Small Bus Econ (2016) 47:771–785
DOI 10.1007/s11187-016-9760-7

Innovation processes in family firms: the relevance of organizational flexibility

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Accepted: 7 June 2016 / Published online: 20 June 2016

Abstract The current study attempts to broaden our understanding of the processes underlying successful innovation in family firms by studying not only research and development (R&D) but also organizational flexibility as drivers of innovation performance. Building on existing theoretical and empirical work, we formulate hypotheses on the relationship between family ownership and R&D and organizational flexibility, and on how this translates into successful innovation. Using a sample of 2604 firms and 3140-year observations, we find that family firms engage less in R&D, but are more flexible in the way they organize and that this organizational flexibility enables them to successfully develop new products and even outperform non-family owned businesses when it comes to process innovation. This research contributes to the family business field by disentangling R&D and organizational flexibility as processes underlying the relationship between family ownership and innovation performance. It illustrates how family firms' organizational flexibility can result in an innovation advantage and thereby has important implications for practitioners.

Keywords Family firm · Organizational flexibility · Innovation · R&D

JEL Classifications D23 · L22 · O32

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1 Introduction

Management and economics scholars are increasingly paying attention to the family firms' innovative performance (De Massis et al. 2013). Whereas the successful development of new products and processes is deemed crucial for firms' long-term performance, innovation is inherently risky and uncertain (Shi 2003). As Classen et al. (2014) point out, these characteristics of innovation may have specific implications for family owned firms (Zellweger 2007; Miller et al. 2011) and several studies investigated whether family firms have a higher innovation performance than non-family owned firms. Unfortunately, the results are rather inconclusive, with some studies finding a positive (e.g., Craig and Dibrell 2006;

Ayyagari et al. 2011), and others a negative relationship between family ownership and innovation performance (e.g., Block et al. 2013; Chin et al. 2009). Classen et al. (2014) show that family SMEs outperform non-family SMEs regarding process innovation outcomes—but not product innovation outcomes—when controlling for innovation expenditures. Why this is the case is unclear as few studies explicitly investigated the different processes that enable family firms to successfully innovate.

In fact, research on determinants of family firms' innovative performance is mainly restricted to their research and development (R&D). As De Massis et al. (2013) show, most empirical studies find that family firms invest less in R&D than non-family owned firms. This is puzzling, as it appears to contradict the empirical findings of superior innovation performance in the studies mentioned above. One possible explanation is that studies of family firms' engagement in R&D—which focus mostly on large, publicly traded enterprises (Classen et al. 2014)—are biased and that the average family firm does not have an R&D disadvantage. Another possibility is that family firms compensate their R&D disadvantage through other processes.

The current study intends to broaden our understanding of the processes underlying successful innovation in family firms by studying both R&D and organizational flexibility, which we define in this paper as a firm's ability to adapt its internal organizational structure or the organization of its external relations, as drivers of innovation performance. These two underlying processes appear particularly interesting as existing literature suggests that family firms and non-family firms may differ in their ability to develop them. In fact, one can argue that some organizational processes stimulating innovation and organizational flexibility may be different for family firms and non-family firms (Hatum and Pettigrew 2004).

Building on existing theoretical and empirical work, we formulate hypotheses on the relationship between family ownership and R&D and organizational flexibility, and on how these translate into innovation output. Using a sample of 2604 firms and 3140-year observations, we find that the average family firm engages less in R&D activities, but is more flexible in the way it organizes. This organizational flexibility allows family firms to attain similar product innovation performance levels and even to outperform their non-family counterparts with respect to successful new process development.

This research contributes to the family business field by extending the literature on innovation in family firms. In particular, it demonstrates that not only R&D but also organizational flexibility underlies the relationship between family ownership and innovation performance. Furthermore, this paper responds to the call for additional research into how family firms' specific processes can result in a competitive advantage (Astrachan 2010), as it shows that family firms are particularly strong in flexibly adapting their organizational structure, giving them an advantage when it comes to developing process innovations. Our research has important implications for business families and family firm managers as it encourages them to continue reconfiguring and enhancing their internal and external organization. It demonstrates that R&D is not the only road to innovation and renewal and that family firms' most efficient choices are not necessarily the same as those of non-family owned firms.

2 Literature background

2.1 R&D and organizational flexibility as underlying processes for innovation

Before exploring the relationship between family firms, R&D and organizational flexibility, we clarify the impact of both R&D and organizational flexibility on innovation performance. R&D activities are generally regarded as one of the main determinants of companies' innovative performance. As Eisenhardt and Martin (2000, p.1107) explain, R&D routines "by which managers combine their varied skills and functional backgrounds […] create revenue-producing products and services". R&D is not the only possible or even a necessary road to innovation, but with R&D activities as an important enabler of technological innovation, a direct (though not necessarily immediate) positive effect of R&D on a company's innovation performance can be expected (Pakes and Griliches 1980). Even from the perspective of open innovation and innovation though external cooperation, internal R&D remains important. After all, a company's internal capabilities generate the absorptive capacity required to turn externally acquired knowledge into

innovation (Rosenberg 1990; Spithoven et al. 2010). This brings us to our first confirmatory hypothesis:

H1 There is a positive relationship between a firm's R&D activities and its innovation performance.

Although R&D is an important driver of innovation performance, other processes may be equally crucial. In particular, we argue that organizational flexibility, i.e., a firm's ability to adapt its internal organizational structure or the organization of its external relations, is crucial for renewal. Firstly, for a company to continuously innovate, it should have the flexibility to change its internal structure and decision-making processes (Miles et al. 2010). Whereas earlier strands in the literature focused on finding the most appropriate structure for stimulating innovation, more recently the understanding has emerged that there is no "one best" organizational structure for innovation (Raynor and Ahmed 2013). Instead, which structure is most helpful may depend on environmental variables, on the kind of innovation that is desired (Kelley 2009; Calantone et al. 2010), and even on the specific phase in the innovation process (Freeman and Engel 2007). Secondly, organizational flexibility also pertains to the organization of a firm's external relations. Cooperation with external partners can yield external ideas (Birkinshaw et al. 2008) but to be fully efficient, such cooperation needs an appropriate organizational framework that manages these relationships and integrates the external inputs (Teece et al. 1997). Furthermore, different external partners stimulate different types of innovations. For example, whereas collaborations with customers and suppliers help achieve incremental product innovations, collaborations with universities and research organizations are more useful for radical product innovation (Faems, Van Looy and Debackere 2005).

Clearly, companies continuously need to adapt both their internal organization and the organization of their external relations to innovate successfully. Therefore, a firm's ability to implement a specific organizational form may be less important than its ability to switch from one form to another and back again, which brings us to our second confirmatory hypothesis:

H2 There is a positive relationship between a firm's organizational flexibility and its innovation performance.

2.2 Family firms and R&D activities

Family ownership can be expected to have an important impact on R&D activities. On the one hand, it is widely believed that family firms engage less in R&D activities than their non-family owned counterparts. There are two theoretical arguments to support this. Firstly, family firms often use different success or performance measures than non-family firms. Their goals are also targeted at value creation for the family, family harmony and maintaining the continuity of family control over the firm (Berrone et al. 2012). Such objectives may lead to a preference of paying out profits to family members over re-investing them in the business or in R&D (Miller et al. 2011). Moreover, a focus on family well-being and continuity may also lead to risk aversion and therefore decreased R&D spending (Chen and Hsu 2009).

Whether due to different long-term priorities or risk aversion, many empirical studies find engagement in R&D to be lower for family firms than for non-family firms (Muñoz-Bullón and Sanchez-Bueno 2011; Block 2012; Chrisman and Patel 2012), although there are significant differences within family firms, depending on the family firm definition used (Block 2012) and on the family generation in control (Beck et al. 2011).

On the other hand, many authors argue that family firms may be more inclined to engage in R&D than non-family firms, as they typically adhere to long-term goals (Zellweger 2007). In the presence of long-term family firm goals, such as transferring family control over the firm to the next generations, families may accept higher risks and hence higher levels of R&D activities (Chrisman and Patel 2012). Additionally, maintaining family control over the company when faced with increasing buyer or supplier power may necessitate a higher level of R&D activities (Kotlar et al. 2014a; Kotlar et al. 2014b). Likewise, industries with a high potential for growth may prompt family firms to focus more on R&D than non-family firms to secure their long-term viability and control over the company (Choi et al. 2015).

Moreover, even family firms with short-term orientation may decide to invest heavily in R&D. When family firms are faced with disappointing company results, they tend to invest more in R&D than non-family firms do in an effort to return to a satisfactory performance level or to secure the firm's

competitiveness (Chrisman and Patel 2012, Kotlar et al. 2014a). More specifically, families tend to prefer exploitative R&D activities when their firm is doing well, but they focus more on risky, exploratory R&D when times are rough (Patel and Chrisman 2014). A related factor that mitigates the family's risk assessment is what portion of the family's overall wealth is invested in the family firm. When only a small part of that wealth depends on the firm's performance, the controlling family may be more willing to undertake risky R&D activities (Sciascia et al. 2015).

All in all, family managers' long-term horizon may be a more important consideration than risk aversion. This could lead to higher levels of actual R&D activities in family firms, even though that may not always be apparent from the company's annual reports since many family managed firms tend to downplay the importance of their R&D processes, possibly in an effort not to deter potential external investors (Schmid et al. 2014).

Clearly the literature offers arguments both for and against family firms' ability to engage in R&D. However, taking into account the empirical evidence showing a negative link, we hypothesize:

H3 There is a negative relationship between a firm's level of family ownership and its R&D activities.

2.3 Family firms and organizational flexibility

An argument can be made that the family influence is a barrier to organizational flexibility. Strong bonds to the company or to certain parts of it can lead to a desire to preserve the status quo and to resist changes. Family traditions, especially when handed down across generations, may create strong path dependencies that inhibit the family firm's adaptability and thereby also its ability to innovate (Chirico and Salvato 2008; Chirico and Nordqvist 2010). Strong family members that cling to tradition may preserve a closed company culture that blocks new ideas and change (Hall et al. 2001). Safeguarding the previous generations' legacy may become the family firm's primary goal, making it nearly impossible for successors to change the company's course (Steier and Miller 2010). Likewise, successors may feel morally or financially obliged to follow in their parents' footsteps or they may feel it's the easiest way to get a job (Sharma and Irving 2005), possibly leading to organizational stasis.

On the other hand, one can also argue that family firms are especially endowed with organizational flexibility. Family firms may benefit from a tradition of innovation and flexibility that helps to strengthen their resolve to remain organizationally flexible throughout different generations (Hatum and Pettigrew 2004). Overall, family firms' innovation management tends to be more flexible and less formalized than is the case in non-family firms (De Massis et al. 2015b). One reason is that family firms can usually benefit from extensive and strong social capital resources, both internally and externally (Arregle et al. 2007). Such social capital includes not only a static repository of knowledge but also the management skills to disseminate and integrate it. Long-term and close intra-family cooperation can lead to more frequent and more in-depth discussion about company issues and processes. As a result, knowledge can be shared and integrated more efficiently between family members, increasing the family firms' ability to adapt its internal structures and external relations (Chirico and Salvato 2008), while mutual trust between family members can speed up decision making and further enhance a family firm's flexibility. Externally, family firms' social capital and keener communication skills may help explain their more externally oriented innovation approach (De Massis et al. 2015b). Such external cooperation entails family firms' increased exposure to a multitude of different perspectives and attitudes, making them more flexible and innovative (Chrisman et al. 2015b). Furthermore, their long-term orientation gives family firms the time and patience to build trust, which facilitates knowledge sharing among partners (Sirmon and Hitt 2003). Finally, families can boost their organizational flexibility further if they succeed in extending their own sense of commitment and group feeling to the non-family employees. Not only does this increase overall motivation but it also stimulates essential components of organizational flexibility like employee creativity and responsiveness to change (Reichers et al. 1997; Zahra et al. 2008).

In conclusion, there is a multitude of compelling arguments in favor of family firms' organizational flexibility, resulting in the fourth hypothesis:

H4 There is a positive relationship between a firm's level of family ownership and its organizational flexibility.

Figure 1 visualizes our hypothesized model.

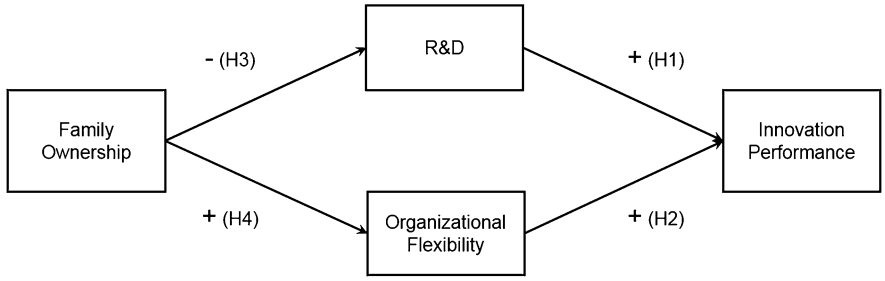


Fig. 1 Hypothesized path model

3 Data collection and analysis

3.1 Sample and data collection

We combined two consecutive waves of the Community Innovation Survey (CIS) conducted in Flanders. The CIS is an official survey of the European Commission and Eurostat and conducted in several European Union Member States. It develops insights into private organizations' innovative behavior. The use of CIS data has a long-standing tradition in innovation economics (Cassiman and Veugelers 2002; Belderbos et al. 2004; Czarnitzki and Toole 2011) and recently also in management (Laursen and Salter 2006; Leiponen and Helfat 2010; Klingebiel and Rammer 2014).

The Flemish CIS is a stratified (according to sector and size class) random sample that complies with the guidelines and definitions of the Oslo Manual (OECD 2005) for surveys on innovation activities and covers both production and service firms. Each year, several questions not included in the standard CIS instrument are added to the Flemish CIS for academic research, such as the items on family ownership used in this article.

The CIS5 wave, conducted in 2009 and reporting on the period 2006–2008, contacted a representative sample of 4969 firms and received 2202 responses (44 %). The CIS6, conducted in 2011 with data from 2008 to 2010, contacted 6493 firms for 3100 responses (48 %). After merging these two consecutive waves of the CIS survey and eliminating data due to missing values, our final sample contained 2604 firms and 3140-year observations.

3.2 Variables and descriptive statistics

Table 1 provides an overview of the descriptive statistics and correlations of the variables used in our analysis.

(a) Family ownership

When categorizing firms as family or non-family firms, we are constrained by the information available in the CIS. Although the CIS gathers data on family ownership, it does not contain information about the family's management or board presence. Therefore, we limit ourselves to an ownership-based definition of family firms. In line with previous research (López-Gracia and Sánchez-Andújar 2007; Feito-Ruiz and Menéndez-Requejo 2010; Ben-Amar et al. 2013, among others), we use the percentage of company shares owned by one person or one family during the period $t - 2$ to t to distinguish four categories. A value of 0 indicates that there is no main family shareholder. The variable takes the value of 1 when one person or family owns between 0 and 25 % of all shares, the value of 2 for 25–49 % and the value of 3 when one person or family owns at least 50 % of the company's shares.

Our sample contains mostly firms that have either no family ownership (44 %) or at least 50 % family ownership (48 %). Additionally, 5 and 3 % of the firms in the sample report a family ownership of less than 25 % or between 25 and 50 %, respectively.

(b) R&D activities

In line with previous work (e.g., Czarnitzki and Kraft 2010), we represent the firm's R&D activities by

Table 1 Descriptive statistics and correlations

	Mean (of absolute values)	*SD (of absolute values)*	*Ln_New_to_Market_Prod*	*Ln_New_to_Firm_Prod*	*Ln_Cost_Reduc*	*Ln_Quality_Impr*	*Ln_RD*
Ln_New_to_Market_Prod	4.31	13.18	1.00				
Ln_New_to_Firm_Prod	4.52	12.55	.54***	1.00			
Ln_Cost_Reduc	1.52	5.37	.31***	.30***	1.00		
Ln_Quality_Impr	1.35	6.06	.31***	.25***	.52***	1.00	
Ln_RD	.02	.09	.57***	.52***	.33***	.28***	1.00
Org_Flexibility	.57	.91	.30***	.29***	.34***	.28***	.35***
Family_ownership	1.54	1.45	−.02	−.01	.00	.07***	−.02
Ln_Size	42 M	203 M	.11***	.16***	.17***	.04*	.20***
Ln_Age	27.63	22.96	−.06**	.02	.02	−.04*	−.04*
Ln_Ext_cooperation	1.17	2.94	.44***	.43***	.29***	.24***	.59***
Services	.44	.50	−.04*	−.03	−.10***	−.08***	−.08***
Hitech	.33	.47	.17***	.12***	.02	.03†	.26**

	Org_Flexibility	*Family_ownership*	*Ln_Size*	*Ln_Age*	*Ln_Ext_cooperation*	*Services*	*Hitech*
Ln_New_to_Market_Prod							
Ln_New_to_Firm_Prod							
Ln_Cost_Reduc							
Ln_Quality_Impr							
Ln_RD							
Org_Flexibility	1.00						
Family_ownership	−.04*	1.00					
Ln_Size	.20***	−.23***	1.00				
Ln_Age	−.05*	.07***	.28***	1.00			
Ln_Ext_cooperation	.32***	−.07***	.26***	.01	1.00		
Services	.03	−.10***	−.08***	−.18***	−.08***	1.00	
Hitech	.13***	−.05**	−.09***	−.19***	.16***	.08***	1.00

SD standard deviation

† $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

including the variable *RD* and measured as the firm's internal R&D expenditures in year t divided by its turnover in year t. Due to its skewed distribution, we transformed this variable by taking the natural logarithm of $\{1 + RD\}$ and labeled it *Ln_RD*.

As is evident from Table 1, the average firm in our sample spends about 2 % of its total turnover on R&D. A more detailed look into the sample shows that only 31 % of the firms engage in any R&D activities.

(c) Organizational flexibility

To measure organizational flexibility, we analyze whether the company has introduced "new business practices for organizing tasks or procedures," "new methods for organizing responsibilities and powers of decision within the enterprise" or "new methods for organizing the external relations with other companies or public institutions" during the period $t - 2$ to t. We sum the three binaries to get one indicator for organizational flexibility and label the variable *Org_Flexibility*.[1] The average firm in our sample scores 0.57 on this measure.

(d) Innovation performance

We used four alternative variables representing both product and process innovation performance.

For product innovation performance, we followed previous work (Faems et al. 2005; Laursen and Salter 2006), measuring product innovation success as product innovations' share in total sales. We distinguished between new to the market and new to the firm product innovation. *New_to_Market_Prod* measures the successful development and commercialization of radically new products or services as the share of turnover in year t from goods and services that were new to the market and were introduced during the period $t - 2$ to t. The average firm in the sample obtained 4.32 % of its turnover from such radically new goods and services. Similarly, *New_to_Firm_Prod* represents the successful development and commercialization of new to the firm product or service innovations and is measured as the share of turnover from goods and services that were new to the firm but that were already available on the market and that were introduced during the period $t - 2$ to t. The average firm in the sample obtained 4.53 % of its turnover from new to the firm innovations. Both *New_to_Market_Prod* and *New_to_Firm_Prod* are represented as a percentage of total company turnover in year t.

With respect to process innovation success, we measured both the cost and quality implications of process innovations (OECD 2005). *Cost_Reduc* is the percentage average cost reduction per unit in year t due to process innovations that were introduced during the period $t - 2$ to t. *Quality_Impr* is the percentage turnover increase in year t due to quality improvements (of the production process) resulting from process innovations introduced during the period $t - 2$ to t. The average firm in the sample obtained a cost reduction of approximately 1.52 % per unit produced due to process innovations. It had an average turnover increase of about 1.35 % due to process innovation.

Because of skewed distributions, we added 1 to all values (to avoid zero values) and then took their natural logarithm when entering them into our analyses. We labeled those variables *Ln_New_to_Market_Prod, Ln_New_to_Firm_Prod, Ln_Cost_Reduc* and *Ln_Quality_Impr*.

(e) Control variables

External cooperation A higher diversity of external partners can help a company remain innovative (Duysters and Lokshin 2011). The CIS questionnaires ask each company to indicate whether it cooperates with each of 7 different partner categories (i.e., suppliers, customers, universities), into four possible geographical categories, resulting in a 7×4 answer matrix. We obtain our external cooperation variable by summing all binary scores and applying a logarithmic transformation.

Size Several theoretical arguments substantiate potential innovative advantages of both small and

[1] Although our measure shares similarities with process innovation, it is important and relevant to distinguish the two as this yields a more nuanced and complete approach to the study of innovation. Both the CIS survey and the Oslo Manual go to considerable lengths to explicitly explain the difference between organizational flexibility (which CIS labels 'organizational innovation') and process innovation. Among other things, the Oslo Manual notes that "A starting point for distinguishing process and/or organizational innovations is the type of activity: process innovations deal mainly with the implementation of new equipment, software and specific techniques or procedures, while organizational innovations deal primarily with people and the organization of work." (OECD 2005, p. 55). Additionally, the survey respondents are presented with extensive definitions and examples.

large firms (Acs and Audretsch 1990). To control for a company's size, we added the natural logarithm of the turnover in year *t* to our model.

Age The firm's age is also used as a control variable, as younger firms may be more innovative than older ones (Schneider and Veugelers 2010). For the path analysis, we used the natural logarithm of {1 + the firm's age}.

Industry The literature indicates an industry effect on both innovation and innovation success (Spithoven et al. 2010). We use the companies' main NACE code to create a first industry dummy, distinguishing manufacturing firms from service firms. Based on the sector's average R&D intensity (R&D expenditures/value added), Eurostat also classifies the NACE codes into high tech, medium–high tech, medium–low tech and low tech sectors. Our second industry dummy distinguishes between high tech (high tech or medium–high tech) and low tech companies (medium–low tech or low tech).

4 Results

Given the complexity of our hypothesized model and the need to analyze multiple regressions simultaneously, we use a path analysis approach. As we have a large sample, we use Browne's asymptotically distribution-free (ADF) estimation method to counter estimation problems that may result from the non-normality of some of our (categorical) variables (Norman and Streiner 2003). Since we want to distinguish between four different variables measuring specific innovation performances, we analyze a total of four path models.

To assess how well the models fit the data, we evaluate some common goodness of fit indices. As can be seen in Table 2, both the goodness of fit index (GFI) of 0.9999 and the adjusted goodness of fit index (AGFI) with values between 0.9965 and 0.9985 lie well above the generally accepted cutoff point of 0.9 (Sharma 1996; Norman and Streiner 2003). Instead of using the GFI and the AGFI, in the case of the ADF method, Hu and Bentler (1998) recommend looking at alternatives like the Standardized Root-Mean-Square Residual (SRMR) and the Comparative Fit Index (CFI). Commonly accepted values to indicate a good fit are below 0.05 for the SRMR and above 0.95 for the CFI. Our models yield SRMR values between 0.007 and 0.01 and CFI values consistently over 0.99.

Ideally, the Chi square value for the models should indicate non-significance, but such is not the case with our sample. However, as previously shown (Sharma 1996; Norman and Streiner 2003), the Chi square statistic easily becomes significant for large samples, even when there is no actual reason to question the model's fit. Therefore, and given the positive signal from the other goodness of fit indices, we do not reject our model.

Next, we analyze the relationships between our main variables, as hypothesized in the literature section, by looking at the standardized results of the four models. As shown in Table 3, all models reveal a significant negative relationship between *Family_ownership* and *Ln_RD*, confirming hypothesis 3. However, the results concerning the relationship between *Ln_RD* and innovation performance are less uniform. Although we find the expected positive link between *Ln_RD* and both product innovation

Table 2 Goodness of fit measures for different models

	(1)	(2)	(3)	(4)
Goodness of fit index (GFI)	1.00	1.00	1.00	1.00
Adjusted goodness of fit index (AGFI)	1.00	1.00	1.00	1.00
Standardized root-mean-square residual (SRMR)	.01	.01	.01	.01
Bentler comparative fit index (CFI)	1.00	1.00	1.00	.99
Chi square	7.68	7.52	7.57	18.09
Degrees of freedom	2.00	2.00	2.00	2.00
Pr > Chi square	.02	.02	.02	.00
Akaike information criterion (AIC)	93.68	93.52	93.57	104.09

(1) Ln_New_to_Market_Prod model, (2) Ln_New_to_Firm_Prod model, (3) Ln_Cost_Reduc model, (4) Ln_Quality_Impr model

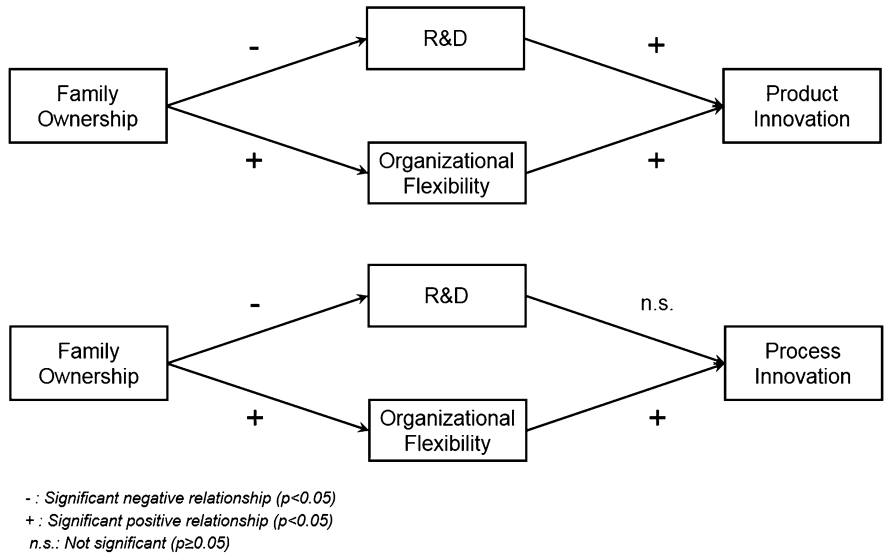
Table 3 Standardized Path Coefficients and (*t* values)

Path from -> to	*(1)*	*(2)*	*(3)*	*(4)*
Direct effects				
Family_ownership	−0.05**	−0.05**	−0.05**	−0.05**
-> *Ln_RD*	(−3.21)	(−3.21)	(−3.19)	(−3.29)
Ln_Size	−0.13***	−0.13***	−0.13***	−0.13***
-> *Ln_RD*	(−8.36)	(−8.48)	(−8.64)	(−8.7)
Ln_Age	−0.03	−0.03	−0.02	−0.02
-> *Ln_RD*	(−1.63)	(−1.64)	(−1.6)	(−1.62)
Ln_Ext_cooperation	0.36***	0.36***	0.36***	0.36***
-> *Ln_RD*	(16.32)	(16.41)	(16.47)	(16.52)
Services	0.12***	0.12***	0.12***	0.13***
-> *Ln_RD*	(8.66)	(8.75)	(8.76)	(8.8)
Hitech	0.17***	0.17***	0.17***	0.17***
-> *Ln_RD*	(12.12)	(12.24)	(12.37)	(12.45)
Family_ownership	0.04*	0.04*	0.04*	0.04*
-> *Org_Flexibility*	(2.38)	(2.39)	(2.38)	(2.33)
Ln_Size	0.16***	0.16***	0.16***	0.16***
-> *Org_Flexibility*	(8.57)	(8.61)	(8.6)	(8.46)
Ln_Age	−0.07***	−0.07***	−0.07***	−0.07***
-> *Org_Flexibility*	(−3.84)	(−3.84)	(−3.91)	(−3.85)
Ln_Ext_cooperation	0.28***	0.28***	0.28***	0.28***
-> *Org_Flexibility*	(12.81)	(12.95)	(12.87)	(12.96)
Services	0.05**	0.05**	0.05**	0.05**
-> *Org_Flexibility*	(2.97)	(3.02)	(2.98)	(2.94)
Hitech	0.08***	0.08***	0.08***	0.08***
-> *Org_Flexibility*	(4.34)	(4.36)	(4.37)	(4.41)
Ln_RD	0.20***	0.10***	−0.02	0.00
-> *Innovation*	(6.76)	(3.92)	(−0.68)	(0.09)
Org_Flexibility	0.16***	0.13***	0.25***	0.24***
-> *Innovation*	(7.87)	(6.81)	(11.98)	(10.35)
Ln_Size	−0.01	0.02	0.03†	−0.09***
-> *Innovation*	(−0.48)	(1.25)	(1.69)	(−5.22)
Ln_Age	−0.04*	0.02	−0.03	−0.04†
-> *Innovation*	(−2.35)	(1.4)	(−1.52)	(−1.92)
Ln_Ext_cooperation	0.30***	0.30***	0.18***	0.14***
-> *Innovation*	(11.87)	(12.63)	(6.92)	(5.3)
Services	−0.03*	0.00	−0.07***	−0.06***
-> *Innovation*	(−2.33)	(−0.26)	(−3.9)	(−3.54)
Hitech	0.05**	0.03†	−0.03	−0.02
-> *Innovation*	(3.06)	(1.96)	(−1.53)	(−0.98)
Total effects				
Family_ownership	−0.00	0.00	0.01*	0.01*
-> *Innovation*	(−0.91)	(0.04)	(2.41)	(2.13)

(1) Ln_New_to_Market_Prod model, (2) Ln_New_to_Firm_Prod model, (3) Ln_Cost_Reduc model, (4) Ln_Quality_Impr model

† $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Fig. 2 Standardized results



outcomes *New_to_Market_Prod (%)* and *New_to_Firm_Prod (%)* (models 1 and 2 in Table 3), the links with process innovation performance measured as *Cost_Reduc (%)* and *Quality_Impr (%)* are not significant (models 3 and 4 in Table 3), thereby only partially supporting hypothesis 1. Our analysis yields significant positive relationships between firms' level of *Family_ownership* and *Org_Flexibility* and between *Org_Flexibility* and all four innovation performance measures and be it related to product or process innovation. Hence, both hypotheses 4 and 2 are supported.

The overall, total effect of family ownership on innovation performance is significantly positive where process innovation is concerned (see the last row of Table 3). As for product innovation, *Family_ownership* has no significant overall effect on product innovation performance. Figure 2 shows the main results for our models.

5 Discussion

This study wanted to broaden our understanding of the processes underlying successful innovation in family firms by taking into account not only R&D but also organizational flexibility. Firstly, our results confirm previous empirical evidence showing that family firms invest less in R&D than other firms. Although several studies argued that family firms' long-term orientation may spur R&D activities (Zellweger 2007), our findings support the contrasting argument that family firms' focus on value creation for the family, family harmony and continuity (Berrone et al. 2012), and the accompanying risk aversion (Naldi et al. 2007; Chen and Hsu 2009) will lead to decreased R&D spending. However, this study also shows that the impact of this lesser R&D engagement on innovative performance is not at all straightforward. Whereas R&D clearly stimulates eventual product innovation performance, it has little or no impact on process innovation. This may be due to the fact that product innovations are often developed internally and therefore depend on a company's internal knowledge and capabilities, while process innovations rely considerably more on external suppliers' input.[2] Hence, this first finding indicates that family firms' innovative "handicap" due to their lower R&D activity may be less pronounced than assumed in previous studies, as this lesser engagement in R&D does not affect their process innovation performance.

[2] Whereas 69 % of the product innovators in our CIS6 subsample developed their product innovations without the help of external partners, this was only the case for 32 % of the process innovators.

Furthermore, our main finding indicates that family firms are actually better than non-family firms at flexibly changing their internal and external organization, which in turn leads to improved innovation performance. This supports our argument that family firms are especially endowed with organizational flexibility, possibly because (a) their focus on non-financial and long-term goals leads to a more dynamic attitude if they perceive innovation to be in their long-term interest, (b) mutual trust between family members speeds up decision making, improves knowledge exchange and enhances flexibility and (c) when the family succeeds in extending its own sense of commitment and group feeling to its non-family employees, this stimulates essential components of organizational flexibility like employee creativity and responsiveness to change.

We find that family firms' R&D disadvantage is in fact compensated by their organizational flexibility. This leads to similar product innovation performance as observed in non-family owned firms. Novel and recent research on new product development (NPD) projects in family firms leads to similar insights (De Massis et al. 2016). Among other things, the authors find that family firms' specific organizational characteristics allow employees to flexibly switch between the innovation project and their "normal" tasks and to achieve better NPD results than full-time cross-functional innovation teams. At the same time such an approach keeps costs under control, effectively allowing those family firms to achieve better innovation performance with less R&D efforts by tailoring the design of their innovation process to their specific family firm characteristics.

Furthermore, as R&D activities turn out to be less relevant for process innovation, family firms' advantage regarding organizational flexibility even allows them to outperform their counterparts when it comes to process innovation performance. Classen et al. (2014) already showed that family SMEs tend to outperform non-family SMEs regarding process innovation outcomes when controlling for innovation expenditures. Our findings complement those results by proposing that family firms' elevated organizational flexibility is at the basis of this outperformance and even more that R&D activities are of little importance in this respect. As our results indicate that family firms' organizational flexibility grants them an advantage when it comes to the development of process innovations, this paper responds to the call for additional research into how family firms' specific processes can result in a competitive advantage (Astrachan, 2010). These insights reconcile the apparently contradicting results of previous empirical studies that family firms engage less in R&D than non-family owned firms, but display superior innovation performance.

We believe our research has important implications for future family firm research. By disentangling R&D and organizational flexibility as separate underlying processes of innovation performance and by distinguishing between product and process innovation performance, we paint a more nuanced and comprehensive picture of the relationship between family ownership and innovation, which can inform future research and theorizing on innovation in family firms. Firstly, our results demonstrate the clear necessity of distinguishing between product innovation and process innovation. Lumping together measures of product and process innovation performance may obscure the true processes and effects that are going on in family firms. Secondly, the study clearly demonstrates the need to move away from a focus on R&D activities, and in addition investigate other processes underlying innovation performance, specifically the ones concerning innovation management and organizational flexibility. Distinguishing between product and process innovation and the distinct processes underlying these specific innovation outcomes may help overcome and explain the inconsistencies of previous studies, thereby moving the field further forward. In this respect, the recently proposed Family Driven Innovation (FDI) framework (De Massis et al. 2015a) looks quite promising as it offers an integrated and detailed approach to analyzing family firm innovation. Specifically, the FDI framework emphasizes the need for family firms to achieve a fit between their unique characteristics as a family firm and the approach they take toward innovation. This means that they should strive for compatibility between their goals and motivations, their organizational structure and their available resources on the one hand and their choices on where to search for knowledge, how to manage the innovation process and what kind of innovation (e.g., product or process innovation) to pursue on the other hand (De Massis, et al., 2015a).

Our research has important implications for business families and family firm managers as the

development of R&D and organizational flexibility require significant investments of time and money. While this may be obvious for R&D, also the cost implications of organizational flexibility and change have started to receive more attention. Changes require work to be diverted away from the company's existing business, creating opportunity costs. Organizational ecologists (Hannan and Freeman, 1989) and organizational scholars (Kotter 1995) argued that change is costly and complicated and can lead to firm failure (Barnett and Freeman, 2001), decreased market shares (Greve 1999) and employee turnover (Baron et al. 2001). Demonstrating that flexibly adapting their internal and external organization in fact helps family firms overcome their R&D disadvantage and leads to successful product and process development and can strengthen family firms' resolve to look beyond these short-term costs. Our findings can hence encourage family owners to continue reconfiguring and enhancing their internal and external organization. Developing internal R&D activities is not the only road to innovation and renewal, especially if the ultimate goal is process innovation. Family managers should realize that the most efficient choices for them are not necessarily the same as those for non-family owned firms.

6 Limitations and suggestions for further research

We acknowledge that this paper does not incorporate the cost implications of R&D and organizational flexibility and can therefore not provide any conclusions on their ultimate financial effects. It would be interesting to study this further, also distinguishing between different types of organizational changes, as it could help managers prioritize certain organizational changes. Furthermore, we acknowledge that the turnover and cost savings effects of R&D projects and organizational changes introduced during the period $t-2$ to t may not fully materialize by time t. The timeframe in this study may hence be too short to fully grasp the positive effect of R&D and organizational flexibility. Thus, the current study may be underestimating their positive effects on innovation performance.

Finally, there are limitations regarding the measure we used to indicate the extent to which a company can be considered to be a family firm. The operationalization of family ownership in the CIS is rather limited. Further analyses could benefit from more detailed information about the family's influence in the firm. While family firms' typical ownership and control characteristics will give them a better ability to innovate than non-family firms, their specific goals and motivations may decrease their willingness to do so (Chrisman et al. 2015a). Thus, although family ownership as we measure it indicates family firms' ability to behave differently from non-family firms, a more accurate definition of family firms should also include willingness indicators (Chrisman et al. 2012; De Massis et al. 2014). Ownership and other demographic indicators of being a family firm should ideally be combined with essence indicators that more directly measure actual differences in behavior (Chua et al. 1999; Chrisman et al. 2005; Basco, 2013) to reveal greater variety within family firms. Moreover, information on family ownership should ideally be combined with information on the actual family management of the firm. Due to agency complications, managers with little or no ownership share have a different attitude toward R&D than manager–owners (Czarnitzki and Kraft 2004; Beyer et al. 2012). Finally, it could be interesting to distinguish lone founder firms from other types of family firms to see whether our results hold for both groups (Miller et al. 2011).

In addition to including more detailed information about the family's influence in the firm, the field of family firm innovation may benefit from more in-depth analyses of the relationships between specific strategic innovation decisions and various family firm characteristics. In particular, more research is needed into how family firms can achieve a good fit between their unique characteristics and the innovation options available to them (De Massis et al. 2015a). For example, further research could lead to more and better understanding of the positive link between family firms and organizational flexibility that we find in our study, as well yield more insight into how this flexibility can lead to better innovation performance. Which family firm goals, which organizational structures, which management methods or resources are most compatible with the desired level of flexibility? How does such flexibility impact the family firm's innovation process and eventually lead to product versus process or radical versus incremental innovation? Considering the nature of those research

questions, we believe qualitative approaches will be most appropriate to advance our understanding of such complex processes.

7 Conclusions

The current study attempts to broaden our understanding of the processes underlying successful innovation in family firms by studying not only research and development (R&D) but also organizational flexibility as drivers of innovation performance. Building on existing theoretical and empirical work, we formulated hypotheses on the relationship between family ownership and R&D and organizational flexibility, and on how these translate into successful product and process development. We found that family firms engage less in R&D, but are more flexible in the way they organize and that this organizational flexibility enables them to successfully develop new products and even outperform non-family owned businesses when it comes to process innovation. The study contributes to the field of family businesses by substantiating the need to distinguish between product and process innovation performance and by demonstrating that not only R&D but also organizational flexibility underlies these distinct innovation outcomes. It has important implications for business families and family firm managers as it highlights how family firms' organizational flexibility can result in an innovation advantage vis-à-vis non-family owned firms.

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