesting to understand whether innovative learning techniques, such as simulations or gaming, represent appropriate learning techniques for training individuals to become more entrepreneurial and to

discover entrepreneurial opportunities in a variety of sectors. This idea, which was proposed by Shepherd (2004), suggests engaging individuals in EE through feelings or emotions. Discussing feminist theory, Ahl (2007) takes advantage of narrative analysis to explore a rather unique teaching case related to the sex business in toy stores. It would be interesting to examine whether there is a metaparadigm technique to EE that involves different actors and stakeholders.

Finally, this recommendation works toward answering the long-standing call of Cope (2005, p. 391), who concluded that “further research may reveal entirely new dimensions of learning in entrepreneurial contexts and more interdisciplinary, in-depth empirical work is a vital part of this (i.e. entrepreneurial) theory-building process.”

5.2. Recommendation—Increase the international collaboration to boost impact

In line with the first recommendation, enhancing the interdisciplinarity of EE will also facilitate both international collaboration and international impact. This will increase the discovery and exploitation of future entrepreneurial opportunities in the EE research literature. This is a key recommendation in light of the vast development of and investment in EE on a worldwide scale.

The taxonomy scheme makes clear that European universities have a strong presence as contributors to the EE research literature, across all clusters. However, cluster 5 in particular (“(Re)design and evaluation of EE initiatives”) and cluster 8 (“EE opportunity-related environment”) are characterized by international leading contributors (e.g., University of Southern California, Saint Louis University, Indiana University Bloomington). Moreover, only cluster 7 (“EE impact studies”) provides a leading institution, Universiti Putra Malaysia, outside of Europe and the US in the top list of contributors to the EE research literature. This fact underscores how much room there is for improvement in international co-authorship and collaboration. Developing countries in particular would benefit from the knowledge generated in Europe and the US, leading to high impact on a global scale. In line with the first recommendation, interdisciplinarity could be enriched by strengthening opportunities for synergy-building collaboration among established organizations and maturing institutions (in both developed and developing nations) to enhance not only the interdisciplinary quantity and quality of EE literature but also its global impact in terms of practical implications.

Although we are fortunate to have valuable EE impact studies (e.g., Diaz-Garcia & Jimenez-Moreno, 2010; Gonzalez-Alvarez & Solis-Rodriguez, 2011; Liñán & Chen, 2009; McGee et al., 2009; Peterman & Kennedy, 2003; Pihie & Bagheri, 2012; Pihie & Bagheri, 2013; Shneur et al., 2013; Wurthmann, 2014), our taxonomy nevertheless reveals that the EE research literature appears to be heavily biased toward a) higher education, especially business schools, to the omission of EE targeted at children, the unemployed, immigrants, secondary education, minority groups like prisoners, among others, and b) self-employment and new venture creation, neglecting the kind of education that enhances entrepreneurial behavior in other contexts like large organizations. For instance, Patzelt et al. (2014) stressed that EE is valuable for building the occupational career paths of prisoners. Developing entrepreneurial mindsets helps to support and shape attitudinal bases for rebuilding positive futures. Overall, targeting currently underserved groups like kindergarteners, retirees, or non-entrepreneurs in large organizations, may have great potential to positively impact an entrepreneurial society. Indeed, the very fact that how the training of these individuals to become more entrepreneurial might affect the innovation, growth, and performance of firms across sectors, genders, and countries remains an open question is itself a recommendation for future EE research.

Several scholars have already explored potential foundations for designing new entrepreneurship programs or retooling existing ones (Duval-Couetil et al., 2012; Lobler, 2006; Morris & Kuratko, 2014) and sought to identify critical factors for success (Kingma, 2014), but it is still unclear which regional and/or national strategies and investments are required to motivate different individuals with different educational backgrounds at varied career stages to develop an interest in the entrepreneurial life. A study by Kuratko (2005), whose work has also been discussed earlier (Kuratko & Hodgetts, 2004), outlines the importance of fostering individuals' ability to recognize successful opportunities that leave other individuals simply confused. Moreover, while most studies focus on entrepreneurial success as a context for learning (e.g., Itkonen, 2009; Izquierdo & Deschoolmeester, 2010; Krauss et al., 2005; Lans et al., 2011; St-Jean & Audet, 2012), Cope (2011) outlines an interpretative analysis of entrepreneurial learning from failure. The identification of different stakeholders and involvements via the success and failure stories of experts would enrich the various facets of EE research (Duval-Couetil, 2013; Fellnhöfer, 2017).

In this context, Shane (2012) revised his earlier work with Venkataraman (2000) and emphasized that, in the past, his discussion on the nexus of opportunities and individuals, along with relationships, innovations, and new combinations, had received the most scholarly attention. Peterman and Kennedy (2003) also investigated people's changing perceptions in relation to an enterprise education program providing entrepreneurial opportunities for individuals. It would be interesting to explore how exposure to and engagement with innovative entrepreneurs affect individuals' entrepreneurial perceptions and intentions. With respect to the cognitive nature of entrepreneurship research, as Shepherd suggests (2015) and in line with previous studies (Aronsson, 2004; Souitaris et al., 2007), future research on how role models affect individuals' entrepreneurial mindsets would be valuable.

Our taxonomic scheme makes clear that the cluster dedicated to social and policy-driven EE has attracted scholars' particular attention in the past. As several authors have discussed, policy entrepreneurs play an important role in boosting EE (e.g., Jordan et al., 2003; Nambissan & Ball, 2010; Su & Gaughan, 2014; Verger, 2012; Windle, 2011). Thus, future research could explore whether such policy entrepreneurs are able to open policy windows and networks that will enable new EE research and policy agendas to be pursued. As Krueger et al. (2000, p. 413) put it, “Even if we successfully increase the quantity and quality of potential entrepreneurs, we must also promote such perceptions among critical stakeholders including suppliers, financiers, neighbors, government officials, and the larger community.” Finally, in line with Vesper and Gartner's (1997) survey results ranking university entrepreneurship programs, it would be interesting to examine how financial commitment, administrative support, and organizational environment impact the development of EE research.

6. Conclusion

EE research literature, by its complex nature, is both challenged and challenging. While it has experienced an extraordinary increase in recent decades, several scholars have called for a systematic taxonomy to provide an overview of the past and suggestions for the future. Thus, the objective of this SMS was to analytically explore and visually structure the EE research literature and provide just such a taxonomic scheme with recommendations for future research. The EE research literature has been systematically clustered, taking the most influential publications, references, authors, and organizations in terms of bibliometric indicators on the growth of the EE literature into account.

This SMS, with its bibliographic mapping and visualization, has yielded a taxonomy that enhances the discussions presented in previous literature reviews (e.g., [Kakouris & Georgiadis, 2016](#); [Yu & Yang, 2013](#)). The visually presented body of strongly interlinked relationships in EE research provides a readily comprehensible structure of influential contributors and contributions in the EE research literature. Guided by the objective of shedding light on the EE literature's future, research recommendations are presented. In sum, the EE literature would benefit on the one hand from an increase in interdisciplinarity and stronger ties to education and, on the other, from international collaboration that would boost the theoretical and practical impact of EE research literature on a global basis.

However, it is important to note that this effort represents only a first distillation of the core research and most influential contributions and contributors. Future research should consider more complex and detailed interpretations in order to discuss and explore EE literature more intensively. Further reviews should evaluate the individual contributions in each cluster in more detail with respect to their research designs, methods, and strategies. Drawing upon the quantitative data and the visual materials presented here, it is appropriate to conclude that entrepreneurial and opportunity-driven challenges still dominate the EE research literature, suggesting a need for further vital and relevant research efforts.

6.1. Theoretical and practical implications

EE will continue to draw interest from a wide range of communities: researchers, educators, policymakers, (nascent) entrepreneurs, and society at large. For this reason, we not only introduce theoretical implications for researchers but also provide practical implications for policymakers, (nascent) entrepreneurs, and the general public.

We begin with the theoretical implications. First, it is worth mentioning that—to the best of our knowledge—this contribution provides the first taxonomy that structures the EE research literature based on bibliometrics. The retrospective bibliographic coupling and co-citation analyses enable scholars to carve out areas for future research. At the moment, EE is taking vital steps forward to develop into a recognized area of research within entrepreneurship, but it requires more attention from the educational perspective. The taxonomy reveals that theories in EE are fragmented and numerically biased in favor of entrepreneurship over education. For instance, almost all clusters derive from [Shane's \(2003\)](#) entrepreneur-opportunity nexus theory, although entrepreneurial intention studies rely mostly on Ajzen's (1991) TPB, neglecting the opportunity side and theories from the education literature altogether. In this study, we have presented a large number of theories and terms without weighing their contribution to the cluster or explaining the exact meaning of each theory for the relevant cluster(s). This information, while helpful, goes beyond the scope of this paper; it is a fruitful option for future research.

We turn now to practical implications. First, the visualizations could serve as policy instruments in Europe. This effort should motivate European policymakers to support international interdisciplinary EE research collaborations. Although the academic world has produced far-reaching research on EE in recent decades, a call for practical action is still needed, especially from the European perspective. Overall, the findings highlight that the impact of EE requires more attention on a global basis. These aspects should be taken into consideration by EE program elaborators, institutions and centers providing EE, and the policymaking community. Finally, EE's potential as a source of funds (i.e., through the ability of entrepreneurs to discover opportunities where others see chaos) should always be kept in mind.

6.2. Limitation

Like any other academic effort, this study has inherent shortcomings. First, the review could be criticized for the breadth of its range of publications, which might reflect a potential bias when discussing the current body of knowledge. Thus, in considering the findings, readers are asked to exercise caution regarding the methods applied and databases employed. In particular, while bibliographic mapping and visualization have achieved significant recognition among researchers, this study focuses only on peer-reviewed articles in two major databases. Despite our quality cross-checks, other contributions like books and public reports from funded EE projects are not taken into consideration. This limits the effort from a practical perspective, since, particularly in entrepreneurship, project work impacts the literature. Accordingly, there may be some organizations that have greater impact on the EE research literature through other EE-related activities that are not fully considered in the present work.

In addition, there is a tendency to cite more open-access journals. There are also journals that can be accessed only through paid registration and journals that publish in languages other than English. These represent further limitations of the data presented here and should be taken into account.

Furthermore, the cluster titles are based on qualitative interpretations with the support of quantitative methods. Cluster interpretation is challenging because the borders between clusters are rather vague. However, by identifying and discussing these clusters, we refer to the most influential thoughts shared by prior papers within the EE research literature. The identification of clear patterns

in the data requires further qualitative research. As noted in a previous study (Rafols, Leydesdorff, O'Hare, Nightingale, & Stirling, 2012), clustering is especially challenging in the context of studies on innovation, business, and management. This issue should be taken into consideration.

Based on the clustering center of attention, the related citation data may lag behind the actual publication of the article. Although we addressed this issue by considering only those studies published through 2014, our visualized description of the EE literature calls for further investigations with more in-depth foci, which will likely lead to further interesting insights.

Next, citation-based analysis methods assign weight to citations whether they are obligatory, pertinent, or negative, thus raising questions about the inherent value of any one citation to our understanding. Authors are affected by several factors when citing publications, including accessibility of publications, author reputation or visibility, and prestige (Cronin, 1984). This reality of the nature of citation and the contemporary academic publishing environment should be kept in mind.

Finally, because the present study is based on published articles, the analysis cannot identify research that has been totally neglected. Similarly, the maps and clusters formed on the bases of the bibliometric data do not picture everything that is known. This limitation must be kept in mind when reading this work.

However, the EE research literature and the integrity of the study have been enhanced through a diverse set of reliable sources, applied tools, and quality checks. Thus, in spite of its limitations, this study presents the first visualized appraisal and mapping of the EE research literature. All in all, it highlights important prospects for enriching the EE literature and calls for further research. As Kuratko (2005) first argued, let us represent the guardians of the entrepreneurial world in academia, “through combination, recombination, and creativity—to (hopefully) extend both the entrepreneurship field and the ‘other’ fields” (cited in Shepherd, 2015, p. 490).

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