

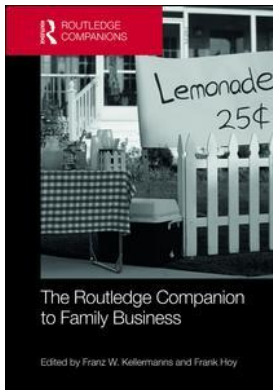
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OPEN INNOVATION

A Literature Review and Recommendations for Family Business Research

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and Martin Carree*

Keywords: Open innovation, Small- and Medium-sized Enterprises, Family Firms

Introduction

By exchanging core organizational resources with their environment and renewing social interactions within and outside the family, family firms are able to build and sustain competitive advantage over many generations (Arrègle et al. 2007; Salvato and Melin 2008). Nevertheless, how the relational resources and capabilities of family firms can facilitate their innovation performance has not received much attention in our field (De Massis, Frattini, and Lichtenthaler 2013). In line with Duran et al. (2015) we believe that the opportunities residing within the networks of family firms may help explain why family businesses achieve similar or even higher innovation output compared to nonfamily firms, despite their structurally lower investments in innovation (Carney et al. 2015). We propose that valuable new insights can be obtained by applying concepts from the open innovation literature (e.g., Chesbrough 2003; Dahlander and Gann 2010) to the empirical context of family firms. As family ownership is more prevalent and more likely to affect goal setting and firm behavior among smaller, mostly private businesses than in large public corporations (Carney et al. 2015), a thorough review of open innovation in the context of small- and medium-sized enterprises (hereafter SMEs) is executed. Supplemented with the knowledge so far developed by the few family firm specific open innovation studies, this review should provide a solid base for future research on open innovation in family firms.

This chapter is structured as follows: To introduce the reader to the concept of open innovation, in *Section 2* we will commence with a brief discussion of its definition, theoretical origins, and its main dimensions. Subsequently, in *Section 3* we review the general SME literature on the opportunities and challenges that open models of innovation bring about, after which in *Section 4* we discuss the effect family involvement may have on open innovation and delineate questions for further research within the family business field.

Open Innovation

From a 'Closed' to an 'Open' view: A New Innovation Paradigm Emerges

Consistent with a Schumpeter Mark II view on the origin of innovations (Schumpeter 1942), the strategic management and innovation literature has traditionally approached the

development of new products and processes as an inherently closed process. Each predominantly large organization conducts its own research and development (hereafter R&D) and uses the produced knowledge to develop and commercialize its own products, services or processes. However, more in line with the earlier ideas of Schumpeter (1934), many business scholars recognize that valuable ideas and technologies may originate outside the boundaries of large corporations and actually reside within smaller companies (Acs and Audretsch 1988), public research institutions (Lee 1996), business clients or end users (Von Hippel 1986). Aggregating these findings, Chesbrough (2003) observes that more often than not, large technology companies closely monitor and source their external environment for emerging ideas or technologies. Also, these businesses are actively looking for external opportunities for valorizing their own knowledge. As such, they use “*purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation*” (Chesbrough, Vanhaverbeke, and West 2006, 1). This broad scope of interaction with external parties in the innovation process is coined ‘open innovation,’ and is, hence, offset against the traditional ‘closed’ view elaborated before (Chesbrough 2003; Chesbrough, Vanhaverbeke, and West 2006; Gassmann 2006).

In his initial work, Chesbrough (2003) integrates ideas from various well-established streams of business research, such as the literature on strategic alliances (e.g., Hagedoorn and Duysters 2002; Hamel 1991; Mowery, Oxley, and Silverman 1996; Narula and Hagedoorn 1999), research on user innovation (Von Hippel 1986), the absorptive capacity literature (Cohen and Levinthal 1990; Zahra and George 2002), literature on knowledge spillovers (Jaffe, Trajtenberg, and Henderson 1992), collaboration networks (Ahuja 2000), the notion of dynamic capabilities (Teece, Pisano, and Shuen 1997) as well as the seminal work of David Teece on why some firms profit from innovation and others do not (1986). Furthermore, in line with the resource-based view of the firm (Barney 1991; Wernerfelt 1984), Chesbrough (2003) acknowledges each firm to possess a unique combination of resources. However, he deviates from the mostly inward focused perspective of the resource based view, which poses the isolated ownership of valuable, rare and inimitable resources to be the source of superior firm profitability. Rather, the focus shifts to the lack of certain essential resources needed in the innovation process of the focal firm. Consequently, acquiring these resources externally to enhance one’s own innovation process serves as a key strategy for securing the competitiveness of the firm (Chesbrough and Appleyard 2007).

Inbound and Outbound Open Innovation

Open innovation can be classified along two broad dimensions. Inbound open innovation refers to the acquisition of external knowledge to enhance the internal innovation process and complement internal R&D (Chesbrough and Crowther 2006; Huizingh 2011). Examples of activities involving inbound open innovation are formal arrangements such as acquisitions, joint ventures, inward licensing of intellectual property or contracting knowledge workers of other organizations (Gassmann, Enkel, and Chesbrough 2010), or less formal actions such as involving suppliers, business clients or lead-users in the front-end of the innovation process (Gassmann, Sandmeier, and Wecht 2006). Outbound open innovation refers to the transfer and subsequent commercialization of knowledge, technology or other resources developed in-house through external channels (Chesbrough and Crowther 2006). Examples of outbound open innovation activities are the patenting and subsequent outward licensing of intellectual property, strategic divestments and the creation of spin-off firms (Chesbrough 2003; Enkel, Gassmann, and Chesbrough 2009; Huizingh 2011).

Opening Up the Innovation Process Across Business Contexts

The open innovation paradigm initially centered on the behavior of big firms in high-tech industries. For instance, all examples used by Chesbrough in his initial work (2003) to illustrate the open innovation model are of high-technology firms in industries such as the pharmaceutical industry (Millenium/Takeda), computer hard- and software (IBM) and the semi-conductor industry (Intel). Though the vast majority of open innovation research still is conducted in the empirical context of large, high-tech firms (cf. West and Bogers 2014), the application of the open innovation paradigm is slowly extending towards different business contexts and industries. To add external validity to the open innovation model, scholars have studied the application of open innovation practices in (mostly large) firms in more mature and traditional industries (e.g., Chesbrough and Crowther 2006; Chiaroni, Chiesa, and Frattini 2011; Spithoven, Clarysse, and Knockaert 2011). A general observation is that, following the high-tech sectors, also firms in traditional industries are adopting a more open model of innovation (Chesbrough and Crowther 2006; Chiaroni, Chiesa, and Frattini 2011). Interestingly, whereas high-tech firms mostly search for complementary technologies, firms from mature industries seem to open their innovation process predominantly to access external market knowledge (Grimpe and Sofka 2009).

Also small and medium-sized enterprises have increasingly adopted open innovation models, as shown by an exploratory study by Van de Vrande et al. (2009). Although in absolute terms SMEs engage in fewer open innovation activities, these firms are more 'open' than larger corporations if one considers relative figures (Spithoven, Vanhaverbeke, and Roijakkers 2013). SMEs actively involve customers, suppliers and other members of their external network in the innovation process. Mostly, SMEs engage in open innovation for market related motives, for example to reach niche customers or to increase their market share (Lee et al. 2010; Van de Vrande et al. 2009). However, technology sourcing may also be attractive to SMEs. As resource and cognitive limitations may inhibit conducting the complete innovation process in-house, SMEs may not have any other choice than to incorporate external knowledge and technology in the development of new products. These pressures are especially salient when SMEs are active in markets characterized by high technological complexity and radical product changes (Dahlander and Gann 2010; Pullen et al. 2012). Other authors studying open innovation in an SME context corroborate these findings and establish open innovation as a highly interesting model to pursue for SMEs, as it will enable these companies to overcome the 'smallness' liabilities that present barriers to innovate for them (e.g., Colombo, Piva, and Rossi-Lamastra 2014; Parida, Westerberg, and Frishammar 2012; Wynarczyk, Piperopoulos, and McAdam 2013). However, some scholars maintain a critical stance and argue that in certain contexts open innovation may not be a valid strategic choice for SMEs (e.g., Oakey 2013). Next we will review the literature on open innovation in SMEs, to shed further light on why, when and how (family and nonfamily) SMEs may profit from opening up their innovation process.

Open Innovation in SMEs: Opportunities and Challenges

The reviewed literature on open innovation in (family) SMEs was obtained by executing the following steps early 2015: First of all we retrieved the majority of sources by searching for a combination of the terms 'open innovation,' 'openness' or 'opening' on the one hand and 'small medium enterprises,' 'SME,' 'small,' 'medium' or 'family' on the other, in Google Scholar and ISI Web of Knowledge. Second, a screening of an extensive range of peer-reviewed journals was performed. These journals were included as leading family business, strategic management, entrepreneurship and innovation journals in Anne-Will Harzing's Journal Quality List (2014)

and/or identified as prominent 'open innovation outlets' by Dahlander and Gann (2010, 701). The selected journals can be found in the notes accompanying Table 12.1. Third and final, we employed a 'snowballing approach,' in which we browsed the reference lists reported in the studies obtained through the first two steps for further useful sources. The main characteristics and contributions of the final set of 32 reviewed studies are summarized in Table 12.1.

The key findings in the literature will be integrated and discussed with respect to the merits of collaborating with other organizations in the innovation process and specific opportunities for inbound and outbound open innovation activities. Additionally, we will discuss the main hampering factors experienced by SMEs in implementing a more open innovation model. The reader will notice that most SME studies in our review do not explicitly distinguish family from nonfamily firms in their respective samples (see the second column of Table 12.1). However, based on our extensive knowledge of the presence of family firms among SMEs in most economies (e.g., Astrachan and Shanker 2003; Flören 1998; Klein 2000), one can safely assume that the samples used in most of the studies include many family SMEs. Especially big representative survey data sets, such as the Community Innovation Survey data (e.g., Barge-Gil 2010; Laursen and Salter 2006; Spithoven, Vanhaverbeke, and Roijakkers 2013) or data obtained from seemingly representative samples of broad manufacturing industries (e.g., Huang and Rice 2009; Moreno-Menéndez and Casillas 2014; Nieto and Santamaría 2010; Tomlinson and Fai 2013) have been amply proven in family business studies to contain large shares of family firms (e.g., Chrisman et al. 2007; Classen et al. 2014). Therefore, one should keep in mind that in the remainder of this review, when we discuss 'SMEs' we are implicitly talking about family SMEs as well, even if the original authors do not take family involvement into account. The limited number of studies that does explicitly study family firms will be discussed in Section 4 to highlight those aspects of open innovation that are particularly salient for family SMEs. Together, the SME and family SME open innovation literatures provide a solid knowledge base upon which future family business research can build.

Opportunities

The relatively small resource bases inherent to SMEs poses constraints on the internal capacity for developing new products or processes (Hewitt-Dundas 2006). This 'liability of smallness' (e.g., Dahlander and Gann 2010; Parida, Westerberg, and Frishammar 2012; Spithoven, Vanhaverbeke, and Roijakkers 2013) manifests itself in limited access to financial resources (Beck and Demirgüç-Kunt 2006; Carpenter and Petersen 2002), human capital (Madrid-Guijarro, García, and Van Auken 2009) and in general in a lack of organizational structures supporting innovation (Pullen et al. 2009).

Because of increasingly rapid technological change and shortening product life cycles facing many SMEs, their limited research budgets and relatively small pools of research personnel strongly inhibit the capability of these firms to respond fast enough to their changing environment. These limitations may partially be overcome if SMEs broaden their search area for innovative technologies beyond the boundaries of their firm. Actively searching the environment for complementary external knowledge significantly improves innovative performance (Fu 2012; Laursen and Salter 2006; Lee et al. 2010; Nieto and Santamaría 2010; Parida, Westerberg, and Frishammar 2012). In fact, externally sourced knowledge complements internal R&D (Laursen and Salter 2006; Wynarczyk 2013) and as such may enable SMEs to bridge the innovation gap with large firms (Nieto and Santamaría 2010).

Where then should SMEs search for complementary technological knowledge and resources? Recent research indicates that publicly funded research centers, such as universities

Table 12.1 Overview of Literature on Open Innovation in Family and Nonfamily SMEs

<i>Authors (Year)</i>	<i>Explicit Focus on Family Firms?</i>	<i>Goal of Study</i>	<i>Deployed Theories and Theoretical Concepts</i>	<i>Data Used in Study</i>	<i>Key Conclusions of Study</i>
Barge-Gil (2010)	No	To assess the relationship between degree of openness and firm characteristics.	Absorptive capacity	Spanish CIS panel data with 10,875 observations.	Medium-sized firms both have the need and the absorptive capacity to engage in open innovation. Small firms have the need for openness, but lack the absorptive capacity.
Bianchi, Campodall'Orto, Frattini & Vercesi (2010)	No	Providing a practical tool for assessing viable opportunities for out-licensing a firm's technologies.	-	Application of tool to one particular packaging company.	Licensing their technology to other firms presents an interesting alternative to reach the market for SMEs with bounded resources. The authors develop a tool which SMEs can use to see if their technology could be interesting for other firms. Cognitive boundaries make it difficult for small firms to identify alternative applications for their technology. Furthermore, disclosing their intellectual property without losing their technology is difficult for SMEs. Small businesses often have a hard time negotiating a favorable position in collaboration agreements.
Brunswick & Vanhaverbeke (2015)	No	Exploring how SMEs engage in external knowledge sourcing.	-	Sample of 1,411 European SMEs from 7 industry groups.	SMEs that have open innovation relationships with various types of partners show the best innovation performance. Especially deep interaction with direct and indirect customers fosters innovation success. SMEs need to have innovation strategy and development processes in place to facilitate successful open innovation. Also, formal innovation project control mechanisms facilitate the success of open innovation activities.

(Continued)

<i>Authors (Year)</i>	<i>Explicit focus on family firms?</i>	<i>Goal of study</i>	<i>Deployed theories and theoretical concepts</i>	<i>Data used in study</i>	<i>Key conclusions of study</i>
Burcharth & Fosfuri (2015)	No	Test the relationship between institutionalized socialization practices and the negative attitudes towards external knowledge, the so-called not-invented-here (NIH) syndrome.	Social identity theory; Organizational socialization	Survey data on 169 Danish SMEs from medium- to high-tech manufacturing sectors.	Institutionalized socialization processes lead to a more negative stance towards external knowledge. Technologically specialized firms are more positive or open towards external knowledge. Interestingly, in these highly technologically specialized firms, institutionalized socialization processes have a positive effect on the attitude towards external knowledge.
Burcharth, Knudsen & Sondergaard (2014)	No	Assess how the not-invented-here (NIH) and the not-shared-here syndrome (NSH) impact the engagement of SMEs in open innovation practices.	-	Survey data on 331 Danish manufacturing SMEs.	Inbound (through NIH) and outbound (through NSH) open innovation practices are negatively influenced by the attitudes of employees towards the acquisition and sharing of knowledge. The impact of these attitudes can be effectively diminished by using specific types of training programs.
Classen, Van Gils, Bammens & Carree (2012)	Yes	Investigating differences in use of external cooperation partners between family and nonfamily SMEs.	Behavioral theory; Socioemotional wealth; Absorptive capacity	Sample of 167 Dutch and Belgian manufacturing SMEs.	Among SMEs, those with significant family ownership apply less broad search for external resources along various types of partners.

De Massis, Frattini, Pizzurno & Cassia (2015)	Yes	Studying how family firms manage product innovation.	Resource based view; Agency theory; Stewardship theory; Behavioral theory	Multiple case studies, based on data from 10 SMEs: 5 family-owned, 5 nonfamily firms.	Family firms might prefer to set up collaborations with partners (e.g., universities, research centers) that do not involve potential control losses. With suppliers only if strong IP regimes prevent involuntary knowledge spillovers. Horizontal collaboration (i.e., with potential competitors) is not very popular among family SMEs, probably because of potential threats to the family's socioemotional wealth.
Drechsler & Natter (2012)	No	Investigating the drivers of openness.	Absorptive capacity	German CIS data on 2,422 firms.	Factors that prevent firms from opening up are lack of technological and market knowledge, ineffective IP protection and imitation threats. Factors that increase firm openness are the need for financial funding in innovation and effectiveness of a firm's IP protection mechanisms.
Fu (2012)	No	Investigating the moderating effect of open innovation on the relationship between incentive schemes and innovation.	Agency theory	406 British manufacturing and business service firms.	Open innovation can give small firms easier and greater access to (inter)national markets. Actively searching for complementary external knowledge significantly improves innovative output. Several challenges: Risk of losing valuable knowledge. Also, larger budget constraints for SMEs makes that investment in open innovation should go at the expense of internal R&D. Opening up the innovation process brings about high coordination costs. Furthermore, information shortage makes choosing the right partner difficult. Shortage of time and money make open innovation difficult to pursue for SMEs.
Huang & Rice (2009)	No	Testing interaction effects between open innovation strategies and absorptive capacity.	Absorptive capacity	Panel set of 292 Australian manufacturing SMEs.	Openness and incentives act as substitutes in their effect on innovativeness. Technology acquisition alone has negative effects on innovation. Only when accompanied by sufficient absorptive capacity will it benefit SME innovation performance. Networking has strong positive implications for innovation, but only if the SME has sufficient absorptive capacity.

(Continued)

<i>Authors (Year)</i>	<i>Explicit focus on family firms?</i>	<i>Goal of study</i>	<i>Deployed theories and theoretical concepts</i>	<i>Data used in study</i>	<i>Key conclusions of study</i>
Kodar, De Massis, Frattini, Bianchi & Fang (2013)	Yes	Capturing the impact of behavioral considerations on the technology acquisition decisions of family and nonfamily firms.	Behavioral theory	Panel data set on 1,540 companies in 20 Spanish manufacturing industries.	There is a negative relationship between technology acquisition and family management. External acquisition of technology forces family managers to give up part of their discretionary control over innovation trajectories, which they do not want. Among family firms, the effect of negative performance aspiration gaps on external technology acquisition is smaller than among nonfamily firms. The acquisition of external technology is more attractive for family firms when their technology can be protected by means of intellectual property rights.
Lasagni (2012)	No	Investigating the role of external relationships in small business innovativeness.	Absorptive capacity	490 SMEs from six European countries.	Active relationships with suppliers and users enhance innovation. Also, relationships with research institutes are proven to be effective.
Laursen & Salter (2006)	No	Linking search strategy, in terms of search depth and breadth, to innovative performance.	Absorptive capacity	CIS survey data on 2,707 UK manufacturing firms.	External information can complement knowledge created through internal R&D. Collaborating with multiple partners is beneficial for innovation outcomes. Also, the strength of the collaborations determines innovative performance. There are both an optimal depth and breadth of collaborative ties. Too many ties and too deep relationships cause over-complexity and over-embeddedness.
Lecocq & Demil (2006)	No	Investigating an open innovation system in a low-tech setting.	-	Data on 193 companies playing a role in the tabletop role-playing game industry.	The core of a business model may be already developed by incumbents. Through that, entry barriers in an industry can be significantly lower if a company decides to join an open innovation system. New/small firms therefore do not have to build the core technology themselves if they join an open innovation system.

Lee, Park, Yoon & Park (2010)	No	Developing understanding of open innovation in the SME context and to suggest the input of a network intermediary in facilitating innovation.	-	Survey data from 2,743 Korean SMEs and larger firms.	Networks of collaborating SMEs generate shorter time-to-market of innovative ideas, because firms can focus on activities that lie closest to their core. Furthermore, market uncertainty can be reduced by effective networking. Also, collaboration may enhance the creation of other innovative ideas. Networking gives access to much needed external financial and human capital. Allying with network intermediaries enhances innovation opportunities.
Moreno-Menéndez & Casillas (2014)	No	Studying the relationship between open innovation and internationalization.	Network theory; Resource based view	Sample of 424 Spanish manufacturing SMEs.	High transaction costs are named as the biggest network-challenge for SMEs. Imitation of valuable technological assets is a risk when engaging in open innovation. Open innovation is instrumental to internationalization, because it requires firms to develop internal capabilities for managing international relationships. International innovation networks give access to foreign contacts, and international opportunities.
Nieto & Santamaria (2010)	No	Analyzing how collaboration serves as an important innovation input factor for SMEs.	-	Panel data set containing data on 1,300 Spanish manufacturing firms.	Technological collaboration allows SMEs to bridge the innovation gap with large firms. Specifically regarding product innovation, collaboration is a key input. Working with vertical partners is especially crucial for performance.
Nieto, Santamaria & Fernández (2015)	Yes	Examining the innovation behavior of family firms.	Resource based view; Agency theory	Unbalanced panel data set of Spanish manufacturing firms containing 15,173 observations.	Family firms are less prone to engage in technological collaboration to access external resources, suggesting that certain aspects of family influence may hinder opening up innovation.

(Continued)

<i>Authors (Year)</i>	<i>Explicit focus on family firms?</i>	<i>Goal of study</i>	<i>Deployed theories and theoretical concepts</i>	<i>Data used in study</i>	<i>Key conclusions of study</i>
Oakey (2013)	No	Relating the open innovation concept to the context of high-tech SMEs.	-	Conceptual study.	Open innovation may not fit with the confidentiality required in the development of high-technology small firms. As such, not engaging in open innovation may also be a valid strategic choice.
Padilla-Meléndez, Del Aguila-Obra & Lockett (2013)	No	Exploring the role of social capital in enabling knowledge transfer and exchange between higher education institutions and spin-off SMEs.	Social capital	18 in depth semi-structured interviews and a semi-structured questionnaire.	Knowledge transfer and exchange is an attractive option for SMEs to gain access to new technologies. SMEs are often not aware of developments in universities and other research organizations, resulting in missed opportunities. Ensuring formal agreement on expectations concerning partners' behavior and commitment is vital.
Parida, Westerberg & Frishammar (2012)	No	Investigating the effect of four open innovation activities on innovation performance of SMEs.	Absorptive capacity	Survey data from 252 Swedish high-tech SMEs.	Scouting technology externally helps SMEs in pursuit of radical innovation. Depending on the type of innovation pursued, horizontal and/or vertical collaboration enhance innovative performance. SMEs suffer from their smallness in the sense that it imposes constraints on resources and capabilities.
Pullen, Weerd-Nederhof, Groen & Fisser (2012)	No	Building on configuration theory, this paper examines multiple network relationships simultaneously in relation to innovation performance.	Configuration theory	Survey data on 60 SMEs in the Dutch medical devices sector; triangulated with 50 interviews.	The most successful innovators serve as suppliers to distributors rather than selling directly to end consumers. Complementarity within an NPD network is the most important prerequisite for successful innovation. A key challenge is to retain a business-like approach to networking. The best performing innovators have a relatively closed NPD networking approach.

Roper & Hewitt-Dundas (2013)	No	Exploring the open innovation catalyzing function of publicly funded R&D centers.	Absorptive capacity	Monitored data on the external connections of 18 R&D centers.	Publicly funded research centers offer relatively open access to new knowledge and as such may enhance innovation opportunities for SMEs. A high need exists to ensure the fit between the research focus of publicly funded R&D centers and the needs of smaller firms.
Spithoven, Vanhaverbeke & R.oijakkens (2013)	No	Exploring how SMEs and larger firms differ in their use of open innovation practices, and the extent to which these firms benefit from open innovation practices.	-	CIS data from 967 Belgian innovative firms.	SMEs benefit more from the use of protection mechanisms than larger firms; perhaps they patent more efficiently, or only the innovations with the greatest market potential. Open innovation activities contribute to relative revenues from new products only for smaller companies, corroborating the view that SMEs depend more on networking. SMEs do not have enough financial and human resources to systematically search their environment for relevant external knowledge and benefit less from external search. SMEs generate fewer marketable products from their open innovation initiatives than larger firms.
Theyel (2013)	No	Assessing the adoption of open innovation practices during different value chain activities.	Resource based view; Dynamic capabilities; Value chain perspective	Survey data on 293 US manufacturing SMEs.	Opportunities for collaboration exist across all value chain activities. Not all forms of collaboration positively relate to innovation performance. Rather, it depends on partner choice (i.e., supplier or customer). Also, it may depend on the mode of collaboration (in terms of value chain activity). Cooperation with suppliers enhances product and process innovation. Cooperation with buyers enhances product innovation. Horizontal collaboration does not affect innovative performance.
Tomlinson & Fai (2013)	No	Conducting a broader measurement of SME co-operation to capture the multi-scalar and multi-dimensional nature of cooperation	Absorptive capacity	Survey data on 371 UK manufacturing SMEs.	In spite of the potential gains from cooperative innovation efforts, SMEs may shy away from them because the inherent difficulties of nurturing such relationships

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<i>Authors (Year)</i>	<i>Explicit focus on family firms?</i>	<i>Goal of study</i>	<i>Deployed theories and theoretical concepts</i>	<i>Data used in study</i>	<i>Key conclusions of study</i>
Vahter, Love & Roper (2014)	No	Exploring whether and how the benefits of openness in innovation are different for small firms compared to medium and large ones.	Absorptive capacity	Panel data set on Irish manufacturing firms, containing 3842 observations.	Although SMEs have fewer linkages than large firms, innovative linkages contribute more to innovative sales for SMEs than for larger firms. SMEs thus seem to have more to gain from collaboration than larger firms. There is an optimal amount of linkages, too few will offer limited opportunities, too many will result in too high coordination costs. This limit is reached earlier by SMEs than by large firms.
Van der Meer (2007)	No	Descriptive analysis of adoption of open innovation in Dutch industry.	-	Survey data from 814 Dutch firms.	The biggest challenge lies in the flexible and open way of handling business models. Many SME entrepreneurs recognize their 'normal' way of thinking in open innovation principles.
Van de Vrande, Vanhaverbeke & De Rochemont (2009)	No	Investigating if open innovation practices are also applied by SMEs, and identifying motivations and hampering factors concerning the engagement in open innovation activities.	-	Survey data on 605 innovative Dutch manufacturing SMEs.	SMEs are increasingly adopting open innovation approaches. Market-related motivations (such as better serving existing customers and opening up new markets) are the biggest motivation for SMEs to open up their innovation process. Customers form a fertile ground for innovative ideas. Informal open innovation practices such as customer involvement and networking are less capital intensive and as such particularly interesting for resource-constrained SMEs. Especially in the pursuit for external technology, SMEs find it difficult to connect with reliable and qualitatively sound partners. Dealing with increased external contacts presents SMEs with a number of organizational and cultural issues. Uncommitted employees and resistance to change are also often mentioned as hampering factors.

Vanhaverbeke, Vermeersch & De Zutter (2012)	No	Research report on how SMEs and start-ups can benefit from open innovation strategies.	-	Multiple case-studies on 10 SMEs from Belgium, Denmark, and the Netherlands.	Collaboration seems particularly likely to happen with the SME's value chain partners. Cooperation with technology partners is less common among SMEs. In changing their business model, SMEs need to rely on innovation partners. IP management in partnerships is important to avoid tensions in the network. In order to capture maximum value from collaborative innovation, SMEs need to organize themselves internally to learn from their partners.
Wincent, Anokhin & Boter (2009)	No	Studying how boards of open innovation networks should be organized in order to enhance the innovative status of network participants.	-	Longitudinal data on 53 Swedish strategic small-firm networks.	Networks of collaborating SMEs may appoint network boards. These boards are most effective at either low or high rates of member renewal.
Wýnarczyk (2013)	No	Assessing the impact of open innovation practices on the innovation capability and export performance of SMEs.	Absorptive capacity	Survey data on 64 UK science and technology based SMEs.	Open innovation significantly predicts SME export performance. Open innovation complements R&D in achieving international competitiveness. SMEs lack knowledge and awareness of external opportunities.

Note: Several studies that specifically focus on (open source) software SMEs (e.g., Colombo, Piva, and Rossi-Lamastra 2014; Gruber and Henkel 2006) are neither included in the summary table, nor in the review of challenges and opportunities. Though certain common principles apply, the empirical context is too different from the more traditionally operating SMEs that are typically family owned. The following journals were included in the literature search: *Academy of Management Annals*, *Academy of Management Journal*, *Academy of Management Review*, *Administrative Science Quarterly*, *California Management Review*, *Creativity and Innovation Management*, *Economics of Innovation and New Technology*, *Entrepreneurship and Regional Development*, *Entrepreneurship Theory and Practice*, *Family Business Review*, *Industrial and Corporate Change*, *Industry and Innovation*, *International Small Business Journal*, *International Journal of Entrepreneurial Behavior and Research*, *International Journal of Technology Management*, *Journal of Business Venturing*, *Journal of Engineering and Technology Management*, *Journal of Innovation Management*, *Journal of Family Business Strategy*, *Journal of Management Studies*, *Journal of Management*, *Journal of Product Innovation Management*, *Journal of Small Business Management*, *Management Science*, *MIT Sloan Management Review*, *Organization Science*, *R&D Management*, *Research Policy*, *Research-Technology Management*, *Small Business Economics*, *Strategic Management Journal*, *Strategic Organization*, *Technovation*.

and polytechnics, offer relatively open and low-cost access to new knowledge and as such may enhance the innovation opportunities for some SMEs (Lasagni 2012; Padilla-Meléndez, Del Aguila-Obra, and Lockett 2013; Roper and Hewitt-Dundas 2013). Other inbound open innovation opportunities for SMEs can be found across the firm's value chain partners (Theyel 2013). First, looking upstream, suppliers offer a fertile ground for innovative ideas, for example concerning product design or streamlining of production processes (Lasagni 2012; Tomlinson and Fai 2013). Second, downstream relationships may offer cheap yet very effective advice for SMEs on how to improve their products. Indeed, actively involving customers in the development of new products positively affects the innovation performance of SMEs (Brunswick and Vanhaverbeke 2015) and increases the revenues generated from new and improved products (Tomlinson and Fai 2013). In sum, vertical partners are a great source of performance-enhancing external knowledge (Nieto and Santamaría 2010; Parida, Westerberg, and Frishammar 2012) and are more likely to be used as such by SMEs than (horizontal) competitors (Vanhaverbeke, Vermeersch, and De Zutter 2012). However, even collaboration with competitors may succeed. Networks of collaborating SMEs function best when intermediaries act as brokers between potential innovation partners (Lee et al. 2010) and a group level governance structure mitigates misappropriation concerns (Wincent, Anokhin, and Boter 2009).

Smallness liabilities faced by SMEs do not only create difficulties regarding the development of technologies. In general having limited market power and few marketing resources (Knight 2000) and relatively narrow cognitive boundaries (Bianchi et al. 2010), SMEs also have a hard time finding commercial applications for their internally developed technologies, which significantly deters their innovation potential (Hewitt-Dundas 2006). Moreover, even if opportunities are identified, due to time and resource constraints exploiting proprietary technologies through the in-house development of new products based on these technologies is often hard for SMEs (Bianchi et al. 2010).

Through strategically pursuing outbound open innovation activities, SMEs may find applications for their technologies by using more effective external pathways to the market, which require fewer resources to be invested (Bianchi et al. 2014). Moreover, by allowing commercialization of the firm's knowledge outside its boundaries, redundant or otherwise unused technologies can be taken off the shelves and generate additional profits. Following this reasoning, utilizing external market opportunities is a dominant motivation for SMEs to open up their innovation process (Van de Vrande et al. 2009). Rightly so, as the time-to-market for innovative ideas can be significantly reduced by effective networking (Lee et al. 2010), and (international) markets can be accessed easier and to a larger extent by connecting with the right innovation partners (Fu 2012; Moreno-Menéndez and Casillas 2014; Wynarczyk 2013).

In a similar vein, the typically specialized knowledge of SMEs may be leveraged by connecting their niche technologies to business models of which the core has already been developed by industry incumbents, thereby allowing for synergies and significantly lowering the entry barriers in new industries (Lecocq and Demil 2006). By acknowledging that the full internal development of products may be unfeasible and subsequently joining such systems of open innovation, SMEs can focus on the activities that lie closest to their core and the overall innovation process is more resource efficient (Lee et al. 2010). As a viable mode of external commercialization, Bianchi et al. (2010) propagate the strategic out-licensing of proprietary technology and develop a practical tool which SMEs can use to assess the external uses of these technologies. Although Bianchi et al. (2010) stress the difficulties SMEs seem to encounter in finding external applications for their technologies, encouraging findings by Spithoven, Vanhaverbeke, and Roijakkers (2013) show that SMEs profit to a larger extent from their patented technologies.

Challenges

If both the external sourcing of complementary technologies and the external commercialization of proprietary technology offer ample potential benefits, why are some SMEs still hesitant to open up their firm's boundaries? Throughout the literature studied for this review, a number of common themes resonate, together capturing the main challenges and hampering factors experienced by SMEs in the implementation of a more open model of innovation. First, cognitive boundaries imposed by limited financial, managerial and network resources make that SMEs often lack the knowledge and awareness of external opportunities (Drechsler and Natter 2012; Spithoven, Vanhaverbeke, and Roijackers 2013; Wynarczyk 2013), both residing within the business environment (Bianchi et al. 2010; Van de Vrande et al. 2009) and at universities and other knowledge institutes (Padilla-Meléndez, Del Aguila-Obra, and Lockett 2013; Roper and Hewitt-Dundas 2013). Second, and related to this lack of awareness and information, comes the difficulty SMEs experience in choosing partners of appropriate quality (Fu 2012). Third, reliability of partners is sometimes hard to assess prior to establishing the partnership (Van de Vrande et al. 2009). The risk of involuntarily losing their valuable intellectual property (Bianchi et al. 2010; Drechsler and Natter 2012; Fu 2012) and consequently the risk of imitation of their technology by competitors (Lee et al. 2010) may be a justifiable reason for SMEs not to engage in collaborative innovation initiatives (Oakey 2013). Fourth, SMEs need to have certain formal innovation- and development structures and processes in place (Brunswick and Vanhaverbeke 2015; Van de Vrande et al. 2009) to secure sufficient absorptive capacity for assimilating the additional knowledge inflow (Barge-Gil 2010; Huang and Rice 2009). These required organizational structures may pose too much of a burden on resource-constrained SMEs. Fifth, the transaction and coordination costs involved in maintaining and controlling open innovation ties are often perceived as very high (Fu 2012; Lee et al. 2010; Padilla-Meléndez, Del Aguila-Obra, and Lockett 2013), and sometimes judged to outweigh the benefits of increasing the SME's openness (Tomlinson and Fai 2013). Indeed, research shows that there are both an optimal number of open innovation partners and an optimal 'depth' of the relationships with these partners; too many ties will create over-complexity, whereas too 'deep' ties may result in over-embeddedness (Laursen and Salter 2006). These findings are confirmed by Vahter, Love, and Roper (2014), who also show that this 'optimal number' of ties is lower for SMEs than for larger firms, as SMEs have too little managerial capacity to handle bigger portfolios of open innovation partners. Sixth and last, both towards the inflow of external knowledge (labeled the not-invented-here syndrome) and the outflow of internally developed knowledge (the not-sold-here virus) organizational members of SMEs often take on a negative attitude (Burcharth and Fosfuri 2015; Burcharth, Knudsen, and Søndergaard 2014). This negative attitude forces SMEs to shy away from open innovation activities (Burcharth, Knudsen, and Søndergaard 2014), which supports the observation by Van de Vrande et al. (2009) that uncommitted employees and a general resistance to change are among the top factors hampering the successful implementation of a more open model of innovation.

To conclude, our discussion of opportunities and challenges elicits several factors that shape the degree to which SMEs apply and profit from open innovation activities. These factors either affect the desirability of using open or closed innovation strategies or relate more to the ability to do so, as we visualize in the matrix in Figure 12.1.

The desirability of adopting an open innovation model is increased by prospects of easier market access and a shorter time-to-market, as well as shortening product life cycles or the possession of technology which is not used internally and may thus be commercialized externally. On the other hand, internal resistance to both the adoption of external knowledge and the sharing of own ideas, and the risk of involuntary knowledge spillovers decrease the desirability

	Factors affecting ability	Factors affecting desirability
Factors favoring open innovation	Limited internal research budgets Limited internal research personnel Specialized knowledge and technologies (Family) social capital*	Decreasing product life cycles Easier market access Shorter time to market No internal use for technologies Desirability of connectedness*
Factors favoring closed innovation	Limited awareness of open innovation opportunities Lack of supporting organizational structures for open innovation Limited diversity in management*	Not-invented-here and not-sold-here attitudes Risk of involuntary knowledge spillovers Protection of control and broader socioemotional wealth*

* = Additional factors argued to be more important for family firms

Figure 12.1 Factors Affecting Open Innovation in (Family) SMEs

of open innovation models. The desire to pursue either a closed or an open innovation model is however not a sufficient condition for successful implementation of the chosen approach. Certain capabilities are essential to the feasibility and effectiveness of either innovation model (Lichtenthaler and Lichtenthaler 2009). The possession of certain resources or capabilities (e.g., niche technologies and highly specialized knowledge), or the lack of those (e.g., limited internal research budgets and personnel bases) are factors that push SMEs towards more open models of innovation. Conversely, the ability to engage in open innovation activities is negatively affected by other factors (e.g., the lack of awareness of open innovation opportunities and supporting structures), thus advocating a relatively closed innovation strategy.

Barge-Gil (2010) illustrates the tensions that may arise between issues of ability and desirability. His findings suggest that although both small and medium-sized companies have a need for a fairly open innovation model, the smallest firms may lack certain abilities to incorporate external knowledge in their innovation process and therefore find it difficult to increase their openness relative to medium-sized firms. However, the aggregate findings of Barge-Gil (2010) do not explain why for so many smaller firms open innovation seems to come as a second nature (Van Der Meer 2007; Vanhaverbeke, Vermeersch, and De Zutter 2012). SMEs are heterogeneous in the innovation trajectories they wish to follow (e.g., Mangematin et al. 2003) and the nature of the innovations they pursue (i.e., radical or incremental innovation; process or product innovation, see for example Massa and Testa 2008). Hence, abilities and desires may play out differently among different SMEs. Future studies may therefore aim to disentangle the highly heterogeneous population of SMEs and investigate which characteristics of these firms facilitate proper alignment of desirability and ability regarding the implementation of open innovation models.

A commonly identified source of SME heterogeneity is the presence or absence of a dominant business family, which may bring about various strategic implications (Habbershon and Williams 1999). We believe that family involvement in the business, which may manifest itself through family ownership, family management or less formal channels of influence on strategic behavior (Astrachan, Klein, and Smyrniotis 2002), affects various aspects of open innovation. In the final section, we will therefore assess the current state of our knowledge on the impact of family involvement on the openness of SMEs and integrate this knowledge in the broader context of technological innovation in family SMEs, thereby identifying several broad opportunities for future research.

Family Influence on Open Innovation: Terra Incognita

Current Knowledge

The knowledge base regarding the effect of family involvement on a firm's open innovation activities is rather limited (cf. De Massis, Frattini, and Lichtenthaler 2013). This is remarkable, since family firms are renowned for their highly idiosyncratic relationship building- and maintenance skills (Arrègle et al. 2007; Cennamo et al. 2012), suggesting that these businesses may have access to a very specific array of open innovation opportunities. Sirmon and Hitt (2003) propose that the rich social capital of business families, together with their patient capital and transgenerational outlook allows family firms to derive more value from their cooperative behavior. The stewardship characteristics of family businesses further increase the desirability of building connections with external stakeholders (Miller, Le Breton-Miller, and Scholnick 2008). Moreover, ample research has established that family businesses, both publicly traded organizations and private SMEs, systematically invest fewer financial resources in R&D compared to firms without family ownership (Block 2012; Carney et al. 2015; Chrisman and Patel 2012; Classen et al. 2014). Family firms may thus be at a disadvantage when it comes to autonomously generating sufficient innovative output to secure the long-term, transgenerational family involvement which so often is at the heart of their strategic interests (Le Breton-Miller and Miller 2006; Lumpkin and Brigham 2011; Lumpkin, Brigham, and Moss 2010; Zellweger et al. 2012). To secure their long-term existence, family businesses may therefore have to rely more on collaborative innovation modes than their nonfamily counterparts.

The studies conducted till thus far unanimously focus on the search and acquisition of external (technological) resources to enhance the internal innovation process, in line with the inbound dimension of open innovation. Contrary to the motivations outlined before, common findings are that family firms search and acquire external technological resources to a lower extent than firms without significant family involvement (Classen et al. 2012; Kotlar et al. 2013; Nieto, Santamaria, and Fernández 2015). More specific, Classen et al. (2012) establish that Dutch and Belgian family manufacturing SMEs search their environment less broadly than nonfamily SMEs, making use of a less diverse set of partners in the innovation process. Similarly, Nieto, Santamaria, and Fernández (2015) find in their analysis of a large sample of Spanish firms that family businesses are less inclined to turn to external sources for innovation. Furthermore, they find that technological collaboration is avoided by family firms. Additional robustness is provided by Kotlar et al. (2013), who show that family firms acquire significantly less external R&D than other companies. Moreover, negative performance aspiration gaps provide less of an incentive to acquire external technologies for family firms than for nonfamily businesses.

These findings raise the question whether the lower use of external technologies by family SMEs is grounded in issues of ability or desirability. Based on the argumentation and findings in these respective studies, the answer seems to be a bit of both (cf. Figure 12.1). On the one hand, the lower engagement in inbound open innovation is attributed to limited cognitive diversity, partially due to the restricted access to qualified human capital family firms encounter (Classen et al. 2012). This lack of qualified managerial talent, combined with relatively low absorptive capacity derived from their aforementioned limited internal research base constrain family firms in the search for-, and assimilation of external knowledge (Classen et al. 2012; Nieto, Santamaria, and Fernández 2015). On the other hand, though, to gain access to external technologies, a certain level of disclosure of sensitive information related to the core technology of the family firm may be necessary. In addition, partners may require a certain voice in the decision making process (Nieto, Santamaria, and Fernández 2015). Including too many external

parties in the innovation process might, therefore, come at the expense of the control the family has over the strategic direction of the firm and, hence, the independence family owners typically prioritize (Kotlar et al. 2013; Nieto, Santamaria, and Fernández 2015). As this control facilitates the preservation of the family's socioemotional wealth (e.g., Gómez-Mejía et al. 2011), refraining from external technology acquisition may be a deliberate and rational choice (Classen et al. 2012). Qualitative evidence gathered by De Massis et al. (2015) highlights that through a fear of involuntary knowledge spillovers and diminished control, potential socioemotional wealth losses indeed form a key motivation for family firms to abstain from technological collaborations with other businesses.

Both the ability and desirability issues outlined in the previous paragraph can be somewhat counterbalanced. Regarding the former, Classen et al. (2012) show that family SMEs gain in terms of search breadth and opportunity recognition if they are led by a CEO who underwent university education. Furthermore, including nonfamily managers in the top management team is beneficial for the family SME's external outlook, especially when the inclusion of outsiders increases the educational background diversity of the top management team (Classen et al. 2012). With regard to the 'desirability' problem, family firms seem less reluctant to engage in collaborative innovation initiatives when misappropriation risks are mitigated. Therefore, sourcing technological resources from parties that require less control over the application of these resources, such as universities or other public research centers, may offer relatively 'safe' opportunities for family firms (De Massis et al. 2015). Additionally, in contexts characterized by strong intellectual property regimes, family businesses are less afraid of involuntary knowledge spillovers, which mitigates the negative attitude towards technological collaboration (De Massis et al. 2015; Kotlar et al. 2013).

Clearly, though the discussed studies offer the first insight, a lot remains to be uncovered regarding the relevance of open innovation models for family firms. To facilitate a broader investigation, in the final section we will delineate several research directions that may guide and encourage family business scholars in the process of bringing forward our knowledge regarding this matter.

Future Research

Antecedents to openness: Desirability and ability

The desirability and ability factors discussed before deserve more attention in future studies. Regarding the desirability of open innovation, prior work (Classen et al. 2012; De Massis et al. 2015; Kotlar et al. 2013) already highlights the importance family firm owners attach to maintaining control over their firm's activities to protect their socioemotional wealth. Hence, control concerns negatively influence the desirability of open innovation activities. However, recent discourse stresses the multidimensionality of socioemotional wealth and encourages scholars to consider nonfinancial aspects of family firm ownership beyond firm control (e.g., Berrone, Cruz, and Gómez-Mejía 2012; Miller and Le Breton-Miller 2014). Other, perhaps more positive aspects of socioemotional wealth, such as reputation building (Deephouse and Jaskiewicz 2013) or the family's concern for transgenerational continuity (Lumpkin and Brigham 2011) may increase the attractiveness of setting up and nurturing collaborative relationships.

Similarly, deeper understanding is needed concerning the ability of family firms to benefit from open innovation opportunities. Recent studies highlight family firms' limitations regarding human capital and absorptive capacity (Classen et al. 2012). What we do not know, however, is how the quality of family firms' rich social capital (Sirmon and Hitt 2003), rather than the number

of collaborative ties, enables family firms to extract valuable knowledge from their environment. Family firms have benefits when it comes to maintaining long-term quality relationships with close stakeholders such as customers and suppliers (Bingham et al. 2011; Schmieder 2014). Their reputation of trustworthiness is likely to enhance family firms' attractiveness as innovation partners, and may consequently lead to more opportunities for collaboration (Huybrechts et al. 2011). Some caution should be used though if trustworthiness is signaled by family firms to attract innovation partners. When trust in an open innovation relationship becomes a unidirectional construct and the innovation partner behaves as a free rider, or the family firm gets over-embedded in the sharing of knowledge and resources, the future of the family business can be seriously harmed (Steier and Muethel 2014). Future research should model and test factors affecting the ability of family firms to open up, and as such create a better understanding of explanatory mechanisms linking family involvement and open innovation.

Open innovation activities and outcomes

Given the focus on inbound open innovation activities in the research conducted to date (Classen et al. 2012; Kotlar et al. 2013; Nieto, Santamaria, and Fernández 2015), research on outbound open innovation seems warranted. Additionally, scholars may want to assess the relative emphasis on inbound versus outbound open innovation displayed by family businesses. On the one hand, given their in-house focus on developing incremental innovations (Carnes and Ireland 2013; Patel and Chrisman 2014), family firms may choose to periodically insource more radically novel technologies. Subsequently, little opportunity is left for licensing out the family firm's own incremental improvements. On the other hand, the deep and specialized knowledge of family firms, often established over multiple generations of family involvement, may add to the attractiveness of their technologies for other firms and therefore give family firms the opportunity to sell or out-license their technology at a premium (cf. Bendixen, Bukasa, and Abratt 2004). Following Hoy (2014), we recommend the use of life cycle stage models to assess the research challenges above, as these models have illustrated their explanatory and predictive power for strategic management behavior.

Further insights can be gained by assessing how the desires and abilities of family firms affect the screening and selection of innovation partners and the governance of their innovation partnerships and collaborations. For example, the emphasis on socioemotional wealth maintenance may cause a preference for partnering with other family firms sharing similar sensitivities, or with knowledge institutes (universities, public research centers) to mitigate misappropriation and control loss risks (De Massis et al. 2015). Along similar lines, it would be interesting to investigate whether family firms prefer formal agreements to limit misappropriation risks or undue external interferences, or (after meticulous upfront screening and selection) trust-based informal agreements in which contractual stipulations put fewer limits on the family's discretion in pursuing their idiosyncratic socioemotional wealth agenda (cf. Chrisman et al. 2015).

Recent work suggests that (private) family firms, although having smaller research budgets, are more efficient in the conversion of these research inputs in innovation output (Duran et al. 2015). These authors partially attribute the superior conversion rate of innovation inputs to the better network access of family firms. In line with Sirmon and Hitt (2003), Duran et al. argue that family firms are better at extracting value from their cooperative innovation efforts and therefore require fewer internal R&D investments. Future research should aim to explain how family firms benefit from open innovation and whether their 'innovation efficiency' relative to nonfamily firms can indeed be attributed to their superior use of open innovation opportunities.

Family firm heterogeneity

Given the rather embryonic state of research on this topic, the outlined research areas deserve deep investigation both regarding the differences between firms with and without family involvement, as well as differences among the heterogeneous population of family-owned firms (Sharma 2004). Heterogeneity among family firms may arise from differences in goals, governance structures, and resources (Chrisman et al. 2013; Chua et al. 2012).

Differentiating on goals, the various dimensions of socioemotional wealth (e.g., Berrone, Cruz, and Gómez-Mejía 2012) may be valued differently in each family firm and preservation of these socioemotional benefits may thus lead to diverse noneconomic goals (Chrisman et al. 2012; Zellweger et al. 2012). Furthermore, the competitive situation a family firm finds itself in may change the relative importance of noneconomic and economic goals of family firms (Chua et al. 2012). Accordingly, how differences in these goals affect family firms' engagement in open innovation activities deserves more scholarly attention.

Heterogeneity may also stem from differences in governance structures. For example, the inclusion of nonfamily members in the top management may increase the ability of family firms to engage in open innovation activities (Classen et al. 2012). Also, differentiating family firms based on which generation(s) has (have) control over the business may lead to interesting findings. For example, Kellermanns et al. (2008) find that involvement of multiple generations in the family business increases the entrepreneurial behavior of family firms. Does this then also hold for the engagement in open innovation? Furthermore, many family businesses are part of larger family business groups. Control motivations play a big role within these groups (Masulis, Pham, and Zein 2011). Morck and Yeung (2003) illustrate the danger of business families blocking innovation in their more peripheral businesses, to protect themselves from what they coin 'creative self-destruction' of their core business. Taking a more positive perspective though, if a business family owns a diverse group of businesses, cross-fertilization of technologies may actually enhance innovation within the group (Belenzon and Berkovitz 2010) and subsequently decrease the need for opening up the firm (group)'s boundaries. Taking into account whether partnerships are set up within family business groups or with external firms would not only expand our knowledge but may be imperative as failure to do so might lead to flawed analyses of empirical data through unjust omission of important information. Scholars should thus use caution when investigating inter-firm collaborations of family firms.

Family firms have access to heterogeneous pools of resources and the accumulation of resources in family firms is path dependent (Chua et al. 2012). The depth and richness of social and human capital available to the family firm differ and are highly idiosyncratic to the involved family (Arrègle et al. 2007; Sorensen and Bierman 2009). Additionally, differences can be observed as to how family firms finance their business (Danes et al. 2009). How these variations in resource availability relate to family firm engagement in open innovation may serve as an interesting avenue for future research.

The interactions of family firm heterogeneity aspects may pose further research opportunities. For example, the goal setting of family firms is argued to be dependent on the generational stage of the family firm (Berrone, Cruz, and Gómez-Mejía 2012; Gómez-Mejía et al. 2011). Researchers may study how family firm goals affect their engagement in open innovation activities during different generational stages. Related to the generational stage of the family firm is the succession of key family members in the firm, often a difficult process (Cabrera-Suárez, De Saá-Pérez, and García-Almeida 2001; Daspit et al. 2015). The transfer of social capital resources from family incumbents to family successors may be vital to the long-term success

of open innovation practices. How family firms' handling of the succession process affects the benefits family businesses derive from open innovation practices remains to be uncovered.

Research methods

The limited literature on open innovation in family firms mainly builds on cross-sectional data and is mostly restricted to one level of analysis (i.e., the firm). Longitudinal data or historical analyses will facilitate researchers to better capture the influence of business life cycle changes, generational transitions or environmental dynamics on the desirability and ability dimensions of family businesses to engage in open innovation, as well as its outcomes. Furthermore, given that multiple partners are involved in open innovation relationships, next to organization or individual-level variables, group, and inter-organizational variables will have to be added to the empirical data of scholars in order to fully grasp the complex dynamics of open innovation in and among family firms. Multilevel analysis techniques are recommended to analyze the nested data.

In conclusion, we are confident that a deeper and finer-grained understanding of the innovation process of family SMEs can be created by investigating how these firms derive value from their external relationships and leverage the knowledge available in their networks to enhance their firm's innovation performance. This literature review on open innovation will hopefully inspire family business scholars to direct their attention towards this promising topic.

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