

Understanding Open Innovation in Large Firms: A Co-citation Bibliometric Analysis

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Abstract

The open innovation has received increased attention from the academic and practitioner community as a result of more collaborative approaches to innovation together with rapid advances in the application of internet technologies in support of innovation activities. There have been significant developments in this field since 2003 first time Chesbrough coined open innovation term and so the aim of this paper is to review the extant research to explore open innovation in large firm and map the current knowledge. The review has been conducted using co-citation analysis. This is the first time that a quantitative review method has been used to analysis this research area and it provides an opportunity to bring new insights to complement previous qualitative reviews. This paper makes a contribution to understand the key points of open innovation and the implementation in large firm.

Keywords: open innovation, large firm, bibliometric analysis, co-citation analysis

Introduction

Since the first time Chesbrough published a book 'Open Innovation – The New Imperative for Creating and Profiting from Technology' in 2003, many researchers and practitioners have been interested and spawn this concept. Open Innovation becomes a new research area that continuously develops and discusses in academic literature and business practices. Open innovation is a paradigm for considering how organisation expand their innovation efforts beyond their own boundaries by utilising inbound and outbound knowledge flows to improve these efforts (J. West & Bogers, 2017). Open innovation has been defined as "a distributed innovation process based on purposively managed knowledge flows across organisational boundaries, using pecuniary and non-pecuniary mechanism in line with the organisation's business model" (H. Chesbrough & Bogers, 2014). This topic has investigates in many point of views from industry specific (Luthje, Herstatt, & von Hippel, 2005) to innovation system (Belussi, Sammarra, & Sedita, 2010), size of the firms (Bianchi, Campodall'Orto, Frattini, & Vercesi, 2010; Brunswicker & Chesbrough, 2018), and variety of external sources (Baker, Grinstein, & Harmancioglu, 2016; Cabigiosu, Zirpoli, & Camuffo, 2013)

Current literature in open innovation research area show that large firms implement this concept as a component of large firms R&D, helping to shift the dominant logic of R&D away from the internal discovery to external engagement (Brunswicker & Chesbrough, 2018; Joel West, Salter, Vanhaverbeke, & Chesbrough, 2014). Recent internet and digital technology development have support large firms in this kind of relation. Numbers of application has developed to connect large firms with a variety of practices like alliances and community parties in an interactive relationship. P&G introduces a new model to gain knowledge from external knowledge utilising a connecting and developing method. Through this method, P&G are connected with external sources of new ideas, such as suppliers, users, universities, and even competitors. Then the company develops the ideas into profitable, new or refined products (Huston & Sakkab, 2006).

Even literature has discussed how large firms implement open innovation (Alkemade, Heimeriks, Schoen, Villard, & Laurens, 2015; Brunswicker & Chesbrough, 2018; H. Chesbrough & Brunswicker, 2014), the underlying concept or theory that assist the understanding of open innovation process especially in large firms still little (Brunswicker & Chesbrough, 2018). Moreover as large firm has complex process, J. West and Bogers (2017) suggests the need to have complete picture of open innovation process. For the purposes of following the current understanding, a state of art review of

the extant literature on open innovation in large firms is warranted. The objective, therefore, is to conduct a review of the literature on the open innovation in large firm the following contributions:

1. This article provides the first review on open innovation in large firms. Thus, this paper portrays a comprehensive view of prior concept and theory of open innovation, therefore it will enlarge understanding for its implementation in large firms.

2. This article make a major methodological contribution by introducing a quantitative method by following the 'systematic' review method (Tranfield, Denyer, & Smart, 2003). This article uses the co-citation analysis method, one of the bibliometric analysis methods that use a quantitative approach in analysing literature in a particular area. This paper is among the first to use the co-citation analysis method to identify the intellectual structure of open innovation research. Cluster mapping provides a visualization of the state of the art of open innovation in large firm research field, the research development in this area over the years, and suggests topics for future research development.

3. It provides information to practitioners, policy makers and executives who wish to understand open innovation. In addition it can also inspire the emergence of valuable understandings for executives about how to implement open innovation in their firm especially for sustainable innovation in the digital era.

The review is structured as follows. First, we outline the systematic literature review process that was used in collecting, identifying and analysing the relevant open innovation literature. This is followed by a use of the co-citation method to summarize the understanding of open innovation based on the prominent literature in this area while also mapping the main themes discussed regarding open innovation in large firm. This article concludes the review by suggesting directions for future research.

Methods

A systematic literature review was conducted to identify what research had been conducted in the open innovation research area. It has been divided in two stages: the co-citation analysis and a focused review. The co-citation analysis is a key method in bibliometric research (Small, 1973) to understand the basic concept of particular topic based on main literature cited. In searching the literature, the review to double-blind peer-reviewed journal articles, excluding books and non-refereed publications. The use of validated knowledge serves to strengthen the robustness of the review. A three-stage selection process is applied to identify relevant articles from innovation/management journals. First, literature search is at Web-of-science database which provides the Social Science Citation Index (SSCI) and was used as the main data source. The database is generally considered as the most comprehensive database for scholar work and includes thousands of high-quality journals (Dahlander & Gann, 2010). The articles chose which were published from 2003 to 2018. The reason to choose 2003 as the cut-off point for the past because in this year open innovation proliferation had started to develop. Third, this review searched the titles and abstracts of journals using combinations of the keywords 'open innovation' and 'large firm'. The search resulted with 286 articles.

Outputs were further restricted to articles that published in management and technology innovation journals that indexes in Q1 and Q2 SJR, which resulted in an initial database of 144 journal articles. To make sure subjective selection biases, the author read all articles' titles and abstract to ensure the relevance of the open innovation. The 144 articles selected comes out with 9758 cited references. Only references cited more than 10 times are then included in co-citation analysis. The process of co-citation analysis then resulted 82 articles for further analysis.

To find the connections between articles, Bibexcel tool is used. VOSviewer tool is used to cluster them. Bibexcel is a versatile bibliometric toolbox developed by Olle Persson that help to do most types of bibliometric analysis (Person, Danell, & Wiborg, 2009). VOSviewer is primarily intended to be used for analysing bibliometric networks. The program create maps of publications, authors, or journals based on a citation, co-citation, or bibliographic coupling network or to create maps of keywords based on co-occurrence network (Eck & Waltman, 2014).

Table 1 List of selected journals to filter the articles search

No	Journals	Number of articles
1	Research Policy	15
2	Technovation	10
3	International Journal of Technology Management	9
4	R&D Management	8
5	Journal of Product Innovation Management	8
6	Industry and Innovation	8
7	Research-Technology Management	8
8	International Journal of Innovation Management	7
9	Technology Analysis and Strategic Management	6
10	Creativity and Innovation Management	5
11	Technology Forecasting and Social change	5
12	Total	82

The output of the proses is resulted with a network structure. Based on that, four groups are formed. The prominent words that analysed based on tittle and abstract from articles in each group are identified and used to label it.

Results and Discussion

Based on co-citation analysis four clusters are formed and visualize in the picture 1. Each cluster represents with different colors.

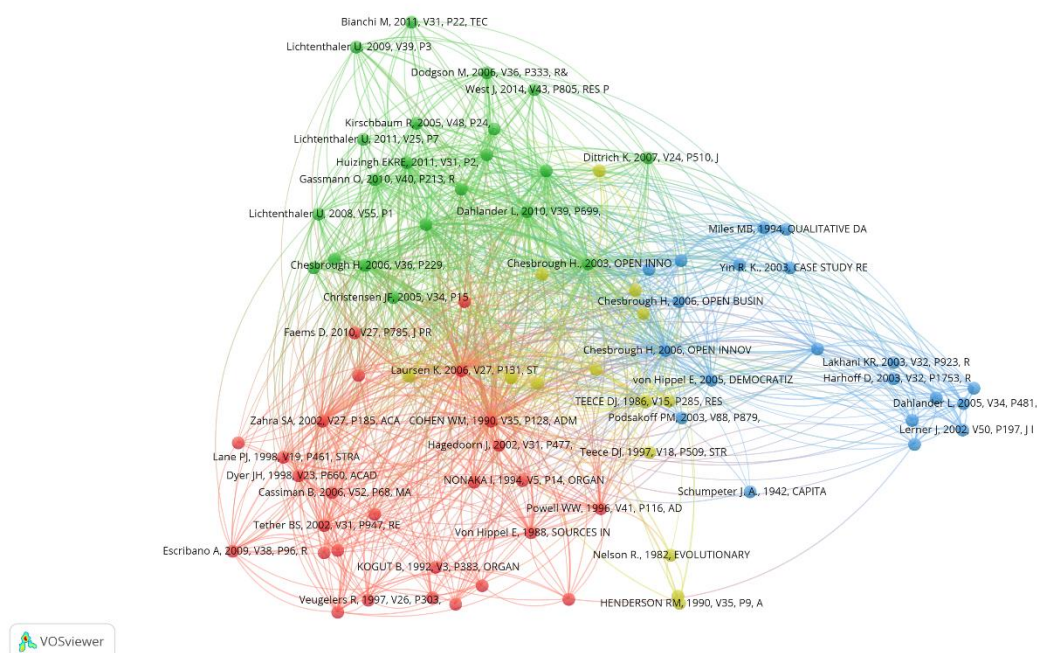


Figure 1 Clusters visualization from co-citation analysis

1. Open innovation principal

This cluster consist of 27 articles and appear in red dots color. Its label as open innovation principal because most of the article topic related to absorptive capacity (Cohen & Levinthal, 1989, 1990; Escribano, Fosfuri, & Tribo, 2009; Lane & Lubatkin, 1998; Tsai, 2001; Veugelers, 1997; Zahra & George, 2002), collaboration network (Baum, Calabrese, & Silverman, 2000; Powell, Koput, & SmithDoerr, 1996; Tsai, 2001), combination internal R&D and external

- knowledge (Cassiman & Veugelers, 2006; Henry Chesbrough, 2003; Katz & Allen, 1982; Rosenkopf & Nerkar, 2001; Tether, 2002; Veugelers, 1997).
2. Open innovation perspective
The second cluster is label as open innovation perspective, consist of 21 articles and mapped as green dots. Different perspective of open innovation are related to the definition of openness (Dahlander & Gann, 2010; Huizingh, 2011), content, context, and process (Huizingh, 2011), R&D, innovation, technology management (Enkel, Gassmann, & Chesbrough, 2009), open innovation practices and implementation (Bianchi, Cavaliere, Chiaroni, Frattini, & Chiesa, 2011; Huston & Sakkab, 2006; Ulrich Lichtenthaler & Ernst, 2008), organisational dimension (Chiaroni, Chiesa, & Frattini, 2010), strategy and firm performance (Dittrich & Duysters, 2007; U. Lichtenthaler, 2009), the future of open innovation (Gassmann, Enkel, & Chesbrough, 2010; Joel West et al., 2014).
 3. Lesson learn from open source software
The third cluster consists of 21 articles and label as lesson learn from open source software (OSS) and present in blue dost. In this cluster most of articles discuss open source software as open innovation practices and rise the issues regarding limited revealing of openness (Henkel, 2006), employee careers and organization (Dahlander & Wallin, 2006; Lerner & Tirole, 2002), model of investment (von Hippel & von Krogh, 2003), strategy (J. West & Gallagher, 2006), contributor motives of free information (Jeppesen & Frederiksen, 2006; Lakhani & von Hippel, 2003), and lead users (Vonhippel, 1986) communities relation (Dahlander & Magnusson, 2005), the innovation process (von Krogh, Spaeth, & Lakhani, 2003)
 4. Former open innovation
The last cluster with yellow dots is titled by former open innovation in large firms. There are 13 articles belong in this cluster. Mainly articles in this cluster published before the seminal work of Chesbrough (2003) that firstly coined the term open innovation. The topics that previously has the same meaning with open innovation are marketing technological innovation and patent (Arora, Fosfuri, & Gambardella, 2004; Gans & Stern, 2003; Teece, 1986), exploration and exploitation (Henderson & Clark, 1990; March, 1991), and technology adoption and acquisition (Granstrand, Bohlin, Oskarsson, & Sjöberg, 1992; Teece, Pisano, & Shuen, 1997).

Based on finding in co-citation analysis cluster, this article maps the key points that important to open innovation in large firm. The result show in figure 2.

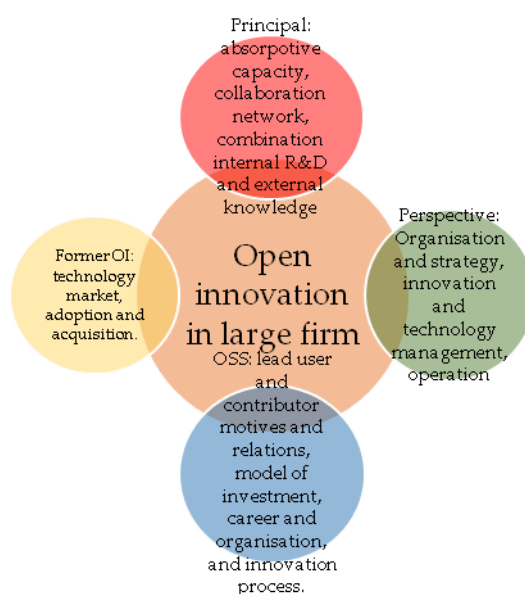


Figure 2 Key points of open innovation in large firms

Conclusions

This study reviews the literature in open innovation research showing the important key points in this research area and identifies opportunities for future research. By conducting the systematic literature review and by using co-citation analysis to synthesise the literature, this review attempts to avoid the subjective explanation that arises when conducting a traditional literature review. This is the first review in this area that used the quantitative approach that will complement the existing qualitative reviews.

This review shows that generally literature published in this research area are clustered in four topic groups: open innovation principal, perspective, former and lessons learned from open source software companies. From this arises various opportunities to develop future research focus. The limitations of this review is that the analysis and finding based on author subjectivity. For more objective result the analysis could support with text-mining software to find the hidden and most keywords in literature. The aggregating words in this review could somehow bias the result.

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