

Chapter 1

A Systematic Review of the Literature on Open Innovation in SMEs

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Abstract

This chapter provides a systematic review of the open innovation (OI) research carried out within the context of small and medium-sized enterprises (SMEs). The chapter should provide an accurate understanding of current literature about OI in SMEs, and it elaborates many future research avenues. The recent increase in the number of publications in this field shows that it has gained the attention of the academicians. The existing research shows that SMEs organize and manage OI in an entirely different way from large companies. SMEs get involved in OI based on their own strategic needs, and OI mechanisms have to be designed differently for SMEs.

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The chapter maps the research through Web of Science — Core Collection database. We investigated the “OI in SMEs” literature from January 2003 till June 2017. A total of 118 articles, eight book chapters, and six books are analyzed. The discussion is mainly categorized into six broad themes: adoption of OI, the benefits of OI, challenges, role of networking, sectoral patterns, and the role of policymaking. The chapter concludes with several avenues for future research in the field.

1.1. Introduction

This chapter provides a systematic review of the open innovation (OI) research carried out within the context of small and medium-sized enterprises (SMEs). As such, the chapter builds on and extends the work carried out by Brunswicker and Van de Vrande (2014) who have equally conducted a literature search and have identified several interesting themes for further research, such as the important role of SMEs as coordinators/orchestrators of their OI relations and how to optimally fulfill this role. Furthermore, they have concluded that, while the literature on OI has grown exponentially ever since Henry Chesbrough published his groundbreaking work in 2003 (Chesbrough, 2003), SMEs have received only little attention. Most researchers have studied large multinationals and their OI practices, and the lessons drawn from these cases and studies cannot be easily transferred to SMEs; SMEs represent unique contexts in terms of their resource endowments, skill sets, the tight connection between the entrepreneur and the (OI) strategy of the company, etc. (Van de Vrande *et al.*, 2009; Vanhaverbeke, 2012). An explicit focus on the specifics of the SME context when studying these companies is thus warranted. Hence, for the purpose of this book, this chapter extends the efforts of Brunswicker and Van de Vrande (2014) and Hossain and Kauranen (2016) with respect to mapping the OI in SMEs research field, albeit with a focus on the themes covered in subsequent chapters of this edited book.

SMEs are crucial catalysts of both developed and developing economies, accounting for over 99% of all businesses and more than

60% of all jobs created, as well as important sources of innovation (Audretsch, 1995; Muller *et al.*, 2015). As such, governments are searching for ways to increase the productivity of SMEs. Several researchers have identified OI as an important strategy to overcome typical SME weaknesses such as resource (time, money, etc.) constraints and skill gaps (Bougrain and Haudeville, 2002; Dahlander and Gann, 2010; Edwards *et al.*, 2005; Lee *et al.*, 2010; Rahman and Ramos, 2010; Wynarczyk *et al.*, 2013). In order to optimally benefit from OI, however, companies need to develop completely new skill sets (e.g., orchestration capabilities) and create the right atmosphere (e.g., open culture) within their firms. While researchers have generated best practices and lessons on how to bring these changes about within the context of large companies, the insights on SMEs are still relatively thin. This chapter intends to remedy this gap, and one important first step is to map the existing work on OI in SMEs, on the basis of which valuable new insights can be generated. The aims of this chapter are thus twofold:

- mapping the existing literature in the OI in SMEs field so as to provide a basis for subsequent chapters;
- identifying promising areas for future research that subsequent chapters connect to.

In terms of methodology, we conducted a thorough review and analysis of papers published on Web of Science (Core Collection) during the period starting January 1, 2003 till June 19, 2017, following established approaches for systematic literature reviews by many authors (Pittaway *et al.*, 2004; Rousseau *et al.*, 2008; Spender *et al.*, 2017). Our review is concentrated not only on the field of innovation management but also includes related fields (e.g., strategic management) where appropriate. The following methodological steps were taken:

- (1) The identification of keywords based on authors' prior experience, an initial assessment of the literature, and brainstorming

sessions. Identified keywords include “open innovation,” “SMEs,” “collaborative innovation,” “strategic alliance,” “innovation,” “small businesses,” etc. These keywords were then organized into search strings, for example: [*open innovation* OR *collaborative innovation* AND *small and medium-sized enterprises* OR *SMEs* OR *small businesses*].

- (2) The carrying out of a preliminary search on Google Scholar using the basic search strings. This initial search was used for identifying additional keywords for the main search. Additional keywords include, for example, “inbound innovation,” “outbound innovation,” “coupled innovation,” “entrepreneurial ventures,” etc.
- (3) The use of the basic search string *open innovation* and *SMEs* in the Web of Science — Core Collection (search engine) database to identify the key citation indexes for review. The selection was made based on the volume of citations relevant to the basic search string. The citation database, Web of Science, was then reviewed using the search strings identified in steps 1 and 2.
- (4) The review of identified citations according to the inclusion and exclusion criteria summarized in Table 1.1. Two stages were undertaken to reduce the number of citations. In the first stage, we analyzed the titles of articles according to the exclusion criteria; in the second stage, we analyzed the abstracts according to the inclusion criteria. We then cross-checked the reference sections of the included articles to assess the search strategy.
- (5) The review of 126 citations that met the search criteria. These publications were organized into different categories according to frequently addressed issues. As such, a list of themes was compiled that is relevant to the remainder of this book. The themes and relevant publications under each theme were then summarized and discussed.

The remainder of this chapter is structured as follows. In the Section 1.2, we present the results of our descriptive and content

Table 1.1. Inclusion and exclusion criteria.

No.	Criteria	Reasons
<i>Inclusion criteria</i>		
1	Studies focusing on innovative SMEs considering collaboration/strategic alliances/partnerships as a tool or source for innovation	Since the OI phenomenon is new, studies on collaborative innovation, strategic alliances, and partnerships where it leads to innovation for SMEs were also considered
2	Studies focusing on OI that consider SMEs as their point of analysis or vice versa	To keep in line with the overall theme of this book
3	Theoretical, conceptual, empirical, qualitative, quantitative methodologies, literature reviews	The aim was to include almost all relevant academic publications in this study
4	Articles/book chapters published/indexed in Web of Science — Core Collection along with other books published on OI in SMEs	All the main journals and other outlets are indexed in the Web of Science — Core Collection database
<i>Exclusion criteria</i>		
1	Studies published on related area before year 2003	OI concept was coined in 2003; so, studies only after 2003 are taken into consideration
2	Simple collaboration arrangements	Only studies on collaborations that lead to innovation were considered
3	Conference papers, business magazine articles, editorials, or similar publications were not considered	Only journal articles, books, and book chapters were taken into account
4	Linguistic expression	Articles published in English were only considered; due to linguistic constraints, publications in other languages were not considered

analyses. Next, we describe the main research themes identified. Finally, we present interesting avenues for further research.

1.2. Descriptive and Content Analysis

In this section, we present the results of our review of the 126 publications considered in this study. Out of these 126 publications, 118 are published in various journals, while 8 publications are published as book chapters. In addition to these 126 publications, six books that are published on OI in SMEs, to date, are also included in our analysis and are also separately discussed in Section 1.4. Below is a descriptive and content analysis of our sample research.

1.2.1. Descriptive analysis

Figure 1.1 illustrates the number of relevant publications that have appeared in the field of OI in SMEs since 2003.

The figure shows that the study of OI in SMEs is a fairly recent phenomenon. It is particularly worth noting that the first publication, which is an empirical study discussing university and industry collaborations for innovating SMEs (Fontana *et al.*, 2006), appeared

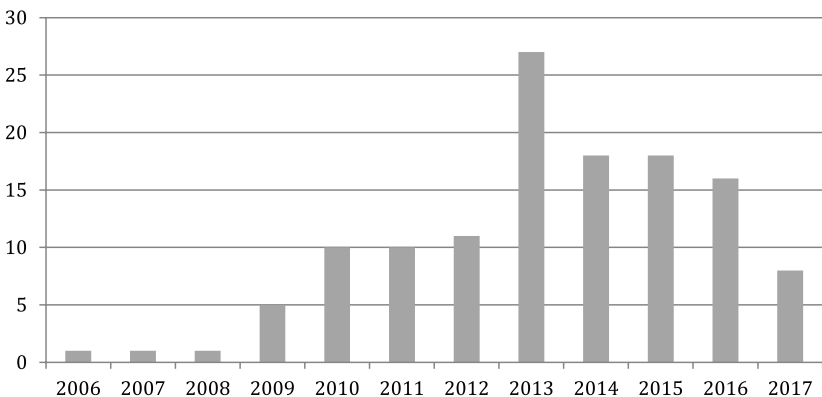


Figure 1.1. Number of publications on “OI in SMEs” per year.

in 2006. The first articles actually mentioning OI in SMEs have only started to appear from 2009 onward. Batterink (2009), for example, discusses the adoption of OI in SMEs as well as in larger companies. Lecocq and Demil (2006) study OI in a low-technology setting and discuss OI strategy from the viewpoint of new entrants to the industry in relation to incumbents that are practicing openness. As important early publications have shown that SMEs adopt OI in a unique way and in relation to different strategic needs than large firms, academics have started to pay more attention to the specific SME context as is evidenced by larger numbers of publications and an increasing citation count.

Figure 1.2 presents the citations per year to these 126 publications. The citations are growing exponentially over the years. This is the result of a combination of a growing number of publications over time and an increase of citations per publication as time progresses.

Figure 1.3 shows the impact of the 126 publications for the period 2009–2014 by showing the number of citations per publication in the

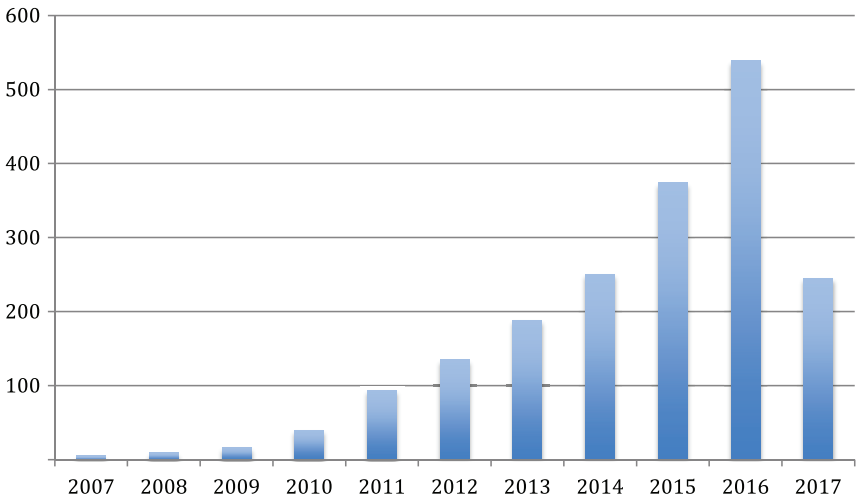


Figure 1.2. Number of citations per year.

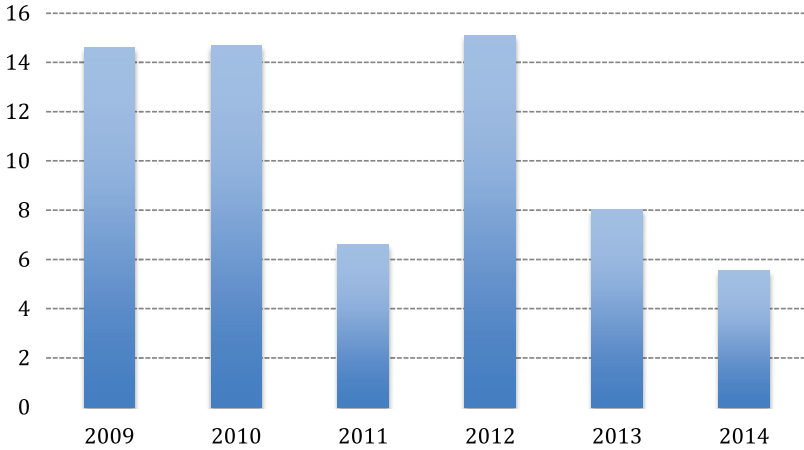


Figure 1.3. Citations per publication for the 126 publications under study (till $t + 3$).

three years following the publications published in a particular year. The articles published after 2014 are excluded since they do not have a window of three years for the citations. The figure, in general, shows the importance of some early publications in this area in 2009 and 2010. We see a higher average citation rate for publications in 2009, 2010, and 2012. This is the result of some highly cited publications — there is highly skewed distribution of the citations across the publications. Therefore, we highlight the most cited publications in Table 1.2.

Table 1.2 shows the topmost cited publications from our sample. The most cited article is from Van de Vrande *et al.* (2009) on the motives and challenges faced by SMEs while adopting various OI activities.

When it comes to publication outlets of these studies, our descriptive analysis shows that the literature on OI in SMEs is scattered across several academic journals. The majority of the articles under review in this chapter are published in *Technovation*, *International Journal of Technology Management*, *International Small Business Management*, *Technology Analysis and Strategic Management*, *Asian Journal of Technology Innovation*, *R&D Management*, and *Research Policy*. Figure 1.4 features the top journal outlets for our

Table 1.2. Top cited publications.

S. No.	Title	Author(s)	Journal	Year	Citations
1	Open Innovation in SMEs: Trends, Motives, and Management Challenges	van de Vrande, V., de Jong, J., Vanhaverbeke, W. and De Rochemont, M.	<i>Technovation</i>	2009	327
2	Open Innovation in SMEs — an Intermediated Network Model	Lee, S., Park, G., Yoon, B. and Park, J.	<i>Research Policy</i>	2010	208
3	Factors Affecting University — Industry R&D Projects: the Importance of Searching, Screening, and Signaling	Fontana, R., Geuna, A. and Matt, M.	<i>Research Policy</i>	2006	172
4	Open PHACTS: Semantic Interoperability for Drug Discovery	Williams, A., Harland, L., Groth, P., Pettifer, S., Chichester, C., Willighagen, E., Evelo, C., Blomberg, N., Ecker, G. and Goble, C.	<i>Drug Discovery Today</i>	2012	112
5	Inbound Open Innovation Activities in High-Tech SMEs: the Impact on Innovation Performance	Parida, V., Westerberg, M. and Frishammar, J.	<i>Journal of Small Business Management</i>	2012	89

(Continued)

Table 1.2. (Continued)

S. No.	Title	Author(s)	Journal	Year	Citations
6	Building Absorptive Capacity to Organize Inbound Open Innovation in Traditional Industries	Spithoven, A., Clarysse, B. and Knockaert, M.	<i>Technovation</i>	2010	89
7	Strategic Entrepreneurship, Collaborative Innovation, and Wealth Creation	Ketchen, D., Ireland, D. and Snow, C.	<i>Strategic Entrepreneurship Journal</i>	2007	63
8	Enabling Open Innovation in Small- and Medium-Sized Enterprises: How to Find Alternative Applications for Your Technologies	Bianchi, M., Campodall'Orto, S., Frattini, F. and Vercesi, P.	<i>R&D Management</i>	2010	53

Source: Web of Science.

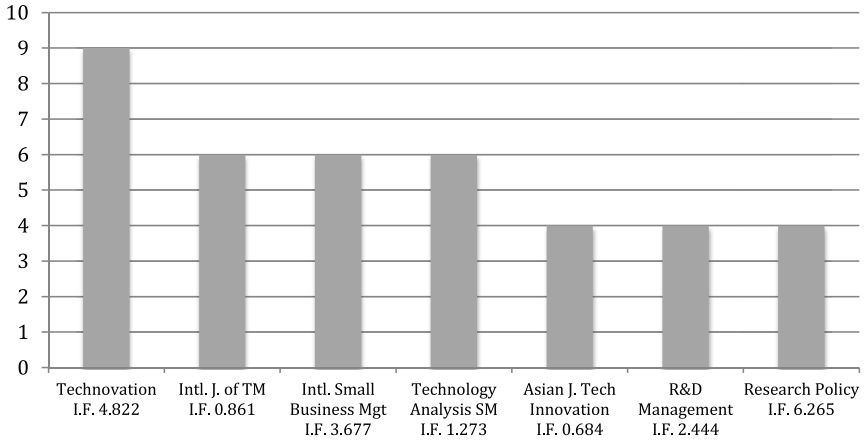


Figure 1.4. Top research outlets for publications on OI in SMEs with their five-year impact factor.

Note: To calculate the five-year impact factor, citations are counted in 2016 to the previous five years and divided by the source items published in the previous five years.

set of publications on OI in SMEs. A total of 81 articles were published in journals, where at least one more article on OI in SMEs was also published; 47 articles were stand-alone publications in their respective journals.

1.2.2. Content analysis

With respect to the method used, our content analysis of the 126 publications shows that the authors of 36 articles collected their data on OI in SMEs through survey research, while 32 articles were based on a combination of data from various databases. A total of 34 publications were based on case study research, and in nine publications authors based their conclusion on mixed methods or a combination of qualitative case study research and larger-scale quantitative data analysis (Table 1.3). Theoretical analyses and simulation methods were found in 19 articles. The majority of articles are exploratory in nature where authors conduct preliminary analyses (qualitative analyses in 27% of all articles considered; quantitative

Table 1.3. Methodologies used in publications on OI in SMEs.

Study methodology	No.	%
Case study	34	27.0
<i>Multiple</i>	22	17.5
<i>Single</i>	12	9.5
Surveys	36	28.6
Database	32	25.4
Mixed	9	7.1
Others (conceptual, reviews, simulation studies, etc.)	19	15.1

analyses in 54% of publications under review) of the OI practices used within the SME context with the purpose of developing new theories that can shed light on this particular type of firms and the way they engage in strategies that require them to be open to their environment and to open up their internal organization.

With respect to the topics addressed in the 126 articles that we analyzed, Figure 1.5 shows the broad categorization into themes such as the adoption of OI, the benefits and challenges of OI, sectoral patterns, etc. These themes are not mutually exclusive in the sense that publications can fall into several themes based on the set of topics they address. The majority of articles study the role of networking and being part of an OI ecosystem (25%) in the performance of SMEs and the manner in which OI practices are adopted or implemented within these small companies (23%). The benefits (16%) and challenges (10%) of OI that are typical for the SME context, such as the way in which engaging in OI helps SMEs remedy some of their (resource) shortcomings and related challenges such as protecting crucial assets such as IP, have also received noteworthy attention in the literature. Few authors (9% of all publications considered) have focused on specific industrial contexts for situating their OI studies. Even fewer studies (3%) have shed light on the importance of effective policies for stimulating SMEs to engage in OI and to thus more effectively fulfill their catalyst role in economic development. In the next section, we describe the most important insights for each of the themes summarized in Figure 1.5.

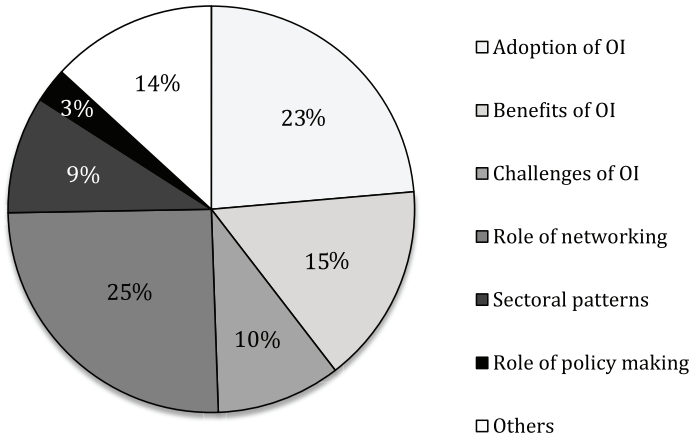


Figure 1.5. Categorization of articles based on topic.

1.3. An Overview of the Identified Research Themes

1.3.1. Adoption of OI

SMEs are facing a number of challenges that are typical for the SME context and are thus not typically burdening large companies. Several authors have identified these challenges pertaining to the liability of smallness, for example, a lack of several types of resources and complementary assets, commodity pressure, etc. (Bougrain and Haudeville, 2002; Dahlander and Gann, 2010; Edwards *et al.*, 2005; Rahman and Ramos, 2010). These challenges can be overcome by practicing OI effectively (Crema *et al.*, 2013; Van de Vrande *et al.*, 2009). Many SMEs are thus often facing a typical “chicken and egg” problem. In this context, Teirlinck and Spithoven (2013) point out that the likelihood of SMEs effectively engaging in OI increases with the availability and level of training (PhD) of R&D managers/experts in research collaboration. While the adoption of OI can help SMEs overcome resource challenges, they are in need of resources in order to practice OI well. On a more positive note, other researchers have pointed out that the SME context is uniquely suited for cultivating successful OI practices (much more so than the rigid large

firm environment), thus increasing the likelihood of effectively adopting OI. Parida *et al.* (2012), Dufour and Son (2015), and González-Benito *et al.* (2016), for example, point to the flexible organizational structure and the easiness with which SMEs can change their strategic paths as important organizational drivers of OI that are typical for the small firm category. The advantages of the SME context thus need to be leveraged well (through effective management) in order to realize the benefits of OI.

Verbano *et al.* (2015) point out that the specific manner in which SMEs adopt OI differs according to various types of factors that can be categorized as either exogenous (e.g., industry effects, technology diffusion effects) or endogenous (e.g., the effects of product strategies, organizational culture, R&D propensity, innovation approach) to the firm. Despite these differences in adoption modes depending on firm and context peculiarities, most SMEs are found to practice inbound OI such as involving partners, employees, and customers in innovation; out-licensing of proprietary technologies and other outbound OI practices continue to be used to a very limited extent (Van de Vrande *et al.*, 2009). Few publications have focused on the stage of the innovation process where SMEs adopt open approaches, interacting with suppliers and customers in different phases to jointly generate new ideas (Bocken *et al.*, 2014). Presenza *et al.* (2016) have emphasized that SMEs' absorptive capacity to utilize external knowledge greatly increases their innovative ability. Krause and Schutte (2016) propose various OI design propositions depending on the OI life cycle framework. Several publications regarding the adoption of OI practices have studied the ways in which the implementation of OI by SMEs can be facilitated. Most notably, authors have focused on the importance of well-developed intellectual property regimes (Bianchi *et al.*, 2010) and digitalization (e.g., collaborative innovation management tools) (Chaparro-Peláez *et al.*, 2014; Garcia and Barcena, 2010; Saetta *et al.*, 2013; Schuurman *et al.*, 2016; Williams *et al.*, 2012). Gagliardi (2013) and Garcia and Barcena (2010), for instance, discuss the value of the use of Web 2.0, which is a user-friendly web-based application, that enables SMEs to effectively

manage collaborative projects. Caetano and Amaral (2011) examine the usefulness of a method for technology road mapping that helps SMEs in applying technology push strategies within an OI context. Hronszky and Kovacs (2013) elaborate on the role of living labs in effectively adopting OI practices. These interactive tools integrate SMEs as partners in the technology development process, making collaborative innovation more easily accessible for these companies.

1.3.2. Benefits of OI

A fairly large number of studies in our sample of 126 publications have analyzed the benefits of OI adoption accruing to SMEs. In different kinds of industries, SMEs have been found to generate value from OI (Chesbrough and Crowther, 2006; Van de Vrande *et al.*, 2009) and, even more so, they are often more effective at benefiting from their openness than large companies (Spithoven *et al.*, 2013). SMEs that are successful at OI initiatives have a longer history of intensely experimenting with and adopting OI practices both at the firm level and at the project level than their unsuccessful counterparts (Yoon *et al.*, 2016). Furthermore, successful SMEs make more effective use of the supporting tools (e.g., living labs) that are available to them (Schuurman *et al.*, 2016). Studies have also pointed out that organizational factors help in creating OI culture and increasing innovation performance of SMEs (Popa *et al.*, 2017; Pustovrh *et al.*, 2017). The SMEs involved in OI are mostly first in introducing innovation in the market rather than being a follower (Hochleitner *et al.*, 2017).

Various authors have focused on studying the effects of different kinds of inbound OI approaches on innovation performance within samples of SMEs (Oke and Kach, 2012; Tranekjer and Sondergaard, 2013). Parida *et al.* (2012), for example, analyze the innovation performance of over 250 high-tech SMEs in relation to four inbound OI practices, that is, technology sourcing, horizontal technology collaboration, vertical technology collaboration, and technology scouting. Technology sourcing and vertical technology collaboration

have a positive influence on radical innovation; horizontal technology collaboration and technology scouting positively affect incremental innovation within SMEs. Bjerke and Johansson (2015) find that the innovation performance of SMEs is particularly stimulated by collaborating with dissimilar technology partners that are geographically positioned at larger distances from the focal firms. Pustovrh *et al.* (2017) show that OI activities involving collaboration and knowledge exchange with the partners significantly influence the innovation performance of the SMEs. Theyel (2013) studied the effects on the innovation performance of 293 US-based SMEs of various OI practices along the value chain. This study concluded that SMEs are most likely to collaborate with OI partners in the commercialization stage of new product/service development and that collaboration in this phase mostly results in effective process innovations. Though SMEs prefer OI relationships at commercialization stage, the extent and mode of involvement in OI activities at this stage depends on the firm's capabilities and strategy for OI (Henttonen and Lehtimäki, 2017).

A study by Minguela-Rata *et al.* (2014) within the context of Spanish SMEs shows that collaborative relations with suppliers result in higher innovation performance. The authors also find that the larger companies in their sample of SMEs are more likely to benefit from OI than their smaller counterparts due to higher absorptive capacity and stronger management skills. In addition, larger companies within the SME category are more likely to generate radical innovations based on their OI practices, while the smallest of SMEs tend to realize mostly incremental innovations.

1.3.3. Challenges of OI

While research shows that SMEs can substantially benefit from effectively adopting OI practices, realizing these advantages requires managing and overcoming a number of OI challenges (Ullrich and Vladova, 2016). Bigliardi and Galati (2016), for example, identify four challenges in relation to OI in their sample of 157 Italian SMEs, for example, challenges related to knowledge and collaboration.

Vanhaverbeke (2017) points to the short-term outlook in most SMEs that is a challenge to successful OI, as collaborative practices typically take long to result in fruitful outcomes. Related to this challenge is the observation by Huggins and Johnston (2009) and Bianchi *et al.* (2010) that SMEs are too focused on their core business and typically lack a systematic innovation process leaving them challenged with respect to grasping and exploiting new technological developments accessed through OI relations. Qin *et al.* (2016) explore the challenges related to adoption of crowdsourcing activity. Deschamps *et al.* (2013) analyze various challenges faced by SMEs in managing collaborations with the universities and subsequent technology transfer issues. Other authors have singled out the challenges related to OI partner selection as important barriers to successful OI in SMEs (Guertler and Lindemann, 2016; Vrgovic *et al.*, 2012).

Besides identifying important challenges, researchers have also enumerated a number of ways in which SMEs can deal with some of these hurdles and manage them in such a way that they enable them to benefit from their OI practices. Spithoven *et al.* (2010), Colombo *et al.* (2012), and Bocquet and Mothe (2015) mention that it is crucial for SMEs to develop their absorptive capacity in capturing value from OI. Similarly, Kim and Park (2010) put forward the strengthening of R&D competencies and the development of a scanning function, where SMEs can diligently monitor external developments, as important drivers of OI success. Other authors (Bouncken and Kraus, 2013) have emphasized the importance of adequate knowledge protection regimes (e.g., IP, NDAs), effective knowledge management, and controlled knowledge sharing in SMEs in dealing with the OI challenge related to the loss of proprietary know-how that many SMEs are struggling with. A number of authors have examined softer coping mechanisms in relation to OI challenges such as the establishment of multidisciplinary teams within SMEs, the stimulation of an open culture and open communication, etc. (Bocken *et al.*, 2014). Finally, researchers have stressed that it is important for SMEs to develop orchestration skills and for orchestrators to take SMEs' interests within OI networks into account as

these small firms tend to occupy weaker network positions leaving them dependent on partners' strategies rather than in control of the direction their OI efforts take (Dodourova and Bevis, 2014).

1.3.4. Role of networking

A large number of studies in our sample of articles analyzed have focused attention on the role of OI networking in SMEs' performance. Several studies, in various geographical settings and network settings featuring different types of OI partners, have pointed out that it is crucial for SMEs to ensure valuable network positions among their OI partners and to build up skills with respect to the effective orchestration of OI partners and relations (Bjerke and Johansson, 2015; Brunswicker and Vanhaverbeke, 2014; Cosh and Hughes, 2010; Dukic *et al.*, 2015; Egbetokun, 2015; Fontana *et al.*, 2006; Heger and Boman, 2015; Ketchen *et al.*, 2007; Lambrechts *et al.*, 2017; Lee *et al.*, 2010; Leyden and Link, 2013; Pullen *et al.*, 2012; Mitze *et al.*, 2015; Roper and Hewitt-Dundas, 2013; Spriggs *et al.*, 2013; Suh and Kim, 2012; Thorgren *et al.*, 2012; Tranekjer and Knudsen, 2012; Tranekjer and Sondergaard, 2013; Trippl, 2011; van Hemert *et al.*, 2013; Xie *et al.*, 2013). Mitze *et al.* (2015), in their sample of German SMEs, for example, show that SMEs that have secured a favorable position among their OI partners (in this case, educational research institutes) outperform their counterparts in less valuable spots. Indeed, social network analysis has for long evidenced the benefits of occupying central network positions where the focal firm is at the crossroad of knowledge and information flows and can thus optimally access the network's common knowledge base (Heger and Boman, 2015). Securing beneficial network positions is not only up to the networking skills developed by SMEs but is also the responsibility of the (large) network orchestrator at the helm of the network, where this leader is in a position to stimulate value creation at the level of the network as a whole by putting SMEs in strategic positions (Lecocq and Demil, 2006). Similarly, Bek *et al.* (2013) and Omta and Fortuin (2013) have highlighted the important role of effective network management in SMEs realizing

their OI potential. Nordman and Tolstoy (2016) emphasize on the role of collaborations with foreign partners to be innovative and capitalize on the home and international market opportunities.

Despite these important insights, different studies continue to find that SMEs seem to be ineffective at building up the necessary networking skills and orchestration capabilities for ensuring optimal positions within OI networks and ecosystems (Dooley *et al.*, 2016). This seems to be particularly the case in transitioning economies as evidenced by studies of Serbian SMEs (Dukic *et al.*, 2015) and Hungarian SMEs (Torok and Toth, 2013). Bek *et al.* (2013), in their analysis of Russian SMEs and their positions in OI clusters, conclude that there is an important role for the government in disseminating best practices regarding entrepreneurs that have managed to secure valuable OI network positions based on their skills, in providing training in networking to SME leaders, as well as in carrying out/ensuring network management that safeguards SMEs' positions and roles.

1.3.5. Sectoral patterns

Several articles that we investigate in this chapter have positioned analyses within specific industrial contexts (Cagno *et al.*, 2015; Oughton *et al.*, 2013). It is important to study OI within SMEs operating in various sectoral settings as research shows that differences in generated insights are often due to the unique characteristics of specific types of industries, for example, high-tech (Colombo *et al.*, 2014; Rolandsson *et al.*, 2011) versus low-tech and medium-tech sectors (Dodourova and Bevis, 2014), service-dominated industries versus manufacturing-based sectors (Hosseini and Narayanan, 2014), R&D-intensive in life sciences sector (Marangos and Warren, 2017), etc.

Studies of high-tech sectors, such as medical devices, typically point at the complexity of technologies and the new product development process that call for unique configurations of large numbers of dissimilar partners that are united through common goals (Pullen *et al.*, 2012). Investigations of low-tech industries, such as the food

industry (Ferto *et al.*, 2016), have identified a typical lack of openness characterizing firms in this particular sector that poses specific challenges for SMEs seeking horizontal collaborations to boost innovation. Saguy and Sirotinskaya (2014) explain the challenges SMEs are facing in the food industry and propose a number of solutions to overcome these challenges. Openness in this sector also seems to increase to the extent that foreign partners are part of OI networks (Dries *et al.*, 2014; Pettenella and Maso, 2011).

More so than in the analyses of manufacturing industries, the role of digital tools supporting OI and stimulating interconnectedness among partners is particularly stressed by researchers investigating service industries, such as tourism (Carlisle *et al.*, 2013; Chaparro-Peláez *et al.*, 2014).

Vanhaverbeke (2012, 2017) has been studying OI in low-tech and medium-tech industries, such as the bicycle parts industry, the textile industry, quilts and pillows, radiators, etc. He argues that SMEs in those industries can benefit substantially by applying OI, but how OI networks are managed by SMEs is hardly comparable to the management of OI in large companies (Chesbrough, 2003, 2006). OI in low-tech and medium-tech industries relies on personal relations between SME managers (not on OI teams), and OI is a direct consequence of business model innovations initiated by the entrepreneur(s). OI in SMEs can be studied in isolation of SMEs' strategy (business model changes) and the essential role of the entrepreneurs. Managing the network of partners is the most difficult part, and failing to manage the networks in a proper way explains why so many SMEs quit OI initiatives prematurely. There is an urgency among entrepreneurs to discover good OI practices in SME networks and to disseminate these good practices through effective guidelines (see also Chapter 15).

1.3.6. Role of policymaking

Studies on policymaking in our sample of publications have nearly always emphasized the important role of governments in stimulating OI in SMEs through, for example, financial support, legal support,

the provision of training, the setting up of research centers and incubators, etc. (Aggestam and Weiss, 2011; Bocken *et al.*, 2014; Cosh and Hughes, 2010; Kang *et al.*, 2013; Padilla-Melendez *et al.*, 2013; Pervan *et al.*, 2015; Spithoven *et al.*, 2013; Suh and Kim, 2012; van Hemert *et al.*, 2013). More specifically, governments can help SMEs overcome some of the challenges associated with OI and more effectively realize the potential benefits.

A number of studies have highlighted the significant governmental task of helping SMEs close the skill and knowledge gaps with academia and other industrial partners, which will enable them to take on more valuable roles within OI networks and ecosystems (Pervan *et al.*, 2015; Reschwamm and Wolf, 2008). In this context, authors stress the crucial function of publicly funded research centers and universities that are particularly suited for assisting SMEs in bridging research gaps by diffusing key basic knowledge (Flores *et al.*, 2009). As such, by providing SMEs with access to core knowledge relevant to their fields of business, by helping them to digest this knowledge, and by educating them with respect to how to integrate this know-how into their innovation processes, governments help small firms build up their absorptive capacity, which is crucial for successful OI (Ferto *et al.*, 2016). Others have emphasized the intermediating role of governments where they can help SMEs identify and connect to the right partners, such as end-users, through, for example, setting up innovation hubs (Vrgovic *et al.*, 2012). Further intermediating tasks of governments relate to helping SMEs develop necessary OI skills at different phases of their development where they set up extensive SME support networks focusing both on content (e.g., which technologies to access through OI) and management (e.g., how to obtain valuable network positions) (McAdam *et al.*, 2014; Xiaoyuan and Yanning, 2011). Finally, studies in our sample point at the important role of governments as OI network orchestrators or as parties that ensure that ecosystem development and orchestration occur in a way that is beneficial for SMEs (van Hemert *et al.*, 2013). When left to large commercial orchestrators, network coordination may lead SMEs to leave the network prematurely or to SMEs' inability to generate and capture value from their participation

(Roper and Hewitt-Dundas, 2013). Governments are thus also stimulated to collaborate with large industrial partners in ensuring that SMEs can play their role effectively within OI networks (Tsekouras and Kompis, 2014).

Besides highlighting the way in which governments can make a positive difference in the OI performance of SMEs, one stream of research within this theme has also emphasized the difficulties SMEs often experience when trying to access public support. Particularly, the administrative and bureaucratic burden on SMEs in need of governmental aid is mentioned as a factor that is preventing many SMEs from making optimal use of the available facilities (Aggestam and Weiss, 2011).

1.4. Books about OI in SMEs

To our knowledge, only a few publications exist on this topic. Most of these books are expensive, and those that are less expensive are only recently published. As a result, most OI scholars do not know these books, and that is why we introduce them briefly in this section. Two of the books we discuss below are edited volumes (Rahman and Ramos, 2012a, 2012b). The other books are monographs: one uses a highly academic approach to OI in SMEs (Wynarczyk, 2014) and the others — the more recent ones — focus on management issues of OI in SMEs (Pickert, 2015; Kasende, 2017; Vanhaverbeke, 2017). The first two focus on a specific SME setting, while the last provides guidelines and a general framework for managing OI in small firms.

1. *SMEs and Open Innovation: Global Cases and Initiatives* by Hakikur Rahman and Isabel Ramos (2012a). This book is an edited volume with 16 chapters, each focusing on individual themes and cases. The authors discuss diverse policy, economic, and cultural issues, including numerous opportunities and challenges surrounding OI strategies, risks and risk management, and evolution pattern of SMEs on adopting OI strategies through measurable criteria. It also intends to assist practitioners in

designing action plans to empower SMEs. The book is divided into four sections: (1) concepts, researches, and practices; (2) innovation marketing, communication, and growth management; (3) entrepreneurship, strategies, and crisis management; and (4) creativity, collaboration, and cocreation. The 16 chapters focus on different business developments in SMEs covering many aspects of research and practices of OI in smaller companies.

2. *Cases on SMEs and Open Innovation: Applications and Investigations* is a second volume edited by Rahman and Ramos (2012b). This book reviews applications of OI concepts and strategies for SMEs development by accommodating theoretical perspectives and case studies. It covers diverse aspects of OI in terms of policy, politics, economy, and culture, making it a useful reference for researchers, practitioners, and academics. The book incorporates twelve case studies and is divided into three sections: (1) government-sponsored programs and projects, (2) public-private partnerships in innovation, and (3) OI approaches in innovation.
3. *The Dynamics of Open Innovation in SMEs* by Pooran Wynarczyk (2014) (Routledge, Routledge Studies in Innovation, Organizations, and Technology). This book is written in an academic style and targets academic audience. Increasingly, research and policy attention has come to focus on the SME sector as a key source of new product development, innovation, and suppliers of new technologies. Increasingly, firms are moving away from the “closed innovation paradigm” to a more open way of working in which firms actively collaborate with other companies and institutions. It has been claimed that this new form of collaboration provides access to technologies and facilities that would otherwise take years and major investment to acquire in-house. This “OI” is of great benefit to any company, but is incredibly useful for SMEs in particular. Although OI is receiving more attention in academic research, the existing literature is largely qualitative and focused on the practices of high-technology multinational firms and generally ignores the work being carried out in this area by SMEs. Using a combination of

theory and cutting-edge empirical (quantitative) investigation, the author strives to address this major gap in current literature.

4. *Open Innovation in Family Firms* by Pickert Michael (2015). This is an interesting book focusing on the particular topic of how two different and simultaneously active generations influence the OI activities in family businesses. The book provides a literature review on the topics of family firms, generations in family firms, and OP, and it combines these topics as far as possible. The empirical work is based on semistructured interviews with family members and nonfamily members, who are responsible for the OI activities in different companies. The interviews generate new insights about the influence of multiple generations in family firms on OI, and practical insights are compared to the theoretical assumptions of the literature review. The main result is that OI is fostered by two simultaneously active generations in family firms. Typical restrictions for undertaking OI activities are the financial restrictions and the fact that managers in family firms do not understand the potential of OI.
5. *Open Innovation for Manufacturing in Small and Medium Enterprises: Open Innovation in SMEs* by Christelle Kasende (2017). This book describes how manufacturing SMEs without R&D department in South Africa can innovate with less resources. It also describes how they can overcome problems that are affecting their long-term success and survival. One of the solutions proposed is the adoption of open innovation strategy (OIS). The book shows that an OIS in SMEs with fewer resources can be effective to help SMEs achieve their goals and create sustainable competitive advantage in the market. OIS also implies internal and external resources sharing with employees, other SMEs, large firms, and other stakeholders such as customers and suppliers. This strategy requires changes in the company's organizational structure and encourages employees' empowerment, motivating factors, and developing program to reward innovative employees. From SMEs to corporation managers, this book

provides management guidance on becoming innovative with fewer resources. It can also be very useful for startups as it streamlined the way such structures can tap their most important resources, employees, to innovate and survive as novice in a competitive market.

6. *Managing Open Innovation in SMEs* by Wim Vanhaverbeke (2017, Cambridge University Press). In line with the previous book, this provides a practical guideline for entrepreneurs and SME managers on how they can innovate better and faster with less resources through OI in networks of partners. The challenge is to manage the partners in such networks.

Most small firms face a harsh business environment through increased global competition. Various factors including changing market conditions or new regulations force them to reinvent their business through new technologies or novel value propositions. As small companies have insufficient financial resources and technical competencies to develop technology in-house, they have to innovate in collaboration with external partners — suppliers, customers, research labs and universities, large companies, or networks of other SMEs. However, OI is not yet a common practice in small firms, and although innovation is imperative for most European SMEs, few understand how to benefit from innovating through partnerships. There is an urgent need to understand how entrepreneurs can organize OI.

This book studies how OI can be managed and implemented in SMEs, including a framework to implement OI strategies successfully. Managing OI in small companies is actually quite specific, and we have to reinvent OI to make it useful for entrepreneurs in small firms; therefore, the book pays a lot of attention to the role of the entrepreneur, and the integration of strategy, business model changes, and OI. The book provides an in-depth analysis of OI practices in small enterprises based on rich case studies from successful European firms. The result is a set of practical guidelines for entrepreneurs at the end of each chapter.

Innovation is usually associated with high-tech industries and top-notch technology. In contrast, most of the companies studied in this book are examples of low-tech or medium-tech industries — bicycle parts, quilts and pillows, chemical treatment of textiles, barometers, radiators, etc. They are representatives for the majority of the European SMEs. Innovation and OI in these industries are not about inventing new technologies or pushing the technological frontier, but it boils down to find interesting applications of existing technologies. All cases show value chain partners are important for OI, but OI connects SMEs with new partners from completely different industries. Take for instance Quilts of Denmark that succeeded in developing the first functional quilt with technology originally developed by NASA. Applying technologies in a new industry context requires a lot of applied technology development, which becomes over time a valuable asset for the innovating SMEs, and allows them to transform the company into a complete new business.

The book focuses in three main topics: the first half is about the OI networks among SMEs in low-tech and medium-tech industries; the second part explains how small firms (high-tech) can team up with large companies; and, finally, attention is paid to the potential role of intermediaries that have customized their services for innovating SMEs to facilitate OI activities in the latter.

1.5. Future Research Avenues

The purpose of this chapter has been to provide a systematic review of the literature on OI in SMEs with a particular focus on describing the most prevalent research themes in this field and setting the stage for subsequent chapters in this book. Our analysis shows that authors' attention has turned toward the OI efforts of SMEs (besides large companies) most notably in the last five years. Since then we have witnessed a growing number of publications in journals such as *Technovation* and *IJTM* as well as an increasing number of citations to these works. Based on both qualitative and quantitative research

methodologies, the authors have particularly explored how SMEs adopt OI practices and how these ways differ from those of large firms as well as the important role of effective networking in SMEs' OI performance. Our analysis suggests several themes for further investigation.

With respect to research methods and settings, our review shows that most studies so far have been of an exploratory nature, making it difficult to generalize results across larger populations of SMEs. While these existing studies and the insights they generate are highly valuable, future (multidisciplinary) investigations will need to quantitatively test hypotheses in larger, longitudinal datasets on the OI practices of SMEs. Besides successful OI implementation cases, we will also need to study failure cases for useful lessons to be retrieved. For example, cases of entrepreneurial OI ecosystems where SMEs successfully function as orchestrators and manage to create self-sustaining networks need to be compared and contrasted to ecosystems that disintegrate once the SME orchestrator exits the ecosystem. Which OI skills are found in SMEs being part of the first type of ecosystem versus the latter? Furthermore, our review shows that OI in SMEs is mostly studied within the context of developed (Western European) economies. Governments of developing nations in, for example, Asia and Africa are also in need of insights with respect to how best to stimulate OI in local SMEs and how to develop effective facilitating policies.

With respect to research topics addressed, this chapter shows that, while the role of networking has received significant attention so far, there is still much need for additional insights within this theme. Specifically, research needs to shed light on how SMEs can secure valuable OI network positions and how they can become effective orchestrators of their OI relationships. Relationships with large OI partners seem to present unique challenges to SMEs (most notably related to IP management), requiring knowledge on the types of management skills SMEs would need to coordinate these partners well. Finally, considering the lack of financial resources within most (nonfamily-owned) SMEs, research is needed on the role of venture capitalists, business angels, as well as public support funds in stimulating the OI performance of SMEs.

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