



Mapping Crowdfunding Research on the Web of Science Database: A Bibliometric Analysis Approach

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Crowdfunding research continues to evolve, particularly in entrepreneurship area. Scholars in various disciplines have shown an increased interest in this new financial technology, making crowdfunding a multidisciplinary concern. As crowdfunding research develops, researchers have systemically reviewed this topic. The purpose of this paper is to conduct a bibliometric analysis of the patterns and trends of crowdfunding research. This study examines the pattern of crowdfunding-related publications regarding citations, co-citations, and co-word analysis using sample data of 2956 articles (487 articles were specific to crowdfunding) published between the years 2008 to 2018. The study results suggest that crowdfunding publications are dominantly from the business and management fields. Findings from co-word analysis reveal that crowdfunding research is evolving within its field with little connections to the broader concept of crowdsourcing. The results also support previous claims by scholars that most of the publications on crowdfunding focus on success. Implications and future research directions are posed.

Key words: *Crowdsourcing, crowdfunding, bibliometric analysis, co-citation analysis, co-word analysis, literature review.*



Introduction

Crowdfunding is a new form of soliciting funds from a group of people, in which participant supporters provide small contributions, usually through an online-based internet platform, to support a particular goal (Ahlers, Cumming, Günther, & Schweizer, 2015; Belleflamme, Lambert, & Schwienbacher, 2014). Although the term *crowdfunding* only emerged after the internet revolution in the 2000s (Brüntje & Gajda, 2016), it is the extension of the long existed concept of crowdsourcing (Macht & Weatherston, 2015). The key characteristic of this concept is the use of the open call style and the wide undefined network of potential participants or the crowd (Belleflamme et al., 2014)). A new phenomenon, this alternative form of financing has revolutionized the way ventures attain capital (Brüntje & Gajda, 2016; Drover et al., 2016) as recognized by the World Bank (World Bank, 2013). Baumgardner et al. (2017) state that crowdfunding has generated more than \$62 billion into the entrepreneurial finance worldwide. Given the potential of this innovative form of financing and its role in funding entrepreneurship, crowdfunding has become an increasingly important research area of interest (Drover et al., 2016), particularly for startups and small businesses (Mohamad et al., 2015).

Crowdfunding research is currently expanding and is highly dynamic. This may be attributed to the following reasons: (1) the basic concept of crowdfunding which allows any individuals to have access to financing for any particular goal such as raising funds for business, charity or entrepreneurship (e.g., Ahlers et al., 2015; Allison, Davis, Short, & Webb, 2015), social causes (Lehner & Nicholls, 2014), scientific research (del Savio, 2017; Siva, 2014), and educational or academic purposes (Bushong, Cleveland, & Cox, 2018; Colasanti, Frondizi, & Meneguzzo, 2018); and (2) the growth and fast expanding market of the crowdfunding industry (Barbi & Bigelli, 2017; Baumgardner et al., 2017) due to many countries introducing new or relaxed existing legislative barriers that support crowdfunding industry (Ahlers et al., 2015).

Similar to other fields of research, entrepreneurship scholars reflect on what has been done in the past with crowdfunding and extrapolate this into the future (Chandra, 2018). The majority of the literature reviewed for this study, focused on crowdfunding research in the entrepreneurship domain. Drover et al. (2016) and Uddin, (2017) provide a general review of entrepreneurial finance alternatives which include crowdfunding. In their review, Drover et al. (2016) discuss how crowdfunding can advance both the theory and practice that has been previously applied in venture capital and angel financing. Specific to crowdfunding research, Short, Ketchen, McKenny, Allison, and Ireland (2017) and Kuppuswamy and Bayus (2018) review the current empirical literature on crowdfunding. Both studies concluded that current crowdfunding research mainly focuses on factors affecting people's motivation to provide funding. They further argue that most crowdfunding literature investigates the role of quality signals on crowdfunding success, with only a few studies examining the role of social norms (e.g., reciprocity and social capital behavior). Similarly, Kaartemo (2017) focused his review on the determinants of crowdfunding success by categorizing them into four classifications: campaign-related factors (e.g., pricing, number of reward levels, funding goal, and early contributions received), investor-related factors (e.g., investor's intrinsic and extrinsic motives – monetary vs. non-monetary motive, entrepreneur's trustworthiness, and regulatory focus), crowdfunding platforms-related factors (e.g., platform's design, policies, norms, and the



number of registered members), and entrepreneurship-related factors (e.g., profit- vs. nonprofit oriented, social capital, and gender).

The significance of crowdfunding and lack of review papers on this subject is an identified gap in the understanding of the evolution of crowdfunding research. In this regard, this study aims to explore the overall contribution of crowdfunding across multidisciplinary research areas. Importantly, this study has taken a different approach from that undertaken by previous scholars in reviewing crowdfunding research. Previous review papers stated that early crowdfunding research focused on the determinants of funding success (e.g., see Kaartemo, 2017; Kuppuswamy & Bayus, 2018; Short et al., 2017). These papers provide an overview of the factors that motivate people to support or invest in crowdfunding projects. However, the research strategy adopted by these papers reflects a lack of the understanding of the patterns and trends in crowdfunding research, as well as the scholarly impact of the publications toward the scientific community. Ellegaard and Wallin (2015) and Udeh, (2017) pointed out that a review paper seeks to provide an overview of the literature by critically summarizing selected scientific content from multiple numbers of publications ¹.

In contrast, bibliometric analysis is fundamentally classified as a quantitative method that provides a different analysis of the literature based on the related statistical data (Ellegaard & Wallin, 2015). This is where the bibliometric analysis fills the gap left by traditional review papers by transforming scientific quality into a manageable entity (Wallin, 2005), hence providing systematic knowledge regarding the patterns, trends and the impact of the publications in more appealing visualization approach (Ellegaard & Wallin, 2015; Van Eck & Waltman, 2014). Furthermore, it has been suggested that crowdfunding research is a multidisciplinary phenomenon (Gleasure & Feller, 2016; McKenny, Allison, Ketchen, Short, & Ireland, 2017) and rooted in the broader concept of crowdsourcing (Belleflamme et al., 2014). However, there is no effort has been made to date to explain its multidisciplinary nature and how it evolves from crowdsourcing. Therefore, this paper has employed a bibliometric analysis to answer three questions: 1) How has crowdfunding been published as a topic across various research areas?; 2) How is crowdfunding research connected to the broader concept of crowdsourcing?; and 3) What are the research themes and the latest trend of crowdfunding research based on the most cited topics?

By applying citation analysis, co-citation network, and co-word networks, significant progress of crowdfunding research from 2010 to 2018 is demonstrated. Firstly, our results show that the most cited journals for the topic are the *Journal of Business Venturing*, *Management Science*, and *Entrepreneurship Theory and Practice*. Secondly, the co-citation network of journals that have published crowdfunding articles reveals four major research clusters, which include entrepreneurship, economics, marketing, and management. This study also observed that crowdfunding research evolved within its own sphere irrelative of the trend in crowdsourcing research. It was also noted that the trend of publications in crowdfunding research focuses on success across the two forms of crowdfunding, namely the reward and peer-to-peer lending model.

¹ Any selected scientific content is normally cluttered within the literature and this is where a review paper helps the readers, mostly researchers, to understand such content.

Furthermore, most of the success-centric publications demonstrate higher citations than others. Finally, it was found that early crowdfunding literature started from the study of success factors in the peer-to-peer lending environment before expanding to reward and equity crowdfunding with more recent publications from China. It is proposed that this is the first research that has used co-citation and co-word analysis in a bibliometric study to map the progress of crowdfunding research. Previous studies by Kaartemo (2017), Kuppuswamy and Bayus (2018), and Short et al. (2017) apply the systematic review methodology with specific focus only on success factors. While the earlier studies that employed a bibliometric approach, they only used citations count to identify the most influential statistics, for example regarding authors and journals (Blasco-Carreras, Albort-Morant, & Ribeiro-Navarrete, 2015; Martínez-Climent, Zorio-Grima, & Ribeiro-Soriano, 2018). A study by Martínez-Climent et al. (2018), in particular, had a narrower focus on the investment type of crowdfunding.

The rest of the paper is organized as follows. Section 2 provides the background of crowdfunding. Section 3 discusses the methodology and data collection for this investigation. Section 4 and 5 present findings and the discussion of the findings. We then conclude the paper in the last section.

Background

What is crowdfunding?

Defining what crowdfunding is before progressing further into literature is crucial in publishing crowdfunding research (McKenny et al., 2017). As this is a newly emergent field of research, arriving at a common definition of the phenomenon can be difficult. Mollick (2014) notes that the current academic conceptions of crowdfunding are in a state of evolutionary flux, which limits the finding of its complete definition. A brief review how scholars define crowdfunding follows and then a definition is presented which is most suited application in this paper. This definition is important as it affects how this research was conducted, particularly in selection of the appropriate target sample.

In general, scholars mostly define crowdfunding based on their research focus. Some scholars have concentrated their definition on the breadth or context of crowdfunding. For example, Belleflamme et al. (2014) provide a broader definition of crowdfunding, which entails: a process of getting funding by making an open call for the provision of financial resources to support projects or specific purposes, without including any specific party or context. Contrarily, Mollick (2014) specifically defined crowdfunding in the context of entrepreneurship, as a process of getting funding from individuals to support entrepreneurial business ventures. Ley and Weaven (2011) also propose a definition within the venture capital context and specifically focus on crowdfunding as a source of equity financing for startups. Mollick (2014) argues that defining crowdfunding in a more general context is elusive as crowdfunding covers a diverse range of usage and has been researched in many disciplines, currently and possibly into the future. Furthermore, Sannajust, Roux, and Chaibi (2014) suggest that a narrower definition is preferable if academics are to focus on examining crowdfunding as a remarkable phenomenon in entrepreneurial finance.

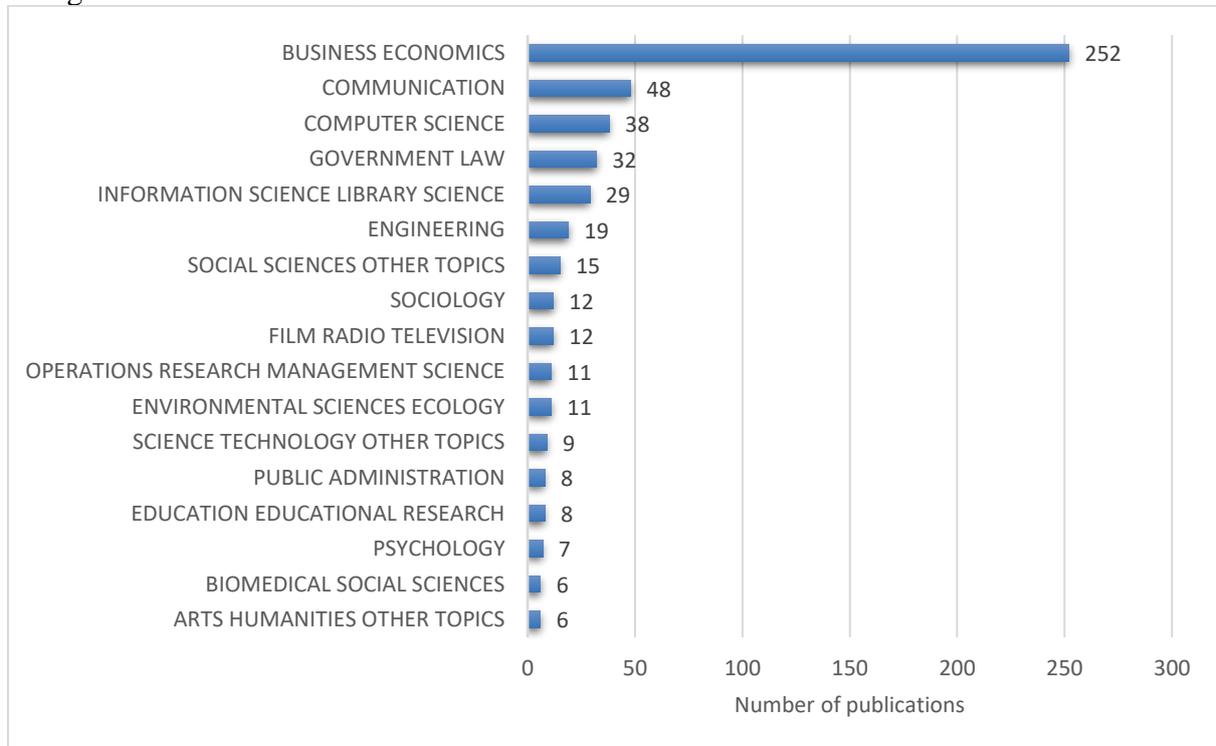


The current development of crowdfunding also plays an important role in shaping its definition. For example, Belleflamme, Omrani, and Peitz (2015) have revised their definition from Belleflamme et al. (2014) due to the recent development of crowdfunding activities where the projects' creators (either on reward or equity-based platforms) combine both forms of financial resources (donation and some form of future rewards) in their crowdfunding campaigns. Belleflamme et al. (2015) also included voting rights in the definition to reflect the equity-based crowdfunding model. Given these different definitional perspectives, which focus on diverse topics across disciplines, the difficulty of devising a broad definition of crowdfunding to suit everyone is noted (Mollick, 2014). However, based on the various definitions used by researchers, it is observed that the basic idea of the crowdfunding concept focuses on the process or mechanism of obtaining external financial resources from the public either through an indirect (crowdfunding platforms) or direct (e.g., using own blog or Facebook page) Internet intermediary, where individuals can support others by contributing their money in exchange for some form or combination of rewards. We believe that the definition provided by Belleflamme et al. (2015) is inclusive in its representation of the current crowdfunding phenomenon that is applicable across all the funding models and forms of crowdfunding and hence has been adopted for this study. This is an important preliminary procedure to justify the later data collection process.

Systematic Review of Crowdfunding Research

Crowdfunding is a relatively new topic of research which has received much attention among scholars, particularly in the entrepreneurship field. A study by Schwienbacher and Larralde (2010) is believed to be the first empirical crowdfunding research. Since then, crowdfunding research has evolved not only in the entrepreneurship literature (for a review, see Short et al., 2017) but across many other disciplines such as computer science, communication, law, engineering, sociology, biomedical, social sciences, and educational research (see Figure 1). Figure 1 presents the top seventeen research categories on the Web of Science database that had published crowdfunding-related topic. As shown in Figure 1, the highest number of publications was in the *business economics* research category (252 publications), followed by *communication* (48 publications), *computer science* (38 publications), and *government law* (32 publications). A possible explanation as to why publications were high in these categories is because they are directly related to crowdfunding. For example, crowdfunding is considered a new form of entrepreneurial finance (business economics research): it involves the communication process between the entrepreneurs and investors when the campaign is launched (communication research); it involves the design of the crowdfunding platform (computer science research) and it concerns the process of reviewing the existing and formulating new regulations (government law category).

Figure 1. Number of Articles Published in Scientific Journals based on the 17 Top Research Categories on the Web of Science Core Collection database



(source: <https://webofknowledge.com>, accessed on 31st March 2018)

The literature continues to expand and while early crowdfunding research emphasized its potential as an alternative source of financing (e.g., Gobble, 2012; Ley & Weaven, 2011; Schwienbacher & Larralde, 2012), more recently the emphasis is on explaining how crowdsurfing should operate within existing or new regulatory development of different countries (e.g., Armour & Enriques, 2018; Ibrahim, 2015; Moore, 2017). Further, the emphasis is on exploring risk-related issues in crowdfunding (e.g., Käfer, 2017; Schwienbacher, 2017) and investigating various factors associated with investors' funding intention and crowdfunding campaign success (e.g., for a review, see Kaartemo, 2017; Short et al., 2017).

Although the current crowdfunding research development shows a diversity of research areas, the focus of early research on crowdfunding was mainly about identifying the determinants of crowdfunding success (Kuppuswamy & Bayus, 2018; Short et al., 2017). Many studies have been conducted on factors that contribute to crowdfunding success such as entrepreneurs' social capital (e.g., Buttice, Colombo, & Wright, 2017; Colombo, Franzoni, & Rossi-Lamastra, 2015; Giudici, Guerini, & Rossi-Lamastra, 2018), informational cues and signaling mechanisms (e.g., Ahlers et al., 2015; Allison et al., 2015; Allison, Davis, Webb, & Short, 2017; Jörn Block, Hornuf, & Moritz, 2018; Ciuchta, Letwin, Stevenson, & McMahon, 2016; Courtney, Dutta, & Li, 2017; Zhou, Lu, Fan, & Wang, 2018), trust management (e.g., Kang, Gao, Wang, & Zheng, 2016; Zheng, Hung, Qi, & Xu, 2016), cultural and geographic effects (e.g., Burtch, Ghose, & Wattal, 2014; Guenther, Johan, & Schweizer, 2018; Mollick, 2014) and gender effects (Mohammadi & Shafi, 2018). Findings of these studies provide an avenue for further research, particularly in the review of crowdfunding success.



Due to the higher number of publications that have focused on success, scholars are limited to focusing on the systematic review of crowdfunding literature that is specific to this topic. For example, Kaartemo's (2017) systematic review is perhaps the current most complete review of the determinants of crowdfunding success. He categorized the success factors into four categories: factors related to the campaign (e.g., funding goal and pricing); investor related factors (e.g., herding behavior and motives), entrepreneur related factors (e.g., experience and size of social capital, and crowdfunding platforms related factors (e.g., platform's design and the number of potential investors or registered members). In a special issue on the crowdfunding phenomenon published by the Journal of *Entrepreneurship Theory and Practice*, Short et al. (2017) past crowdfunding research in the leading entrepreneurship and management journals² was reviewed confirming that the early crowdfunding research was all about its success. Similarly, a most recent review by Kuppuswamy and Bayus (2018) also emphasizes the success factors. In summary, most of the authors of previous empirical research studies in this field note that there was a focus in crowdfunding literature on success.

Methodology

Bibliometric analysis

This study focuses on reviewing the past research on crowdfunding using a bibliometric analysis. Bibliometric analysis has been developed to review the present and past activities of scientific work by quantitatively analyzing citation information (Leung, Sun, & Bai, 2017; Schildt, Zahra, & Sillanpaa, 2006). This type analysis is not new as the early work can be traced back to more than fifty years ago (Perianes-Rodriguez, Waltman, & Van Eck, 2016). The reason for using bibliometric analysis was driven by the fact that the combination of the analysis and science mapping techniques could assist in visualizing and gaining a better understanding of the intellectual structure of the crowdfunding field (Leung et al., 2017; Van Eck & Waltman, 2014; Van Nunen, Li, Reniers, & Ponnet, 2017). Through bibliometric analysis we can identify, for example, the prominent authors and publications, dominant journals, countries and institutions and the evolution of publications focusing on a particular topic (An & Wu, 2011; Leung et al., 2017; Van Nunen et al., 2017).

A bibliometric study can be conducted by employing several techniques such as co-authorship analysis, citation-based analysis (e.g., citation, co-citation, and bibliographic coupling analysis) and co-word analysis (Van Eck & Waltman, 2014). In this study, a combination of co-citation and co-word analysis was employed. As suggested by Leung et al. (2017) using the combination of different techniques in bibliometric analysis can help to reveal more information and insights on crowdfunding research. In using a co-citation analysis, we attempt to measure the relationship between two publications (Ferreira, Fernandes, Peres-Ortiz, & Alves, 2017) which is based on the frequency with which they have been cited together in other

² The leading entrepreneurship and management journals include Academy of Management Review, Academy of Management Journal, Administrative Science Quarterly, Journal of Applied Psychology, Journal of Management, Journal of Management Studies, Journal of Organizational Behavior, Management Science, Organization Science, Organization Studies, Organizational Behavior and Human Decision Processes, Personnel Psychology, Strategic Management Journal, Entrepreneurship Theory and Practice, Journal of Business Venturing, and Strategic Entrepreneurship Journal.



articles. Simply put, the two articles that are cited together in another article are assumed to be co-cited (Small, 1973) and are hence deemed closely or completely related on the topic area (Schildt et al., 2006).

As for the application of co-word analysis technique, this research exploits both the bibliometric and text mining procedure to explore the analytical meaning of crowdfunding research (An & Wu, 2011) by measuring and mapping the strength of interactions between keywords in the sample data (Callon, Courtial, & Laville, 1991; Leung et al., 2017). The underlying methodological reason for co-word analysis is the idea that when keywords co-occur, they may describe the contents of the documents (Callon et al., 1991). Finally, using co-word analysis technique also helps to describe the network of interactions and trend of a research discipline (Leung et al., 2017).

Data collection and analysis

This study utilizes bibliometric data from the Web of Science (WoS) Core Collection database provided by Clarivate Analytics. The data was downloaded in April 2018, and therefore all available data since the emergence of the crowdfunding phenomenon, up until the first quarter of 2018, were included in the initial sample. Before proceeding to data preparation and analysis, several sampling procedures were performed. Firstly, it should be noted that there is an understanding among scholars that crowdfunding evolved from the concept of crowdsourcing. Therefore, the structure and trend of crowdfunding research both in the specific context of crowdfunding (e.g., fundraising related activities) as well as its broader context was explored. To realize this, two datasets were utilized in this analysis. The first dataset includes keywords related to the crowdfunding concept only (e.g., see Belleflamme et al., 2015) while the second dataset will include an additional keyword of “crowdsourcing”.

The next procedure was to download the datasets. In order to find related publications for the first dataset or Dataset 1 (broad concept of crowdsourcing), the WoS’s search strings, searching specific boundaries for keywords “crowdsourcing”, “crowdfunding”, “crowd-funding”, “crowd funding”, “online funding”, “online lending”, “peer-to-peer lending”, and “p2p lending” were used. A similar process was adopted for the second dataset (Dataset 2) that covered research specific to crowdfunding, with the exclusion of “crowdsourcing” as a keyword. To ensure that the search of keywords best represented crowdfunding research, all of the identified keywords were based on an understanding of the definition provided by Belleflamme et al. (2015).

The next process involved screening the publications. Firstly only journal articles were screened. This procedure is commonly used in the review of any research fields (e.g., Chandra, 2018; Drover et al., 2016; Short et al., 2017). Moreover, Saunders, Lewis, and Thornhill (2016) suggest that journal articles are concerned with producing theoretical contribution and highly specialized, generally focusing only on a particular area of research. Secondly, we included only English language articles for easier data analysis and interpretation of results. Thirdly, to reflect the multidisciplinary nature of crowdfunding research, we did not restrict the search results to publications only from the business, management, and social science category even though crowdfunding is closely related to these areas of research (Gleasure & Feller, 2016;

McKenny et al., 2017). Additionally, the larger sample size is preferable as it can produce more information and precise statistical estimates in a bibliometric study (Williams & Bornmann, 2016). These procedures found 2,956 (Dataset 1) and 487 (Dataset 2) publications from the period of 2008 to 2018 available for analysis.

Before data analysis, we performed several data cleaning processes similar to Leung et al. (2017) to remove any coding errors and standardize the data. For example, some authors who have more than one form of their names (e.g., “Cumming, D.” and “Cumming, D.J.” are the same person) were corrected. Similarly, some journals that had more than one abbreviation were also corrected (e.g., “J Bus Venturing” and “J Business Venturing” is the same journal’s abbreviation for the “Journal of Business Venturing”). Another concern entailed the list of keywords supplied by the authors. The authors may have used different keywords to describe the same idea in their research. For example, some authors use “peer-to-peer lending” while others are comfortable with using “p2p lending”.

The data analysis for this study used three steps. Firstly, we present the descriptive statistics of citation analysis results on our dataset. Secondly, the co-citation networks for crowdfunding research were mapped to visualize how crowdfunding has been studied in various research areas. Next, the co-word networks to identify the major topics, structure, and trends in crowdfunding research were presented. In co-word analysis, the analysis initiated by examining the broader structure of crowdsourcing to see how it is related to crowdfunding research. Next an analysis specific to crowdfunding research was made. The BibExcel for data cleaning and VOSviewer for data analysis was utilized. VOSviewer is a program developed by Van Eck and Waltman (2010) that focuses on the bibliometric analysis of scientific publications and all the statistical and normalization measurements used in the program are discussed in detail therein.

Descriptive statistics

Table 1 presents the 12 top-cited journals in crowdfunding research. Overall, from a total citations of 3,300, crowdfunding research has generated publication of 1,671 different articles. The total number of citations generated by the top 12 journals is 1,496, which covers more than 45% of total citations (3,300) from 317 journals. The most cited journal in crowdfunding research was *Journal of Business Venturing*, followed by *Management Science* and *Entrepreneurship Theory and Practice*. These are the top journals perceived by scholars that focus on entrepreneurship (Carragher & Paridon, 2009) and among the top 5 in the Google Scholar Top Publication category of “Entrepreneurship & Innovation”.

Table 1: Most cited journals in crowdfunding research

Journal	Number of articles	Citations
Journal of Business Venturing	6	572
Management Science	10	289
Entrepreneurship Theory and Practice	9	250
Electronic Commerce Research and Applications	11	98
New Media and Society	12	90
Business Horizons	5	46



California Management Review	6	40
Small Business Economics	9	33
Journal of Business Research	5	29
Venture Capital	8	21
PLOS One	5	18
Strategic Change	7	10
Total	93	1,496

It should be noted that the citation results from these journals may contain self-citation bias where authors were mostly citing each other within the same field of research (Leung et al., 2017) but it is unnecessary to correct the bias when performing citation analysis (Benckendorff & Zehrer, 2013). For the Journal of Business Venturing, the most cited publications were from Mollick (2014) and Belleflamme et al. (2014), while for the Management Science Journal, they were from were from J. Zhang and Liu (2012) and Lin, Prabhala, and Viswanathan (2013). As for Entrepreneurship Theory and Practice, the most cited publications were from Ahlers et al. (2015) and Colombo et al. (2015).

Co-citation analysis

In order to visualize the co-citation network of sources, Van Eck and Waltman's (2014) steps were followed with some adjustments made to accommodate the research objective and dataset. We utilized the “fractional counting” normalization method in our analysis because each reference in a publication should be treated as equally representative (Perianes-Rodriguez et al., 2016). Since it is not possible to include all the journals and citations information in bibliometric analysis (Schildt et al., 2006), only sources that received 20 or more citations were included. There are 128 different sources (journals and other literature) that have been cited twenty times or more by the authors (of 487 articles). These sources were clustered using the association strength or proximity index similarity measure (Van Eck & Waltman, 2010). The results of the co-citation network of sources is visualized below (see

Figure 2). The color of the bubble identifies the cluster of the source with which it is associated. The size of the bubble depicts the extent of citations (in terms of numbers) received by a source.



Figure 2, the co-citation network of crowdfunding research can be categorized into four clusters and named according to most representative sources. The first cluster is identified as *entrepreneurship and new business development* (see Table 2). The first cluster is made up of sources that focus on entrepreneurship and new venture creation research, such as the Journal of Business Venturing, Entrepreneurship Theory and Practice, and Venture Capital. These entrepreneurship related sources were observed at the centre of the network. Sources related to financial laws and regulations were also identified as part of the first cluster located at the far right side of the network. The second cluster was labeled as *economics and functional business areas*, where the main focus of the research is about economic problems in functional business areas such as finance and operations. The third cluster was identified as *marketing and information systems* focusing mainly on the marketing management and behavior of consumers. The fourth cluster was labelled *organizational management and strategy* that focuses on management theory, practices, and organizational strategies.

Table 2: Co-citation cluster of research focus



Cluster	Representative Sources / Journals
Entrepreneurship and new business development	Journal of Business Venturing, Entrepreneurship Theory and Practice, Venture Capital, Small Business Economics, and Columbia Business Law Review
Economics and functional business areas	Management Science, American Economic Review, Quarterly Journal of Economics, Journal of Finance, Decision Support System, Expert Systems with Applications, and European Journal of Operational Research
Marketing and information systems	Journal of Marketing Research, Journal of Consumer Research, MIS Quarterly, Information Systems Research
Organizational management and strategy	Academy of Management Review, Academy of Management Journal, Administrative Science Quarterly, Organization Science, Journal of Personality and Social Psychology,

Co-word analysis

The structure of crowdfunding research from the broader concept of crowdsourcing

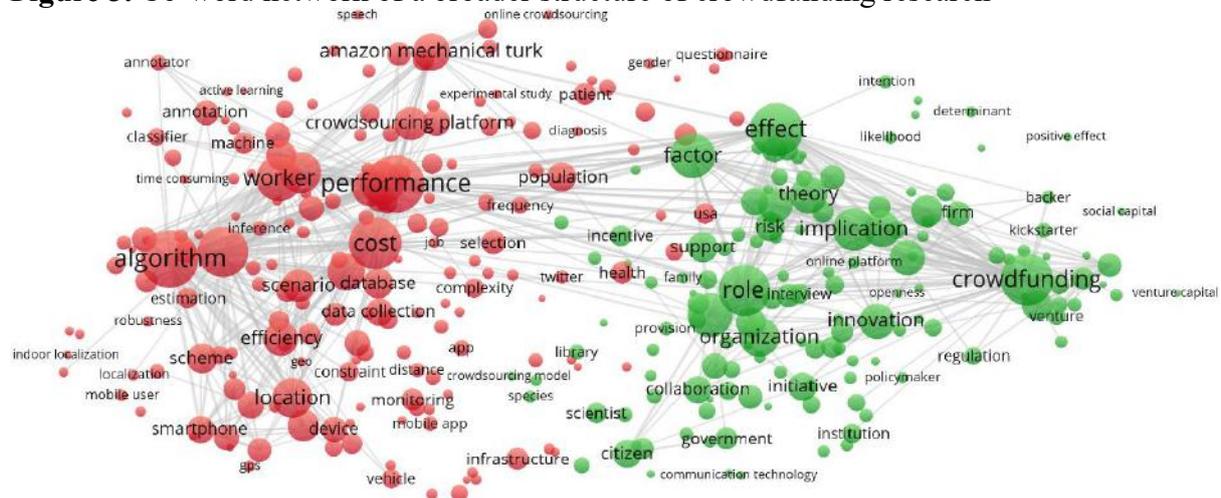
To visualize the network of terms using the co-word network analysis, two fields or types of information from the datasets, which are the title and abstract, are used. To obtain a more comprehensive review of crowdfunding research, two level co-word analysis using separate datasets was conducted. Firstly, a dataset that represents all publications related to crowdsourcing and crowdfunding research were utilized. Next, another dataset that contains publications specific to crowdfunding was used. This strategy enables us to explore the structure and trend of crowdfunding research both in a broader and specific context.

As the research objective is to explore the research themes and trends in crowdfunding literature, two options of co-word network visualizations available in the VOSviewer program are used. First, the default option to view which cluster each term is associated with and second, overlay visualization to observe the trend of crowdfunding research were utilized. To achieve this, the average publication year in the visualization scores option was chosen. Similar to co-citation network analysis, the size of the bubble indicates the number appearances of the term while the thickness of lines and proximity between the bubbles indicates the relationship strength and the colors distinguish clusters (or average normalized number of citations or average publication year when using overlay visualization function).

Figure 3 shows the co-word network of a broader crowdfunding research structure. To produce the network, only terms that occurred at least 20 times were included. As suggested by Van Eck & Waltman, (2014), the binary counting approach to count the number of occurrences was employed. Binary counting means that the number of occurrences of a term in a publication plays no role and by applying this parameter, 643 terms were obtained. The VOSviewer program then calculates the relevant scores of the terms. The program then selects the most relevant terms based on the scores to produce the network. The program default value of 60 percent (or 385 terms) was the parameter in selecting the most relevant terms to be included in the network. To normalize the strength of the links between terms, the association strength technique also known as the probabilistic affinity index (Leydesdorff, 2008), proximity index (Hinze, 1994), and pseudo-cosine (Jones & Furnas, 1987) was used. This technique has been

suggested to be the most appropriate measure for normalizing co-occurrence data (Van Eck & Waltman, 2009) and is preferred for mapping newly emerging topics or fields (Hinze, 1994).

Figure 3. Co-word network of a broader structure of crowdfunding research



In order to see how crowdsourcing is connected to crowdfunding research, we restricted the maximum number of lines to 500. This setup enables us to identify the most relevant links of terms between the clusters. Based on Figure 3, two clusters emerged to represent the structure of crowdfunding research and how it is linked to the broad concept of crowdsourcing. The first cluster (green color), shows how crowdfunding research is structured through the terms “effect”, “factor”, “role”, “implication”, “organization”, “innovation”, “entrepreneur”, “investment”, “success”, and “crowdfunding”. For the red cluster, the cluster is mostly depicting the structure of crowdsourcing research represented by the term “performance”, “cost”, “worker”, “effectiveness”, “amazon mechanical turk”, “algorithm”, “accuracy”, “location”, and “crowdsourcing platform”.

Overall, only a few connections between the two clusters, or specifically between crowdsourcing and crowdfunding research can be found. For example, terms that are the most relevant and highly co-occurred between the cluster were “effect”, “factor”, “implication” and “role” for crowdfunding research cluster while in the crowdsourcing research were the terms “performance” “algorithm”, “worker”, and “cost”. Although these terms were connected between the clusters, they reveal different stories. For example, in crowdfunding research, this new financing technology is touted to play a crucial role in economic and innovation activities (Baumgardner et al., 2017). Scholars have responded to this new phenomenon by starting to identify various factors that contribute to funding success and help entrepreneurs to strategize their online business pitches (e.g., see Mollick, 2014). Regulation is also identified as an important element in crowdfunding. As for crowdsourcing research cluster, crowdsourcing is seen to have a potential role in reducing cost. Therefore, most of the publications focus on proposing models or techniques particularly involving algorithm development to make crowdsourcing more cost-effective and increase its system accuracy (e.g., see Lossio-Ventura et al., 2018; Moayedikia, Ong, Boo, & Yeoh, 2018; Vij & Aggarwal, 2018). Publications in crowdsourcing research also focus on the crowdsourcing activity that is called task outsourcing. This can be observed from the high occurrences of the term “amazon mechanical turk”, one of

Various factors have been found to be associated with success in reward-based crowdfunding such as social capital (e.g., Butticiè et al., 2017; Colombo et al., 2015; Davidson & Poor, 2015; Giudici et al., 2018; Skirnevskiy, Bendig, & Brettel, 2017; Zheng, Li, Wu, & Xu, 2014), projects' perceived risk (e.g., Zhao-Der, Wang, & Chen, 2017), linguistic styles of online business pitching (e.g., Parhankangas & Renko, 2017), narrative styles (e.g., Manning & Bejarano, 2017), and availability of online information (e.g., Bi, Liu, & Usman, 2017). Interestingly, the term “social capital”, “social network” and “social medium” as depicted in

Figure 5 reveal that most scholars focus their attention on the role of social capital on success in reward-based crowdfunding.

For the red cluster, representative terms included “model” (110), “role” (74), “investor” (73), “development” (68), “entrepreneur” (67), and “impact”, (66) had co-occurred respectively. It is of note that this cluster appears to represent publications focusing on equity-based crowdfunding as visualized by the term “equity crowdfunding”, “investor”, “investment”, “framework”, and “regulation”. These representative terms also indicate that publications surrounding equity-based crowdfunding have focused more on the development and exploration of the equity model as an alternative to entrepreneurial finance. For example, Joern Block, Colombo, Cumming, and Vismara (2018) provide an overview of the emergence of crowdfunding as one of the new players in entrepreneurial finance which may be able to help close the financing gap faced by new ventures. Crowdfunding also has been touted to have many advantages over traditional financing such as easy access to funding, provision of marketing and sales platforms and to attract other entrepreneurial funding alternatives (Belleflamme et al., 2015). However, besides its potentiality to close the funding gap, the regulatory aspect was suggested as one of the critical issues for crowdfunding market (Borello, Crescenzo, & Pichler, 2015).

Since regulation is crucial in crowdfunding, scholars have published several articles to discuss the issue. For example, Armour and Enriques (2018) consider how crowdfunding should be governed and propose that the crowdfunding regulation model should correspond to both consumer protection and securities market legislation. They suggested that the regulatory scrutiny for equity crowdfunding should be more comprehensive than reward crowdfunding. They also cautioned that inappropriate mandatory rules such as the disclosure requirement might disrupt crowdfunding market and growth. This was confirmed empirically by Hornuf and Schwienbacher (2017) who showed that maximizing investor protection law may deter new ventures and small firm participation in crowdfunding activity and hence negatively affect the overall crowdfunding market.

For the blue cluster, the most co-occurred terms were “market” (106 times), “evidence” (80 times), “peer” (70 times), “borrower” (68 times), “information” (67 times), and “mechanism” (62 times). In this cluster, the term “borrower”, “p2p”, “lending”, “peer”, and “loan” suggest that most of the publications within the cluster were related to peer-to-peer lending. As with the green cluster, terms such as “lender”, “behavior”, “decision”, “probability”, and “likelihood” indicate that publications related to peer-to-peer lending were also focused more on investigating the behavior of lenders, particularly on the factors that influence lending decisions (e.g., Allison et al., 2015; Lin et al., 2013; Lin & Viswanathan, 2016; J. Zhang & Liu,

“contribution” and “social capital” in the reward-based cluster. For the equity-based crowdfunding research cluster, the term “investor”, which was also connected to the term “decision” in the peer-to-peer lending cluster, was highly cited. These patterns show that publications focusing success influencing factors received the most attention in the scholarly community of crowdfunding research.

Figure 7. Co-word network visualized by the average publication year

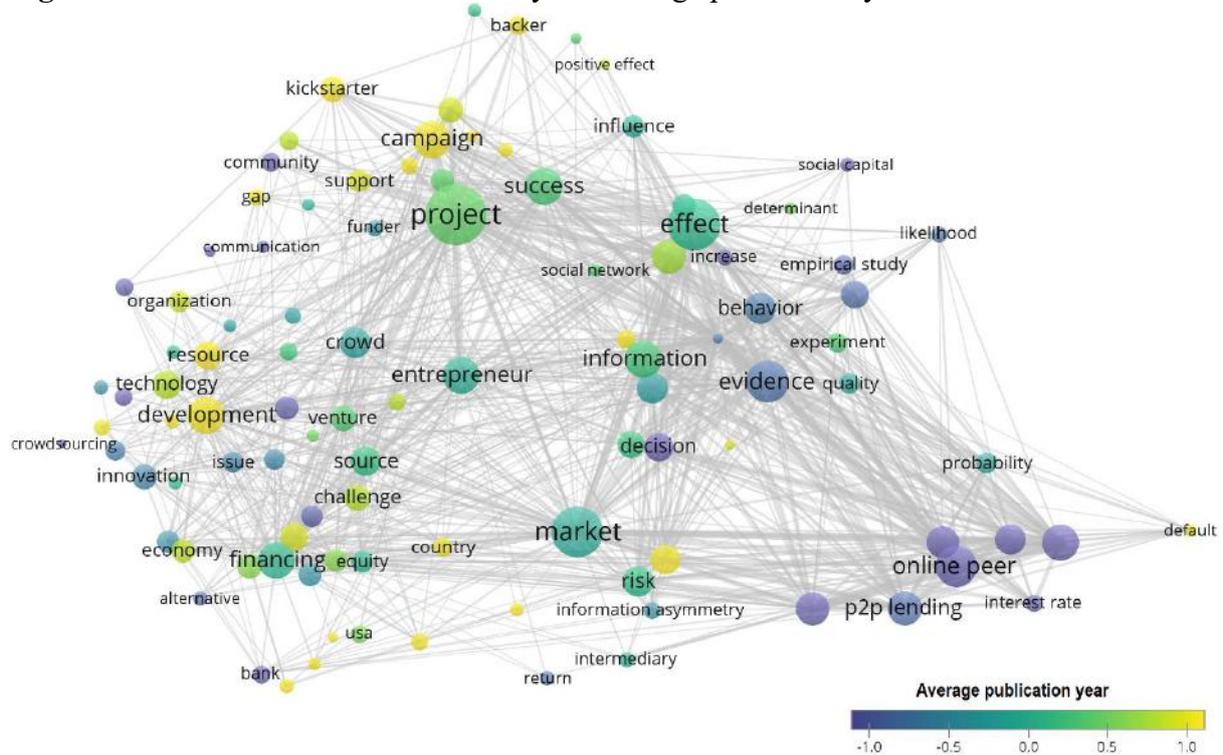


Figure 7 illustrates further the co-word analysis of crowdfunding research, but with added information regarding time to see the trend of the publications. The color of a term identifies the term’s average publication year. Terms that are used more in 2017 and onwards are visualized in yellow, while terms that are used more in 2015 are visualized in blue. Including this time information in the network, reveals that most of the early publications in crowdfunding research are focused on the peer-to-peer lending technology as represented by the term “borrower”, “peer”, “loan”, “lending”, and “p2p”. Research on peer-to-peer lending also started to focus on borrower’s decision-making and behavior in the early period as shown by the terms “decision”, “evidence” and “behavior”. Furthermore, we can determine that scholars have investigated the role of social capital on crowdfunding success since the year 2015.

As crowdfunding research evolved, more publications started to describe the role and potential risks in crowdfunding within an entrepreneurial financing framework particularly within the equity-based and peer-to-peer lending environment (corresponding terms: role, risk, information asymmetry, regulation, and framework, which are closer to the equity and peer-to-peer lending cluster). The more recent term “default” occurred particularly in peer-to-peer lending which suggests that crowdfunding research has been evolving to respond to publications questioning the potential risk in crowdfunding as well as the recent changes in



crowdfunding policy worldwide. Furthermore, more recent publications have also started to investigate the effect of information disclosure on success (Ahlers et al., 2015; Bi et al., 2017). Over time the research has begun to explore further determinants of crowdfunding success (corresponding terms: success, impact, factor, quality, social network, and motivation). The network also shows that two countries were mentioned in the data relatively more frequently than others, namely the US and China. This pattern provides insight into the origin and availability of the sample selected for the study. In the case of the US, one explanation for this pattern is that several pioneering and established crowdfunding platforms originated from the US such as Kickstarter, Indiegogo, Prosper and Wefunder. Interestingly, China's crowdfunding industry is comparatively new as opposed to the United States (based on the color for each term), however it has quickly made an impact in the scientific community. A possible explanation for this is that some of the Chinese crowdfunding platforms were operated by e-commerce giants such as Taobao (Alibaba Group) and JD (Jingdong). Y. Zhang and Z. Chen (2018) who state that the massive entry of business giants is one of the factors that contributes to the growth of China's crowdfunding industry.

In order to further explore the patterns and trends of publications, the location profile of authors in the analysis was included.

Table 3 presents the main countries or the location of authors that published articles on the topic of crowdfunding. The United States is the leading country that published the highest number of articles in crowdfunding research (178), followed by China (108), England (41), and Germany (37) respectively. An intriguing result reported in Table 4 is that Chinese researchers seem to have embraced the phenomenon more quickly than others, even though the Chinese crowdfunding industry is still new as compared to other countries (e.g., US and UK). This pattern is in line with the growth of the industry in China, where the number of registered crowdfunding platforms in China had an unprecedented one-year growth rate of nearly 50 percent, from 283 platforms in 2015 to 415 platforms in 2016 (Z. Chen, Wang, & Yuan, 2018). The industry is also projected to continue to grow because of the new supportive but stricter government policies and the positive impacts of business giants entering the industry (Y. Zhang & Z. Chen, 2018).

Table 3: Countries with the highest number of publications

Country	Number of Publications
USA	178
People Republic of China	108
England	41
Germany	37
Canada	31
Italy	24
Australia	20
France	17
Spain	14
Belgium	11
Netherlands	10

In order to see the time trend of publishing countries,

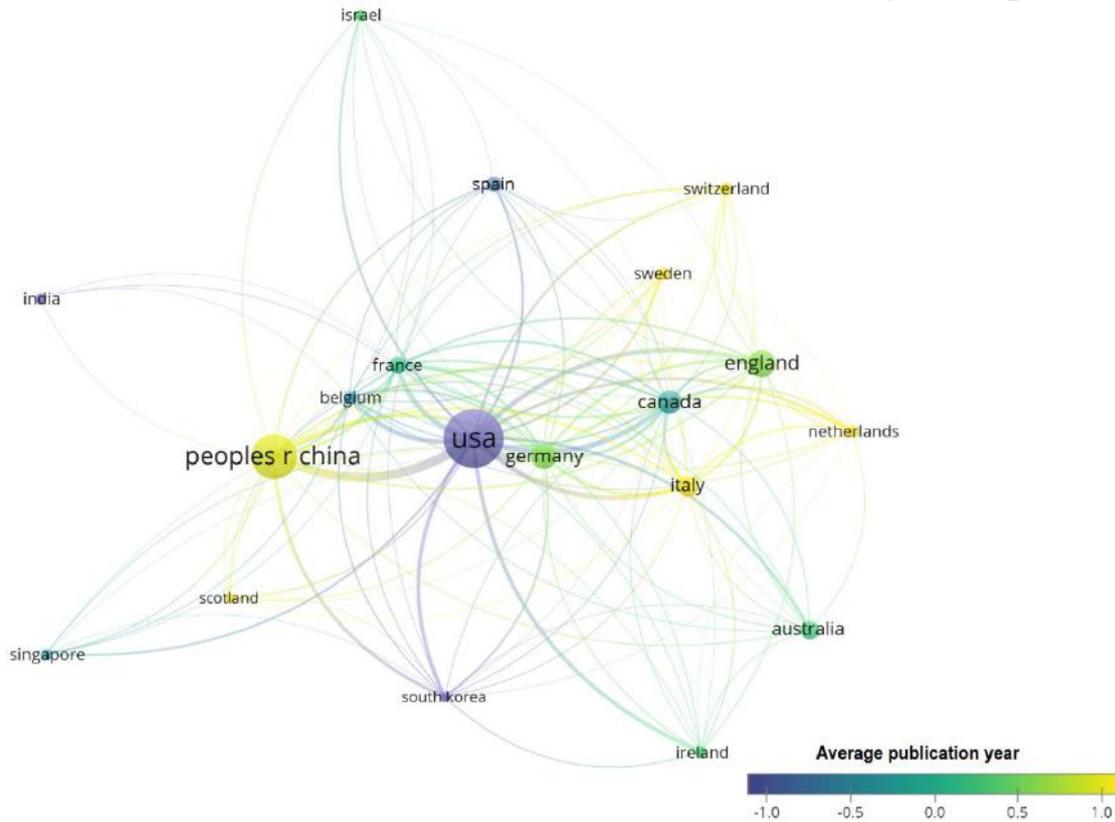
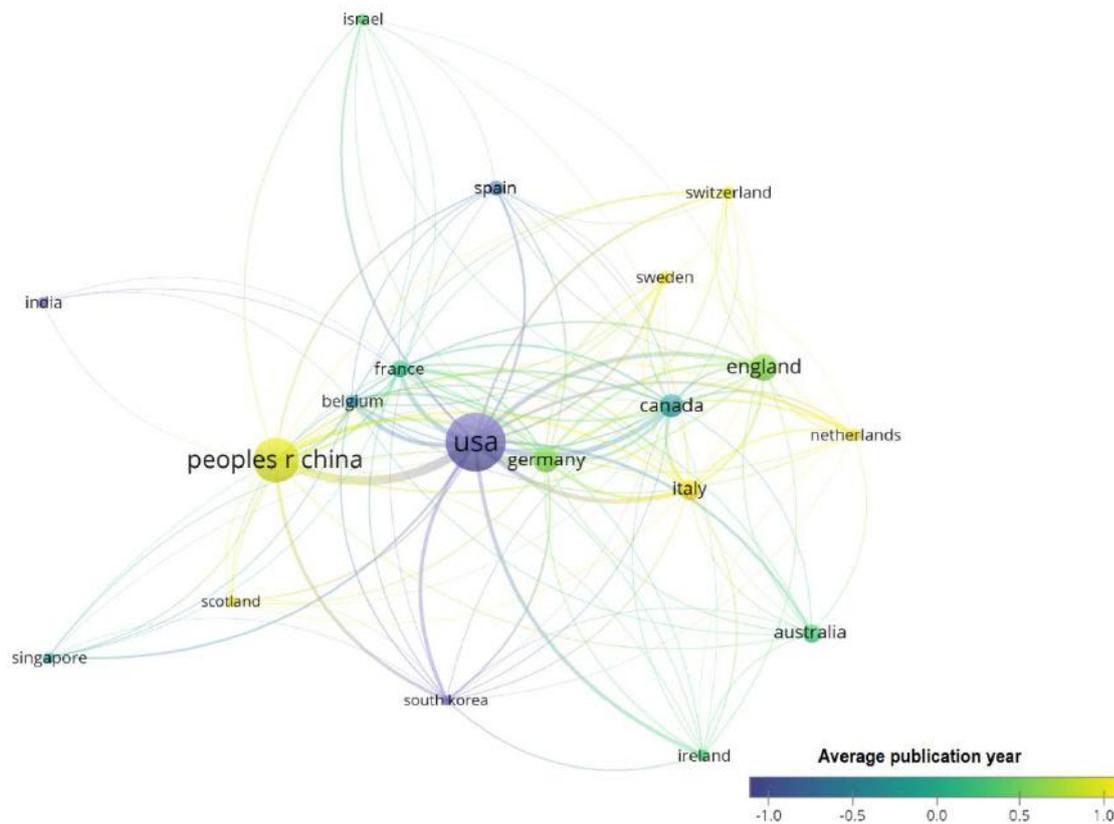


Figure 8 further illustrates the network of countries that have published crowdfunding research. The size of the bubble represents the average number of publications by the country (based on the author’s location) and the colors indicate the year of publications for each country. Based on the network, most of the early publications or authors originated from the United States, followed by India, South Korea, Spain, and Belgium. This result indicates that early publications focused on the US based crowdfunding platforms. The later trend suggests that more publications started to emerge from China, Japan and a few European (Jones & Furnas, 1987) countries such as Italy, Sweden, Netherlands, and Scotland. The expansion trend in other countries indicates that crowdfunding research is still evolving and continues to receive an increasing trend of academic attention globally.

Figure 8. Citation network of countries publishing crowdfunding research



Discussion

Bibliometric analysis provides an interesting and different approach in reviewing the current structure and trend of past research. This paper has reviewed crowdfunding research in a broader perspective, by including all the related publications that have investigated the crowdfunding phenomenon. In this sense, a bibliometric analysis approach allows presentation of how crowdfunding research has progressed from 2010 until 2018. By utilizing citation analysis and co-citation networks, we include the analyses of the sources and co-occurrence of terms with the citation and time information, this paper contributes further to the existing crowdfunding literature.

Citation analysis results showed that the most cited sources or scientific journals in crowdfunding research are the journals of *Business Venturing*, *Management Science*, and *Entrepreneurship Theory and Practice*. Publications that received the highest citations in these journals were identified as papers that provided the basic understanding of crowdfunding such as its definition, funding mechanism and early works on the determinants of success, particularly on project quality and signaling effects (e.g., Ahlers et al., 2015; Colombo et al., 2015; Lin et al., 2013; Mollick, 2014; J. Zhang & Liu).

To answer the first research question, co-citation network analysis was used to present how crowdfunding has been accepted and published by various sources or scientific journals. This study revealed that there are four major clusters of sources that have published articles on the topic of crowdfunding and co-cited together: 1) fundamental of entrepreneurship and new



business development; 2) application of economic theories, problems, and mathematical model in functional business areas; 3) marketing and the understanding of consumer's behavior; and 4) organizational management. These journals mostly published articles that present empirical analysis of crowdfunding phenomenon within the research areas covered by the journals. However, it should be noted that some sources outside the four clusters have published crowdfunding topics particularly on the potential of crowdfunding as alternative financing. Crowdfunding is considered to be able to support other initiatives not focusing on entrepreneurship purposes such as education (e.g., Antonenko, Lee, & Kleinheksel, 2014; Colasanti et al., 2018), health (e.g., Kaplan, 2013; Renwick & Mossialos, 2017), and cultural and social development (e.g., Bernardino & Santos, 2018; Simeoni & Crescenzo, 2018).

The second and third research questions have been answered by using the co-citation networks of terms used by scholars in their articles, particularly in the title and abstract field. Some interesting results emerge from this analysis. By using a dataset that includes a broader concept of crowdsourcing, it was found that crowdfunding research evolved in its own sphere with little connection observed between the crowdfunding and crowdsourcing research clusters. The main goal of participation in a crowdfunding project for entrepreneurs (or funders) is to receive funding (or rewards), while for crowdsourcing it is about individuals or organizations outsourcing their task or projects to crowds or Internet users, which is often compensated with monetary reward for the job done. This research revealed that only one study by Allison et al. (2017) attempted to link the crowdsourcing and crowdfunding phenomenon, by utilizing a sample drawn from a crowdsourcing platform, Amazon Mechanical Turk. Through an experimental-based approach, they attempted to understand persuasion in the reward-based crowdfunding environment.

It is observed that crowdfunding research can be categorized based on the funding model: the reward model, equity model, and debt or peer-to-peer lending model. It is also observed that most of the articles in the reward and peer-to-peer model focused on the determinant of crowdfunding success. This provides support on the argument of entrepreneurship scholars that the focus of crowdfunding research is mostly on success factors (Kartemo, 2017; Kuppuswamy & Bayus, 2018; Short et al., 2017). As for the equity model, most of the articles discuss investors' protection and review of equity crowdfunding regarding the regulatory aspects, acceptance of the technology, and challenges. However, it should be noted that some articles on equity crowdfunding have also investigated the success factors (e.g., Ahlers et al., 2015; Jörn Block et al., 2018; Lukkarinen, Teich, Wallenius, & Wallenius, 2016). The main reason why the studies on success drivers in equity crowdfunding are new and rate behind the other two models is possibly that of data limitation. Equity crowdfunding is still in its infancy stage and is highly regulated with only a few platforms currently active across the world. The number of projects or campaigns on these platforms is also much less than those on the reward and peer-to-peer platforms.

Furthermore, the information on these projects is not publicly available except for registered members. Moreover, entrepreneurs have the discretion to disclose strategic information (e.g., complete business plan) and interested investors are often required to ask for the entrepreneurs' approval in order to receive the information. These issues posed a great challenge to access and produce measurable results from sample data of equity-based platforms (Ahlers et al., 2015;



Jörn Block et al., 2018; Dorff, 2014). However, since the recognition and policy recommendations made by the World Bank (2013) in improving the economy, more countries continue to introduce and amend the regulatory framework to facilitate equity-based crowdfunding. It may be that future publications will focus more on these policy changes and their impact on business. More research opportunity will be at hand after the industry reaches its maturity and the need to evaluate crowdfunding impact become even more apparent.

Secondly, measurable evidence that the most cited articles were those that focused on success factors has been provided. The results show that articles which investigated how the quality of the projects as well as the behavior of entrepreneurs and investors influence campaign success, received high citation counts in crowdfunding research. This evidence also further supports the claim that crowdfunding research mostly focuses on crowdfunding success and is highly referenced by the academic community.

Thirdly, the results indicate that the trend of crowdfunding research started with peer-to-peer lending articles before progressing to reward and equity crowdfunding. Interestingly, articles on peer-to-peer lending were the premise of the research landscape on crowdfunding success before it was extended and applied to the reward and equity crowdfunding. Results also reveal a significant growth in the number of recently published articles which use crowdfunding platforms, those originating from China being an example. Other countries that have contributed to the topic recently are those from the Europe and Scandinavia for example Italy, Scotland, Sweden and the Netherlands. The time trend of publications suggests that as more countries start to ease the regulatory environment for crowdfunding (Hornuf & Schwienbacher, 2017) and the possibility of crowdfunding challenges existing traditional financing (Drover et al., 2016), crowdfunding research will continue to evolve.

Conclusion

In conclusion, through bibliometric analysis, which studied the acceptance of crowdfunding as a research topic and the trend of crowdfunding research, a different review of crowdfunding research was provided. Further these findings support that crowdfunding research is still in the infancy stage, particularly for equity crowdfunding and most of the publications were focused on the determinants of crowdfunding success. It is expected that research surrounding crowdfunding success will continue to evolve as more data becomes available and this will be crucial knowledge for crowdfunding sustainability.

Future research can proceed from this study in a number of ways. Future works can review crowdfunding research by using other techniques or programs through bibliometric analysis. Techniques such as bibliographic coupling and co-authorship could provide different perspectives and interesting results. Also this study uses data solely from the WoS database. Although this is a common database used in bibliometric analysis because of data quality – i.e., in terms of journal classification system (Q. Wang & Waltman, 2016), including other databases for comparison could enrich and provide new insights on the topic. For example, studies have shown that other databases such as Scopus and Google Scholar could provide more bibliographical information than the WoS (Kulkarni & Yuan, 2014; Norris & Oppenheim, 2007), which is useful to help researchers to make more accurate observations



(Meho & Yang, 2007). Resulting future bibliometric analysis findings would value add to the current knowledge of crowdfunding research and predict its future.

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