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ORIGINAL ARTICLE

What Do We Know about Business Angels' Decision Making Research Development? A Document Co-Citation Analysis

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Abstract

Business angels (BAs) mitigate the financial gap of early-stage ventures and get actively involved in ventures they invest in. Their crucial role in the start-up ecosystem is spurring interest in their decision-making processes when making investments. However, the research about their investment decision making is crumpled. So far, we know the knowledge base about BA decision making comes from a blend of interdisciplinary studies where psychology and finance had a significant impact in pushing the research to new levels. With this study, we review knowledge dyads in the BA decision-making field through bibliometric co-citation analysis.

Keywords: Business angels, Intellectual development, Bibliometrics, Co-citation analysis, Interval analysis

JEL classification: L26, G41, M13

Introduction

Since there is an increasingly important evolution of business angels' (BAs) operations in the entrepreneurial ecosystem, the research development analysis is a timely and knowledge boosting study to perform. The early beginnings of knowledge development in the BA decision making field aligned them with venture capitalists (Tyebjee & Bruno, 1984; Zacharakis & Meyer, 1998). Later research attributed BA behaviour and decision making as two of the most critical topics in the BA literature (Edelman, Manolova, & Brush, 2017). We note that scholars sometimes borrowed theories from other research fields, especially in the behavioural approaches to study BA decision making. Reviews of prior research in this field suggested that dyads between different research fields do exist (Huang & Pearce, 2015; Mitteness, Sudek, & Cardon, 2012) and should be more explicit (Drover et al., 2017; Harrison, 2017). Also, in the rise of diverse knowledge sub-fields, several researchers argued that there is a need to measure the intellectual structure of the entrepreneurship field (Cornelius, Landström, & Persson, 2006; Schildt, Zahra, & Sillanpää, 2006; Teixeira, 2011). Some attempts have already been made by employing bibliometric analysis in entrepreneurship research (Gregoire et al., 2006; Reader & Watkins, 2006; Schildt et al., 2006), and to date only one published bibliometric analysis in the BA field (Tenca, Croce, & Ughetto, 2018).

Although some literature reviews of the BA research field do exist and provide a comprehensive and narrative reflection on the past literature (Edelman et al., 2017; Gabrielsson & Politis, 2006; Harrison, 2017), to date no study drew specific intellectual dyads, nor reviewed the informal communication between scholars in the BA decision making research. One of the approaches to draw dyads from different fields and to review the informal intellectual communication within a

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research field is to produce a bibliometric review of the literature. Still, all existing bibliometric reviews in entrepreneurship research that report communication between scholars frame the general discussion in the field, some just mentioning the existence of BA (Reader & Watkins, 2006; Schildt et al., 2006).

The current study addresses the aforementioned issues by investigating what the nature of knowledge in BA decision making is and how its structure developed over time. This study contributes to entrepreneurship research by examining the intellectual dyads in BA decision making research and provides an overview of knowledge clusters within the specific time intervals. A review of the literature about BA decision making and identification of impactful areas is of high relevance, because it creates provoking impulses for BA, entrepreneurs seeking investments and policymakers. It leads to rethinking and restating investment procedure, strategies and policies; thus, it explicitly shows research gaps which future research can contribute to.

1 Theoretical background

We traced back the conceptual foundation of BA to Wetzel's (1983) first formalised introduction of this type of investors who direct their capital investments to start-ups and emerging technology-based companies. From then on, studies represented BA as informal individual investors who give an incentive to ventures in seed or early-stage phases and bridge the financial gap in their development (Edelman et al., 2017; Harrison, 2017; Mason, 2006; Wallmeroth, Wirtz, & Groh, 2017). Usually they are high net worth individuals who use their own money to invest in ventures they feel comfortable with (Freear, Sohl, & Wetzel, 1994, 1995; Wetzel, 1983), and sometimes even invest within their geographic proximity (Avdeitchikova & Landström, 2016; Edelman et al., 2017; Van Osnabrugge & Robinson, 2000).

In the academic community, the vocabulary standardisation, especially in interdisciplinary research, is of a great benefit. However, in our field of interest scholars are faced with a vocabulary inconsistency when defining the unit of analysis. While European-based research commonly used the term *business angels* (Argerich, Hormiga, & Valls-Pasola, 2012; Avdeitchikova & Landström, 2016; Freear et al., 1994; Harrison & Mason, 2007; Mason, Botelho, & Zygmunt, 2017; Maxwell & Levesque, 2014; Sørheim, 2005), US-based research on the other hand used the term *angel investors* to represent the same unit of analysis (Brush, Edelman, & Manolova, 2012; Collewaert, 2012; Edelman et al., 2017; Madill, Haines, & Riding, 2005; Mitteness et al., 2012; Morrissette, 2007; OECD, 2011; Prowse, 1998). Even if the language differences do exist, the problem of lexicon inconsistencies did not. However, the difference in defining the main concepts created only redundancy in supplemental concepts and potential deficiencies in key term search.

The first empirical research about factors that influence BA investment decisions was provided by Wetzel (1983). Since then, the research has evolved but remained relatively small and truncated by diverse research fields. Thus, a comprehensive analysis of BA investment behaviour sub-concepts might enlighten future research. Accordingly, BA investment behaviour represents a group of sub-concepts at the intersection of social psychology and entrepreneurship research. Some academics argue that a set of different criteria impacts BA investment behaviour. More specifically, they believe that besides financial ones, socio-psychological criteria play a significant role in BA investment behaviour (Croce, Tenca, & Ughetto, 2017; Huang & Pearce, 2015; Sudek, 2006).

As an essential part of the entrepreneurial ecosystem, BA do not just play the role of financial incentive providers. From the operational side, their active involvement forms their role in the venture community. Here we would like to emphasise their decision maker role and leadership position in ventures they invest in (Freear et al., 1994; Sørheim, 2005). Even if the most common reasons for BA to invest are positive and overwhelming investment returns (Riding, Madill, & Haines, 2007; Sudek, 2006) as well as an overall business opportunity (Feeney, Haines, & Riding, 1999; Mason, 2008; Yitshaki, 2008), evidence suggests that in post-investment stages BA actively engage in the ventures they invested in, either through taking a hands-on role or through monitoring investments (Freear, Sohl, & Wetzel, 1995; Harrison & Mason, 1992). Consequently, there is evidence that returns on investments made by BA are significantly higher than those made by non-BA, mainly because of the nature of their involvement (Haar, Starr, & MacMillan, 1988; Mason & Harrison, 2002; Riding, 2008). When entering a new business, BA dispose their new ventures with their "own unique motivations, intentions, experience and personality" (Collewaert, 2012), along with their money, time, knowledge and social networks (Freear et al., 1994; Mason, 2008; OECD, 2011). When entrepreneurs use their acquired wealth, accumulated experiences and contacts to boost other's early-stage entrepreneurial

ventures, they become BA, and they entrepreneurially recycle (Mason & Harrison, 2006). Therefore, previous entrepreneurial experience or entrepreneurial exit events trigger BA decision-making behaviour. It demands devotion of their energy, time, money, experience and networks to create and support more entrepreneurial activity.

As we can see, increasing research and empirical evidence formed a common knowledge in the BA decision-making research. However, we still did not reach the edge of complete knowledge. We need further exploration of what forms this knowledge and what was the evolution of that knowledge. To contribute to this knowledge base, we propose two research questions for this study: (1) What is the structure of the scientific community in the BA decision-making field? And, (2) How has the structure of the BA decision-making field developed over time? With this study, we explore the scientific structure of BA decision making from the scientific mapping perspective, where we frame our research upon patterns in previously published peer-reviewed research. With such a historically-oriented study, we establish a benchmark for future research and draw specific dyads in the theoretical development of the BA decision-making research.

2 Methodology

2.1 Bibliometric co-citation analysis

In this study, we use a bibliometric co-citation analysis to produce a quantitative review of the BA decision-making research. Bibliometrics refers to the mapping of the scientific field through literature analysis, and brings to light conceptual patterns, research trends and scientific relationships (Holman, Lynch, & Reeves, 2017), as we investigate the relationships in cited references (Griffith et al., 1974; Small & Griffith, 1974). A co-citation analysis uses co-occurrence data and explains that two references are co-cited, if there is a third reference that cites both previous references (Boyack & Klavans, 2010; Černe, Kaše, & Škerlavaj, 2016; Marshakova, 1981; Small, 1980). This exemplifies the link between the two references, meaning that they are more closely related to each other, if they are in the reference list of the same article. There are two reasons for their close relationship: The two references might be from the same area of interest, or the topic areas of both articles relate closely (Cawkell, 1976; Garfield, Malin, & Small, 1983; Schildt et al., 2006; Small, 1973; Small & Griffith, 1974). The series of contributions or basically the intellectual exchange within the field present an "intellectual history of the field" and the links between scholarly work provide the "means of documenting this history" (Culnan, 1986).

To illustrate the importance of this analysis, we highlight that the typical behaviour of researchers in the academy is to "cluster into informal networks" (Culnan, 1986), often denoted as "invisible colleges" (de Solla Price, 1963; Gmur, 2003; Hagstrom & Crane, 1973) where they share concepts to build the knowledge of the field. With this in mind, we explored the field of BA investment decision making, with a particular focus on the development of dominating clusters of knowledge (i.e. colleges) in this field. In this study, we used co−citational relations among documents (e.g. articles/references) to provide evidence on scientific cooperation and generation of the research clusters in the BA decision-making field. Important to note is that this study is a first bibliometric document co-citation analysis in the BA decision-making field of research.

2.2 Data and procedure

To generate the co-citation analysis, we followed Zupic & Čater, 2014 procedure for science mapping with bibliometric methods. We used ISI Web of Science (WOS), the bibliometric database that the majority of bibliometric studies use (Cornelius et al., 2006; Gartner, Davidsson, & Zahra, 2006; Nerur, Rasheed, & Natarajan, 2008; Schildt et al., 2006). WOS is a citation database with multidisciplinary coverage of high impact journals in science, social sciences, and international proceedings of conferences. We filtered core references in WOS where we determined the sample of primary papers for the co-citation analysis. In the literature, there seems not to be a general definition of how to select search terms in bibliographic studies. We decided to follow the most common practice − we included key terms that derive from reading the literature in the field through Boolean search terms. Though it seems entirely arbitrary, these keywords precisely reflect the observed field. We searched for terms *"business angel*"* OR *"angel invest*"* AND *"decision*"* within the WOS topic search field. The use of the asterisk (*) as a truncation symbol allowed the database to search for different endings of the word (Granados et al., 2011). This search ability is common for e-sources search algorithm and the most convenient way to cover all different appearances, without losing some of the literature sources.

We performed a database search through the Science Citation Index Expanded (SCI-EXPANDED), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI) and Emerging Sources Citation Index (ESCI). To ensure the use of a

validated knowledge base, we restricted our search to peer-reviewed scholarly journal articles and reviews (Meyer et al., 2014; Schildt et al., 2006) in the English language, for the period from January 1981 to March 2019. Further, we manually refined the search by specifying WOS categories with the highest record count for the observed search terms: Business, economics, management, business finance, sociology, operations research management science, social sciences interdisciplinary, psychology, behavioural sciences, and psychology applied.

The initial query resulted in 280 publications with the sum of 5554 citations at the end of March 2019 (without the self-citations result there were 4911 citations). In total, we received a 4151 citing articles base (4003 without self-citations). Total *h*-index of all articles was 44, with an average citation per item of 20,12. Initially, we saw that the field development was exponential since the 1990s, where 12% of total documents were published with 24% of total citations. In 2000s, additional 22% of documents emerged with 43% of total citations, followed by 2010s with 65% of total published articles carrying 31% of total citations (Fig. 1).

After the initial overview of field development in numerical terms, we performed an in-depth bibliometric analysis. We exported data from the WOS database for further treatment on a local level and used specialised bibliometric software, VOSviewer, as our primary tool, both for analysis and visualisation of the bibliometric network (Van Eck & Waltman, 2014). We imported in VOSviewer the data obtained in WOS search and performed co-citation analysis with cited references (documents) as a unit of analysis. Next, we selected all the documents cited five times or more from the bibliometric database. We selected this threshold primarily for convenience in computational processing regardless of the average citation value (as previously shown in Fig. 1). Of the 11,147 cited references in the bibliometric network, 371 met the threshold. For each of the 371 cited references, we calculated the total link strength of the co-citation links with other cited references. Some of the 371 items in our network were not connected to each other. The most extensive set of connected items consisted of 359 references with the highest total link strength, and we sent this set of documents for further internal analysis and network visualisation. We present descriptive statistics of the part of the dataset in Table 1.

In the following step, we visualised a bibliometric network to develop nodes and edges that describe dyads between pairs of nodes. Nodes in our study represented publications (references). According to Van Eck & Waltman (2014), uncovered edges indicate *if* there is a relation between publications and *what* the strength of their relationship is. The distance between two nodes in the visualisation of the bibliometric network in VOSviewer gave us an approximation of node relatedness (Naukkarinen & Bragge, 2016). We used a graph-based approach to visualize the bibliometric network of the domain, which gave us an appropriate two-dimensional space for our bibliometric network (Van Eck & Waltman, 2014).

The last step in this procedure was an analysis of the results with an interpretation and discussion.

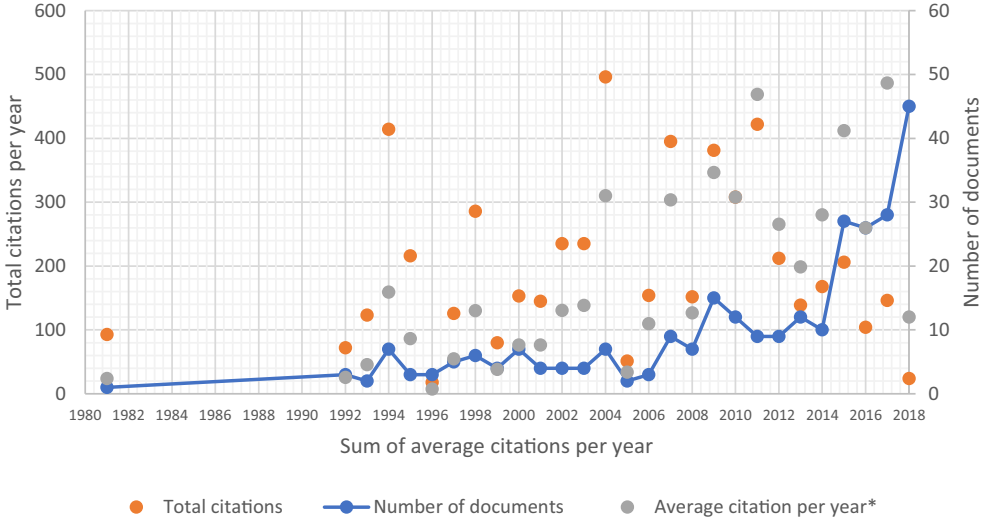

*Fig. 1. **Evolution of the BA decision-making research (end of year data). Source: originated by the authors upon Web of Science data.** Note: We calculated the Average citation per year as a field Sum of single article average citations in a given year. The year 2019 data we did not include in this figure as the analysis was done in March 2019. Thus, we do not have end-of-year 2019 statistics.*

Table 1. Top 20 references with the highest citation frequencies, the highest number of links and link strengths in BA decision-making field.

Total number of citations	Total number of links	Total link strength*	Reference (first author, year and publication)
35	287	1114	Mason C, 2004, Int Small Bus J, V22, P227
33	280	1087	Maxwell A, 2011, J Bus Venturing, V26, P212
33	293	1106	Wetzel W, 1983, Sloan Manage Rev, V24, P23
30	298	1162	Van Osnabrugge M, 2000, Venture Capital, V2
28	286	999	Mason C, 2002, J Bus Venturing, V17, P211
26	240	928	Feeney L, 1999, Ventur Cap, V1, P121
26	287	1018	Mason C, 1996, Entrep Region Dev, V8, P105
23	230	693	Mason C, 2002, Entrep Region Dev, V14, P271
23	287	928	Politis D, 2008, Ventur Cap, V10, P127
22	277	800	Fiet J, 1995, J Manage Stud, V32, P551
22	274	886	Haar N, 1988, J Bus Venturing, V3, P11
22	265	962	Paul S, 2007, Ventur Cap, V9, P107
22	285	737	Prowse S, 1998, J Bank Financ, V22, P785
21	228	749	Mason C, 1996, Int Small Bus J, V14, P35
21	230	777	Mason C, 2000, Small Bus Econ, V15, P137
21	261	647	Robinson R J, 2000, Angel Investing Matc
21	255	578	Tyebjee T, 1984, Manage Sci, V30, P1051
20	272	655	Freear J, 1994, J Bus Venturing, V9, P109
20	284	845	Wetzel W, 1987, J Bus Venturing, V2, P299
20	263	726	Wiltbank R, 2009, J Bus Venturing, V24, P116

Note: Complete list can be obtained upon request.
Source: originated by the authors upon WOS data and VOSviewer analysis.

We used interval sectioning proposed by Černe et al. (2016) and a clustering method proposed by Schildt et al. (2006) and Meyer et al. (2014). Intervals were sectioned by decades. We labelled clusters upon the keywords or titles of core documents in the clusters.

2.3 Co-citation analysis results

Our analysis revealed four significant intervals of research in the BA decision-making research. Even if our analysis showed that the majority of contributions are sectioned through four intervals, they still maintain an explanation of related work between researchers throughout the lifetime of the observed knowledge domain. Concerning the uniqueness of every article that forms this knowledge base, we must refer to the "growing recognition of scholars to borrow from others" (Schildt et al., 2006). Thus, some publications were not exclusively part of the entrepreneurship research, especially in the early stages of BA field development. Bibliometric network visualisation in VOSviewer assigned nodes in the network and revealed nineteen clusters of knowledge within intervals. These clusters reflect closely-related nodes within the intervals.

2.3.1 First interval: early development to the end of the 1980s

An analysis of the first co-citation network revealed the very beginnings of BA decision-making research (Fig. 2). A total number of documents associated with this interval was 50, 45 of which were directly observed for the analysis as some items were not interconnected. Among the 50 documents, the most extensive set of connected documents was 45 which we show separately as four clusters in Fig. 2.

The first two clusters of knowledge in the 1980s point out some historical discussion in *"ethnic entrepreneurship"* and *"managerial behaviour"*. The majority of influential papers in those two clusters were published even before the 1980s, but mainly guide the 1980s conceptualisation of BA decision making as they were highly co-cited in future discussions. A theoretical framework of studies was grounded in the agency theory and the theory of the firm (Jensen & Meckling, 1976). The role of corporate social responsibility and managerial behaviour in ethnic investments was until then investigated on a pure firm level, and this set a new direction of thinking in the BA environment.

The first real article in the BA decision-making field explored backgrounds, investment interests, and behavioural patterns of BA, where Wetzel (1981) started the regional study on closing the equity gap in informal investments. This article shaped the very beginnings in BA decision-making dialogue and densely clustered around itself several most crucial research papers in the 1980s. Later in 1983, Wetzel presented the first attempt to explore the socially-oriented characteristics of BA. A couple of years later, Wetzel (1987) argued that expectations

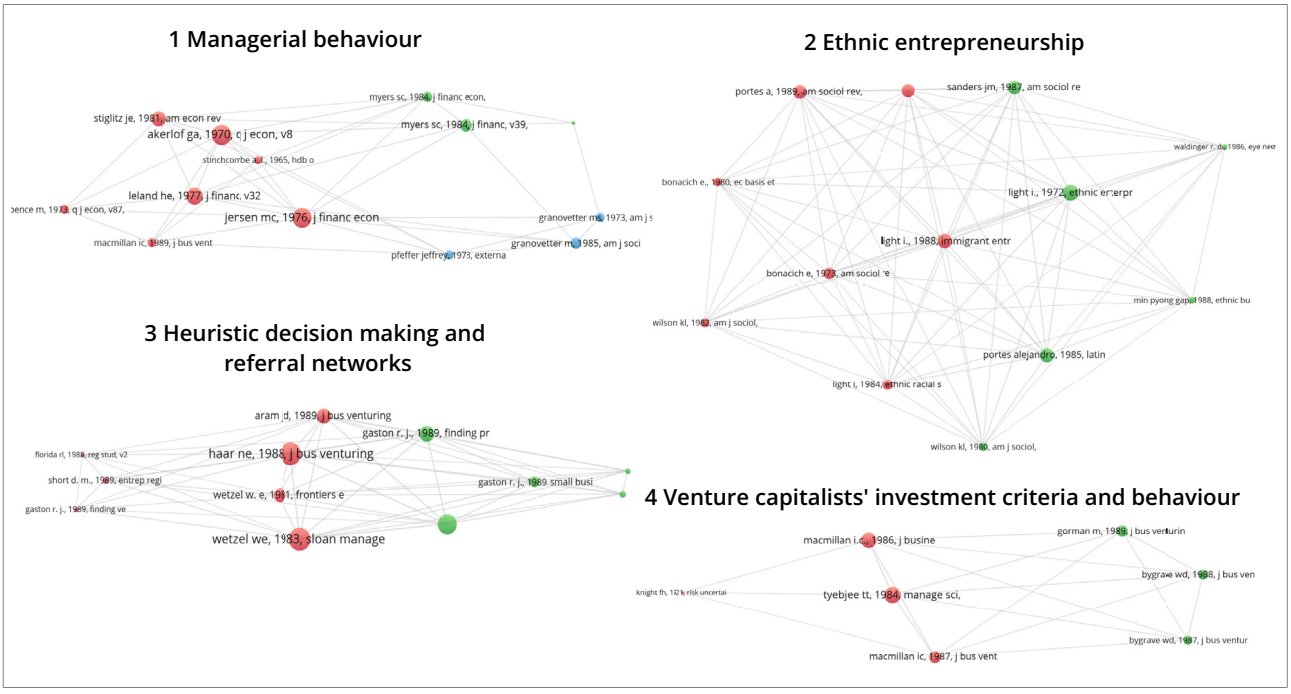

Fig. 2. Clusters of knowledge in the 1980s co-citation network. Source: originated by the authors upon WOS data and VOS Viewer visualisation.

of risk and reward commonly motivate BA, but those do not have to relate to financial incentives. This is the primary difference that distinguished BA from venture capitalists. The nonfinancial incentives in BA decision making are grounded in social responsibility as the leading motivator for investment (i.e. jobs creation, developing socially valuable technology, encouraging minority, and female entrepreneurship). When BAs consider the incentive of nonfinancial rewards, they do not rely on compensatory decision model, but commonly use shortcut decision-making heuristic referred to as "elimination-by-aspects." Still, the shortcut decision making relies on their accumulated knowledge from past investments and trust in referral networks (i.e. friends and business associates). As an addition to this study, another leading document in the cluster is by Haar et al. (1988) who argued that trust and supportiveness influence referral networks and BAs rely less on professional referees who can increase the probability of investment success. Heuristics framed decision making; behavioural aspects lead investment patterns. Aram (1989) implied that BAs are usually entrepreneurs themselves. He builds upon the evolution of tech-oriented BA referral networks (Aram, 1989). The more tech-investments evolve, the more are professional referees' services used by BAs. All articles in this cluster focused on BA referral networks and used them as a part of their investment patterns. Also, they have more of a behavioural outlook for their decision making. For these reasons, we labelled this cluster *"heuristic decision making and referral networks"*.

Another cluster in the 1980s built upon the BA decision-making studies and related strongly to the first cluster. We labelled it the *"venture capitalists' investment criteria and behaviour"*. This cluster is not that dense, and its contribution is not that related to the BA decision-making field, since arguments come from the venture capital lenses. MacMillan, Siegel, and Narasimha (1985) conclude that the key criteria for venture investment are entrepreneurs' experience and personality. Tyebjee and Bruno (1984) focus on venture capitalists decision-making stages and make a significant advance in the understanding of venture capital decision making.

Even if we identified four different clusters of knowledge in this interval, Wetzel (1983) and Haar et al. (1988) represented the centre of all clusters. They are also the bridging authors in the early beginnings of the field development. Different theoretical perspectives within the four observed clusters with a high level of total link strength accounted for well-connected research paths in the observed interval. Still, we see that the first two clusters represented only the conceptual basis for the BA decision-making development and are not that influential for the whole 1980s network.

Additionally, we see that articles with the highest link strength dealt mainly with the heuristic decision making and referral networks in BA framework which provided a basis for the next interval knowledge exchange.

2.3.2 Second interval: the 1990s

The co-citation network of the second research interval revealed five distinct knowledge clusters and showed the heterogeneity of theoretical backgrounds. The central articles in the network by Feeney et al. (1999), Harrison and Mason (1992) and Mason and Harrison (1996a) were also the bridging articles in three clusters (see Fig. 3).

The dominance of works by Freear et al. (1994), Sapienza, Manigart, and Vermeir (1996) and Prowse (1998) in the first cluster of the 1990s represented the new stream of thinking about the differences between the BA and non-BA investors or entrepreneurs. Those studies represented the most cited-papers and the ones with the highest total link strength in this cluster which we labelled *"BA vs non-BA investors"*. Contrary to the study in the previous interval by Aram (1989), Freear et al. (1994) argued that BA preferred geographic proximity of their investments and these criteria strongly influenced their investment decision. In this cluster, we also saw the first formal studies on the differences between BA decision making and other members of the investment process.

The second cluster in the 1990s framed around the *"BA investment attitudes and intercountry investments"*

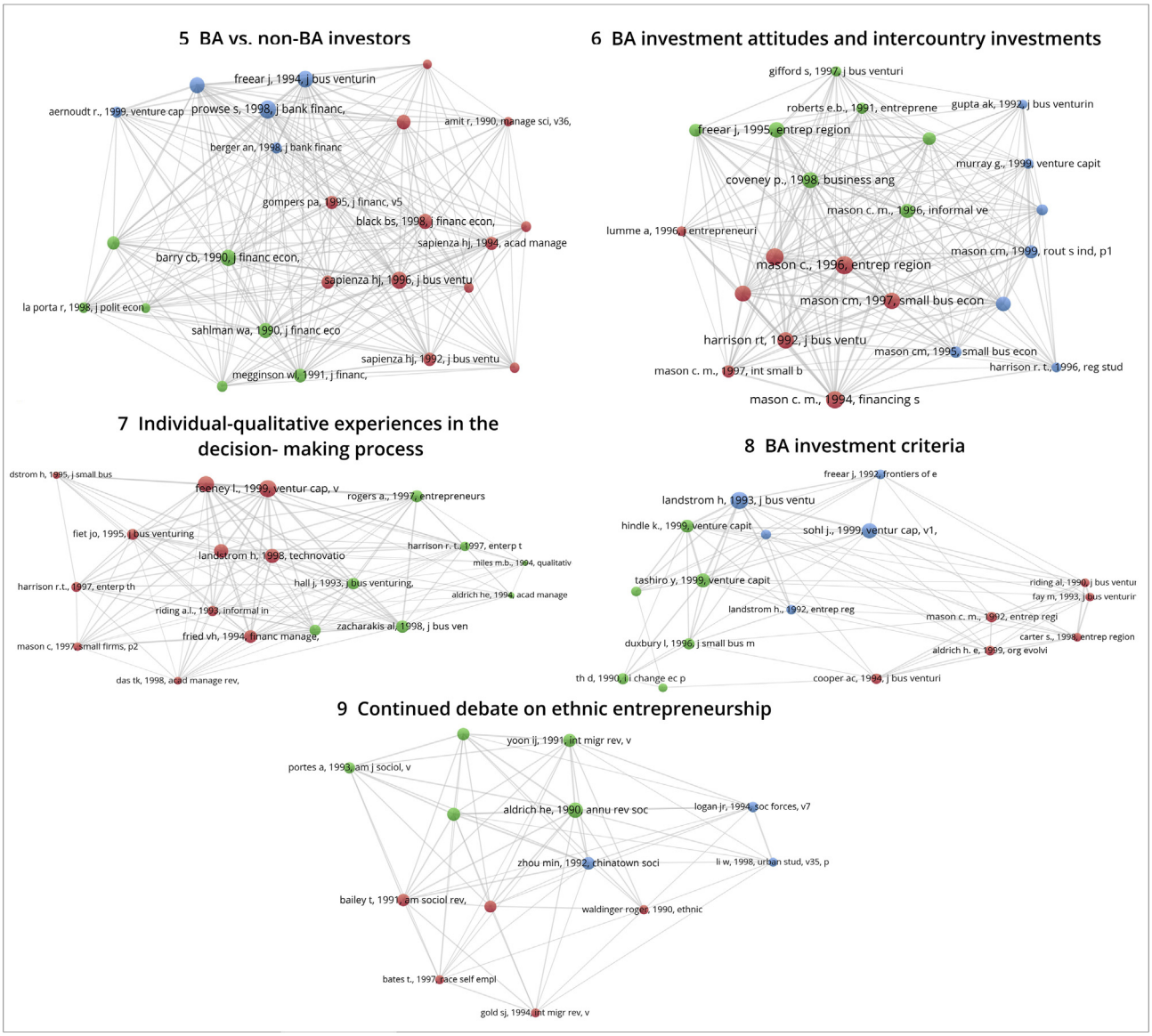

Fig. 3. Clusters of knowledge in the 1990s co-citation network. Source: originated by the authors upon WOS data and VOS Viewer visualisation.

where Mason and Harrison's (1996b) study was the most influential one. They focused on the differences between the investors' and entrepreneurs' view on the expecting venture performance and the situations when the relationships rupture because of different expectations. Freear and Wetzel (1990) pointed out the complementarity aspect of investment relationship, and that in seed or start-up stages of venture financing individual investors tend to behave more risk-averse, having a more conservative attitude in investing. Observing investment attitudes, Freear et al. (1995) discovered that BA and non-BA investors share the same views of the investment process, but differ in the degree of potential investment. Studies in this cluster tended to draw on the differences in taking a hands-on role and making important business decisions in BA and non-BA surroundings (individual investors or formal venture capital market). Non-BAs used professional referee service rather than Bas, due to lack of expertise in this funding process (Freear et al., 1995). One of the principal articles in the cluster was the *Journal of Business Venturing* paper by Harrison and Mason (1992) that confirmed Wetzel's (1987b) findings in a different geographical context. The invisibility of investors, fragmented market, imperfect communication in the investment process and low effectiveness are the keynotes to take from the UK case in this Harrison and Mason's (1992) study. Arguments on the geographic differences in BA investments, with an emphasis on the European economies, formed the central research gap in the research domain.

In the following interval cluster, we observed a strong influence of deal-specific theoretical perspectives. The works of Feeney et al. (1999) and Mason and Harrison (1996b) were by far the most cited documents and dominating points in the second cluster. Research in this cluster went even beyond the current studies on BA decision making and advocated the quality of venture managers or owners as well as the entrepreneurial perspectives as the main obstacle in the decision-making process. In light of this, but going more into specifics of the deal-making structures, Landström's (1998) article advocated the involvement requirement as one of the main decision-making criteria. Risk avoidance strategies were a crucial part of the decision-making process. Fiet's (1995) paper was the first indication that BAs tend to focus more on agency risk in the decision-making process than on the current market risk. Additionally, Harrison, Dibben and Mason's (1997) study reflected on the behavioural part of the risk avoidance where the decision-making process emerged around the concept of trust. Thus, we label this cluster *"individual qualitative experiences in the decision-making process"*.

The last two clusters of knowledge in the 1990s are smaller in size and are more heterogeneous. We label cluster number three the *"BA investment criteria international evidence"* as research mainly framed in the level of commitment, motivation, control, and business diversification. These determinants represent the principal differences between BA and non-BA investors from different countries. In this cluster, Landström (1993) acknowledged that Swedish BA treat investments as entrepreneurial ventures of their own. The final cluster contained a debate on the ethnic entrepreneurship from the 1980s with the most influential paper from Aldrich and Waldinger (1990). We labelled this cluster the *"continued debate on ethnic entrepreneurship"*.

2.3.3 Third interval: the 2000s

The evolution of methodological and conceptual approaches in the BA decision-making domain is evident in the 2000s. The era of technological evolution also strongly influenced the literature in the field. The 2000s brought a denser collaboration in the field, and the density of co-citation network (see Fig. 4) reflects the rich and clustered intellectual collaboration in the field. Main outlets for publishing in the 2000s were *Venture Capital*, *Journal of Business Venturing*, and *Entrepreneurship Theory and Practice* with the vast majority of published influential articles. In the 2000s, we witnessed the proliferation of six different clusters of knowledge.

Mason and Stark (2004) in *International Small Business Journal* and Harrison and Mason (2000), Madill et al. (2005), Mason and Harrison (2008), Politis (2008) and Van Osnabrugge and Robinson (2000) in *Venture Capital* represented the most notable studies in the field. In the observed interval, most studies in the network were published in more specialised research publications, used as "toolboxes" for dealing with BA investments. Accumulated knowledge results in multiple reviews, namely from Van Osnabrugge and Robinson's (2000), as well as Kelly's (2007) and Sohl's (2007), works published in the *Handbook of research on venture capital*. Our analysis revealed that Mason and Stark (2004) with Van Osnabrugge (2000), Mason and Harrison (2002) with Van Osnabrugge (2000), as well as Paul, Whittam, and Wyper (2007) with Van Osnabrugge (2000), are most often cited together and are centrally positioned in the co-citation network of the first cluster of the 2000s.

The most densely co-cited group of works represented the first cluster of knowledge with the total

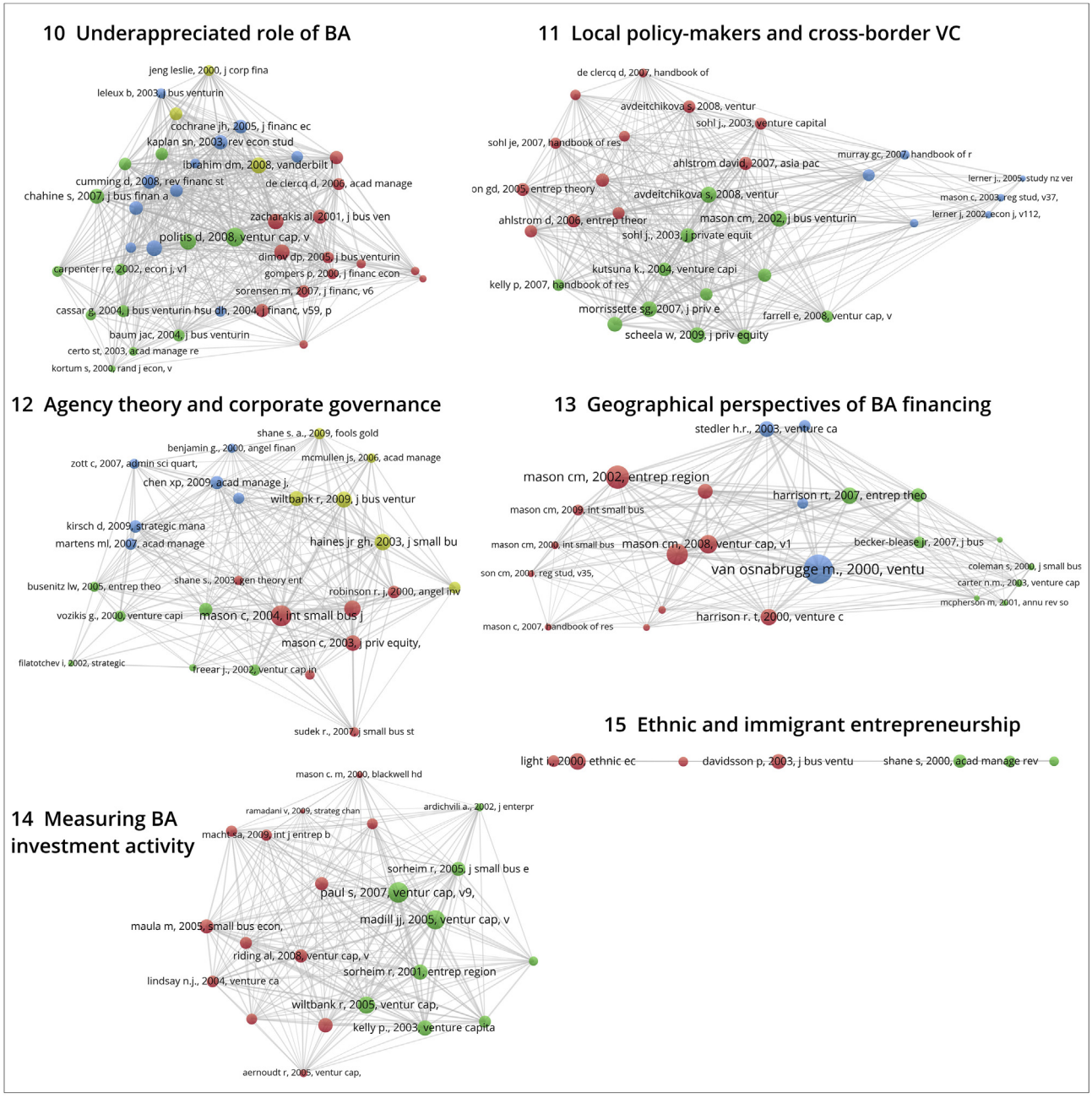

Fig. 4. Clusters of knowledge in the 2000s co-citation network. Source: originated by the authors upon WOS data and VOS Viewer visualisation.

sum of co-citation link strength of 1942. We labelled the first cluster the *"underappreciated role of BA"*. The central work in the first cluster reflected the profound literature review in the field by Politis (2008), where BA was represented as essential stakeholders in venture surrounding while holding a complementary role in financing operations. Leading studies in the cluster offered the insight that the BA role goes even beyond the regular financing alternatives, both from financial (Cumming, 2008; Hellmann & Puri, 2002; Kaplan & Omberg, 2004) and legal perspective (Chahine, Filatotchev, & Wright, 2007; Ibrahim, 2008). The most novel trails in BA decision-making research grounded in the *Journal of Business Venturing* articles where Elitzur and Gavious (2003) examined the relationship between venture investment stakeholders through the signalling aspects of the investment while conceptualising the free-rider phenomenon in the BA society.

Additionally, one of the most co-cited articles in the cluster grounded the research by analysing

biases that appear in the BA-venture team relationship, where Franke, Gruber, Harhoff and Henke (2006) agreed that investors favour venture teams who are similar to themselves. Discussion in this cluster also involved the BA character: overconfidence (Zacharakis & Shepherd, 2001), moral hazard and irrationality (Bruton, Chahine, & Filatotchev, 2009), and reputation (Hsu, 2004). This cluster literature built mainly upon the venture capital knowledge and the majority of highly co-cited works underly the similarities between venture capital and BA financing. Thus, even if BAs are in the financial form different from venture capitalists, their role is largely underestimated, and studies still re-frame the research upon the venture capitalists experiences.

The second cluster in the 2000s started a debate on *"local policy-makers and cross-border VC"*. One of the documents with the highest co-citation link strength came from *Journal of Business Venturing* which remains one the dominant outlets for publishing (Mason & Harrison, 2002b), along with *Venture Capital* (Avdeitchikova, Landström, & Månsson, 2008; Sohl, 2003) and *The Journal of Private Equity* (Morrissette, 2007; Scheela & Isidro, 2009; Sohl & Rosenberg, 2003). The main lessons gained from this cluster outlined the question of how networks and institutions (both formal and informal) support BA activities and venture capitalists in general.

A dominating article in the third 2000s-interval cluster by Mason and Stark (2004) was one with the highest link strength and the highest number of citations in the whole interval network. It went back to the differences between the supply and demand part of the BA investment equation. The verbal protocol analysis in this study advanced the methodological considerations in the field. The results of their study are the first to indicate that there are fewer differences in venture capitalists and BA decision-making criteria, but formal investors like banks retained the standardised procedures in business plans evaluation. Again, a business plan was the first eliminating criterion in venture financing (Mason & Stark, 2004). In addition to this study, one of the essential works came from Van Osnabrugge (2000), where the author applied the agency theory in the venture capital environment to study BA behaviour. Further studies in the cluster mainly focused on corporate governance with a more financial perspective. Thus, we labelled the third cluster *"agency theory and corporate governance"*.

We labelled the fourth cluster of knowledge in the 2000s as the *"geographical perspectives of BA financing"*. Contributions with the highest co-citation link strength estimated the size of informal venture capital in the UK (Harrison & Mason, 2007; Mason & Harrison, 2000, 2008; Van Osnabrugge & Robinson, 2000), and more specifically in Scotland (Paul, Whittam, & Johnston, 2003). Moving forward we saw substantial evidence on BA behaviour also in Germany where social and cultural differences with previous cross-country samples were outlined.

We labelled the fifth cluster in this interval the *"measuring BA investment activity"*. The central studies by Paul et al. (2007) and Madill et al. (2005) reviewed the importance to provide a reliable measure of the size and activity of the BA market. Additionally, the sixth cluster was significantly smaller in size and weight than the rest of the clusters and offered a rather flat co-citation network. We named it the *"ethnic and immigrant entrepreneurship"*, as discussions within it continue with ethnic entrepreneurship topics, however, now in the 2000s, due to the rising immigrant issues all over the world, the immigrant entrepreneurship concept is also introduced (Logan, Alba, & Zhang, 2002).

As we see, the third interval of scholarly contributions in the 2000s was the most important one in terms of the co-citation link strength. The majority of empirical studies in the interval were frequently co-cited together. Also, the first literature reviews appeared, and conceptually BA research moved to more interdisciplinary research (conceptual influence from finance, legal studies, and sociology).

2.3.4 Fourth interval: the 2010s

As a central piece in the fourth observed interval in our co-citation network, Mollick's (2014) article dominated with a total of 18 citations and a total link strength of 102. This interval was the smallest observed interval with regards to total interval duration, but represented the most meaningful current findings in the BA decision-making domain. We sectioned this interval into four clusters.

We labelled the first cluster in the fourth interval the *"BA group investment practices"*. Syndicated deals are just one form of BA group investment practices. Article by Paul and Whittam (2010) was a central work in the first cluster and pointed out the role of BA gatekeepers in the investment syndicates. Syndicated investments were mostly dependent on the regional proximity, and BA group investment practices differed from individual BA decision-making process (Carpentier & Suret, 2015). The first cluster was the densest co-cited cluster in the fourth interval and proposed the importance of new investment forms – syndicated deals in the BA investment practices (Fig. 5).

The second cluster in the fourth observed interval was significantly smaller in size, but framed around

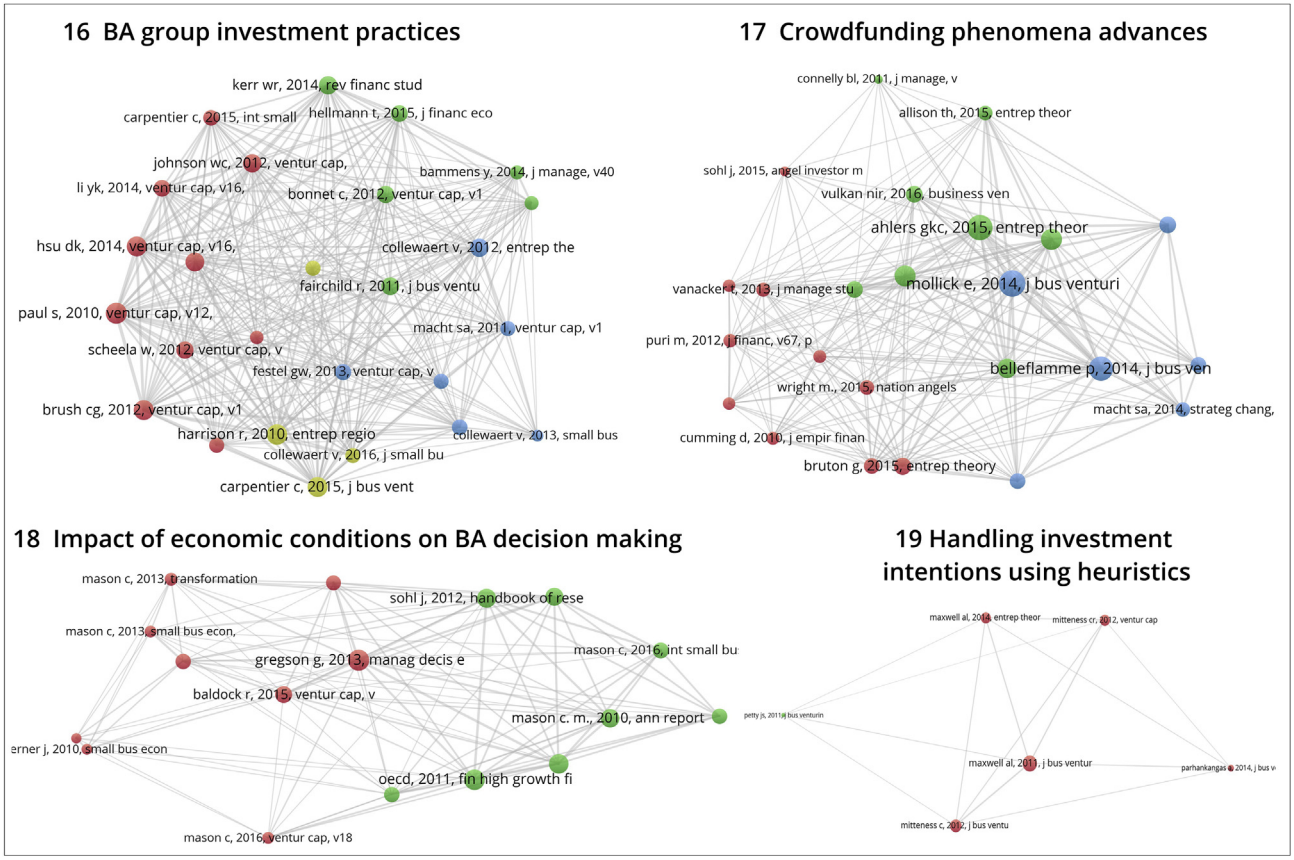

Fig. 5. Clusters of knowledge in the 2010s co-citation network. Source: originated by the authors upon WOS data and VOS Viewer visualisation.

the most cited article and the article with the highest co-citation link strength in the whole 2010s interval. Ahlers, Cumming, Günther, and Schweizer (2015), Belleflamme, Lambert, and Schwienbacher (2014) and Mollick (2014) represented the central works with the highest total co-citation link strength. Their studies provoked the frontiers of research in BA decision making. The late 2010s discovered the crowdfunding phenomenon in entrepreneurial financing. Successful crowdfunding appeared to be a positive signal for BA investments as reported by the central studies in this emerging cluster (Ahlers et al., 2015; Belleflamme et al., 2014; Mollick, 2014). However, the fusion of crowdfunding and BA financing was in the early phase of research. Thus, we labelled this cluster the *"crowdfunding phenomena advances"*.

The last two clusters of knowledge in the 2010s represented smaller and heterogeneous research advances. More focused research on BA decision making provided a study in the third 2010s cluster by Harrison, Mason, and Smith (2015). They outlined the importance of learning from investment practices in the BA environment, and additionally how BAs approached the exit strategy in the investments (Mason & Botelho, 2016) in diverse economic conditions (Baldock & Mason, 2015). Thus, we labelled this cluster the *"impact of economic conditions on BA decision making"*.

We labelled the fourth cluster in 2010s the *"handling investment intentions using heuristics"*. The article of Maxwell, Jeffrey and Lévesque's (2011) was a pivotal study in the cluster. Psychology theories explained the intentional activities in BA decision making in this cluster. Built upon findings from the early studies in the field (Haar et al., 1988), we received new insight into heuristic-led decision making. Maxwell, Jeffrey, and Lévesque (2011) denoted it as the "elimination-by-aspects" decision making, where the emphasis laid in the role of passion in the favourable decision making (Mitteness et al., 2012) that intentionally lead to building trust in a business relationship (Maxwell & Levesque, 2014). It is important to note that most studies in this cluster came from the *Journal of Business Venturing* and *Entrepreneurship Theory and Practice*. It seems these journals represent the foundations of current theoretical contributions to the field of knowledge in BA studies.

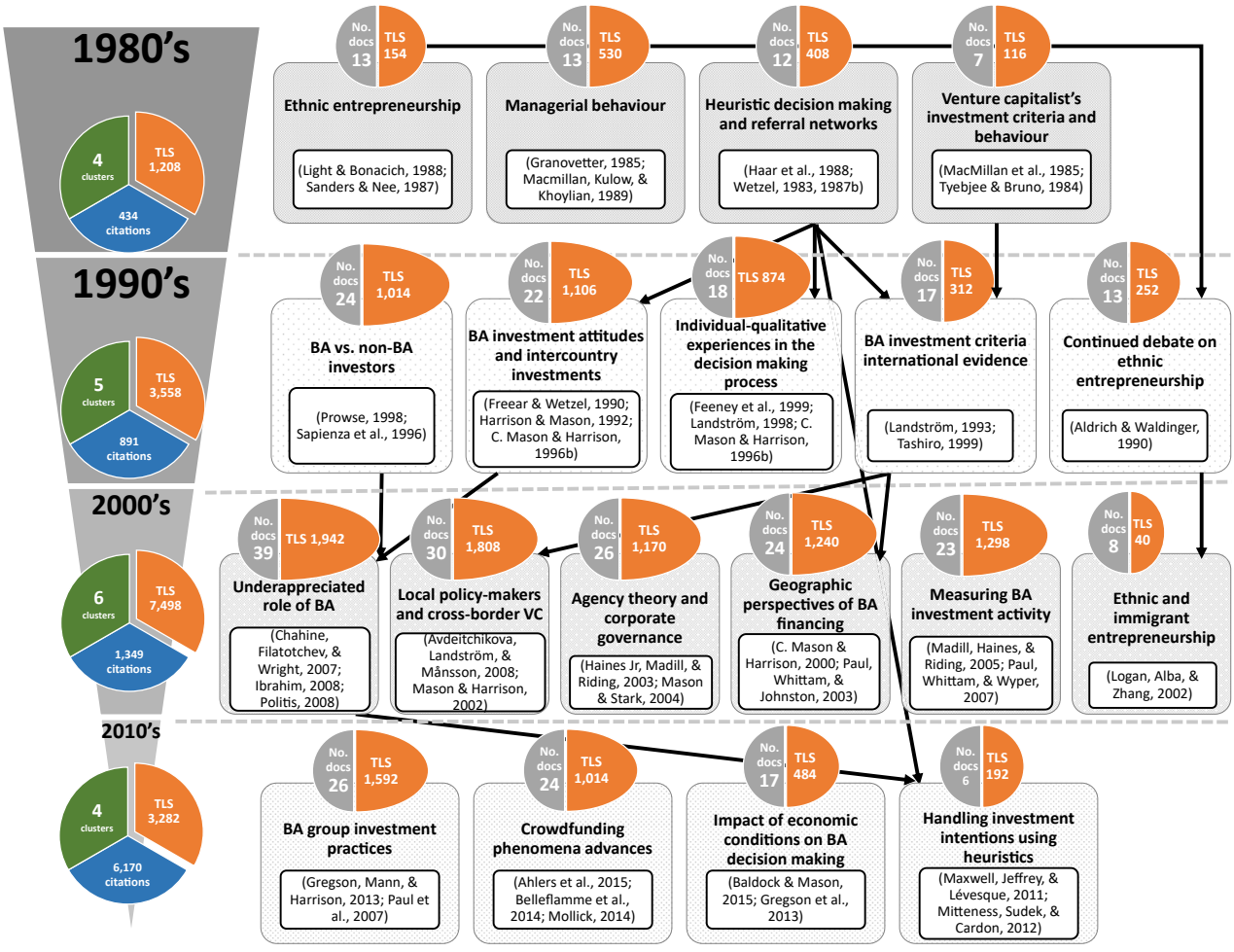

Fig. 6. BA decision-making research development through intervals. Source: originated by the authors. Note: TLS stands for total link strength.

3 Discussion of co-citation analysis results

The main research question in this study dealt with the structure of the scientific community and the research structure development of BA decision making over time. Within the four intervals that we studied, nineteen clusters of knowledge appeared (Fig. 6) which gave us an idea of the diversified and rather heterogeneous knowledge frameworks in the BA decision making in the field. Prior literature reviews were conceptually different, but from the accumulated findings in Edelman et al. (2017), Drover et al. (2017), Harrison (2017), and Wallmeroth, Wirtz, and Groh (2018) we can draw specific comparisons in terms of research gaps.

In our study, we found that BA decision-making research started the conceptual evolution back in the 1980s. One unanticipated finding was that even if Wetzel published the first paper on BA decision making in 1983, the ground for studies had mainly been driven by finance and psychology research on investment behaviour even before the 1980s. The first observed interval discovered four clusters of knowledge. These clusters were grounded in the finance and psychology intersection research, with more specific explanations given to the BA surrounding. At the very beginnings, BA decision making relied on heuristic decision making and referral network ties. These findings further supported the idea established in previously literature reviews that BA decision making is highly dependent on the quality of the business network, whereas investment decisions were usually delivered upon the short-cut decision making (Drover et al., 2017; Edelman et al., 2017; Harrison, 2017; Wallmeroth et al., 2017).

The 1990s research gave us a diversified view of BA investments. The leading lesson we take from this literature interval is that BAs do not only focus on the ideas but also on their proper execution.

Thus, the venture manager's (executive or owner) quality is one of the most important criteria when BAs make an investment decision. Good expectation fit between the BA and venture management is crucial for successful funding. So, it is not the jockey *OR* the horse. Rather, it is the jockey *AND* the horse to have a perfect fit. In the 1990s, we also witness some further developments of the BA decision-making criteria and processes. The differences in BAs and non-BAs are not that significant regarding utilising a formal investment. More importantly, they differed in the psychological factors that did influence the decision-making process along with the success of the venture.

Further use of psychological theories explained the BA decision making where we perceived the investment intention as a trust-related activity. From the psychological perspective, in a BA decision-making surrounding, new concepts like trust play a critical role. The heuristics in decision making form the dynamics in this research field.

Our study also found that one of the major research streams in BA decision making always hypothesises the importance of geographic proximity to BA decision making. This was also outlined previously by Drover et al. (2017), and Edelman et al. (2017) where the proximity in geographical terms was the key investment criteria by BAs, both on the individual and group level. Our analysis showed that the concept of "investing closer to home" is bounded in the 1990s and 2000s studies where the geographic perspectives on BA financing also took note from cross-border venture capital practices and aligned with local investment policies. In 2010s, the importance of the investment proximity for BA decision making emerged and it currently seeks for new evidence.

The evolution of methodological and conceptual approaches in the BA decision-making domain is evident in the 2000s. Most studies were published in specialised research publications and were used as "toolboxes" for dealing with BA investments. Studies in this interval mirror those from the previous ones, but are more specific in the BA research output. The possible explanation for this might lie in the increasing size of the BA market where more sample specific empirical evidence is needed.

In the 2010s, the first empirical studies on BA syndicates appeared, and the investment process changed to more socio-psychological oriented deal-making. Syndicated and group financing decisions were previously also outlined by Edelman et al. (2017) as one of the emerging typologies for BA investments. The 2010s emerged with only four significant clusters of studies, of which one new sphere of venture financing appeared. Even if BAs remain the single most reliable source of well administered and mentored informal capital investment for the early-stage business, the crowdfunding research is the newest sub-field of potential research. This finding confirms the "change of entrepreneurial culture" as outlined by (Harrison, 2017) where crowdfunding is linked to early-stage financing. Yet, this is still not densely connected to BA decision making nor BA investments. Edelman et al. (2017) also emphasised this as a potential research gap where the impact of crowdfunding on BA should be further investigated.

Despite the evolution of BA decision making, and venture financing in general, the literature is scarce on the question of ethnic, minority and immigrant venture financing. This is in alignment with our earlier observations, which showed that ethnic entrepreneurship was the first emerging theme in our interval research, back in the 1980s, and continued appearing through the majority of our study intervals. Even if it occurs continuously, the research contributions are somewhat scarce and heterogeneous. A possible explanation for this might be that ethnic, minority and immigrant entrepreneurship has scrutinised access to BA investments, and "results in less desirable financial outcomes" (Drover et al., 2017).

3.1 Limitations and avenues for further research

Even though this article uses a robust scientometric methodology, some limitations from this research could be addressed in future research. First, all our data came from the same source (e.g. we used the ISI Web of Science database) and there is a possibility of common method bias (Podsakoff et al., 2003). Secondly, in our study, we applied the threshold point to the analysis of the bibliometric database. This means that we excluded studies with less than five citations. So, even if some publications in 2019 are increasingly co-cited, we did not include them in the current study. We believe that those articles will prove its relevancy in the following research periods. Concerning that, our co-citation analysis eliminates the potential use of new publications that do not have citations yet, emerging fields, and smaller subfields, as it requires citations to accumulate. This could be resolved through the use of bibliographic coupling analysis instead of co-citation. It would be interesting to see what the comparative analysis of co-citation and bibliographic coupling analysis would look like.

As we claimed in the Introduction, this study aimed to develop a benchmark for future research

in the field of BA investment decision making, as well as gather a better understanding of the knowledge clusters in the given area. Our results suggest that there are eleven clusters of research to serve as an attractive ground for future research. With that in mind, we challenge the replication of this study soon, so recent contributions to the field could also be part of the quantitative literature review of the field. Due to the practical use of the contributions, the field will evolve in the upcoming years, and there might appear changes in the invisible colleges within the field.

4 Conclusion

The importance of bibliometric analysis lies in the fact that in combination with the narrative review it delivers more powerful methodology in reviewing the given research fields (Van Raan, 1996). With this quantitative, bibliometric co-citation analysis of the BA decision-making research, we highlighted the dominating studies in the field and defined eleven clusters of knowledge within four development intervals.

The density of intellectual collaboration resulted in several important conclusions. First, the field of the BA decision-making research in early phases of research built upon the first possible comparator – venture capital investors. Even if the decision-making processes have the same goal, there are significant differences between those two types of investors. Mainly the differences rely on more heuristic-driven decision making in the BA market, and more formalised investments in the venture capital market. Early research in the BA decision-making field made a clear distinction between those two types of investors and enhanced the research in more personally-oriented decision-making processes. Secondly, the early domination of research in BA specifics (characteristics, background, investment patterns) enhanced the organic growth of knowledge in the field. Thirdly, in the BA decision-making process, the psychological characteristics of BA presented dyads between entrepreneurship and social-psychology where we increased the pool of available theoretical background for future research.

Based on our analysis, we see research grounds in three epistemological areas: entrepreneurship, finance, and psychology. Scholars compare BAs with venture capitalists in decision making, or they indirectly conclude they are similar to entrepreneurs when observing entrepreneurs, or they focus on financial aspects of deal-making structure; or, lastly, they push the research heavily in BA decision making to the psychology field by looking at the soft personality-based criteria when making decisions about investments. This research interdisciplinarity creates research sustainability in the BA decision-making research.

Somewhat surprisingly, our analysis showed that several impactful studies tighten the domain knowledge belt. However, this is not problematic, since the field exponentially evolves. What is problematic is the fact that the evolution of field knowledge went and still goes through the same pool of researchers. Here we have a major question that might serve as a ground for some future study as well: Is it complicated to get involved in BA research, or – what makes research to be favourable by other researchers? In our study, we excluded most data in the bibliometric network from the knowledge base, due to a low number of citations (and accordingly co-citations). From the analysis, we saw that several authors in the field continuously framed research clusters in our study. This is a bit of a concern, as it seems that the research field of BA decision making is rather homogeneous, and quite biased – framed around the same researchers with the same base of documents that constantly circle through intervals.

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