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Research article

The influence of open innovation practices on business performance in Mexican family and non-family SMEs

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Abstract

Open innovation has emerged as a topic of great importance due to the recognized benefits that it brings to the company's business performance; however, it has been sparsely addressed in SMEs from developing countries. Therefore, this study aims to analyze and discuss the relationship between open innovation and business performance in family and non-family SMEs in Mexico. A survey-based study was carried out on a sample of 308 firms. Following this, the data was analyzed through a structural equation model. The results show that for these companies, the outflow and especially the inflow of external knowledge exert a positive influence on business performance.

Keywords: open innovation, inbound, outbound, business performance, family firms, non-family firms.

Influencia de las prácticas de innovación abierta en el rendimiento del negocio en Pymes familiares y no familiares en México.

Resumen

La innovación abierta se ha convertido en un tema de gran importancia debido a los reconocidos beneficios que aporta al rendimiento empresarial, sin embargo, se ha abordado escasamente en las Pymes de los países en vías de desarrollo. Por lo tanto, este estudio tiene como objetivo analizar y discutir la influencia entre la innovación abierta y el rendimiento empresarial en las Pymes familiares y no familiares en México. Se implementó una investigación basada en encuestas en una muestra de 308 empresas, los datos se analizaron a través del modelo de ecuaciones estructurales y los resultados obtenidos muestran que, para estas empresas, la salida y especialmente la entrada de conocimiento externo ejercen una influencia positiva en el rendimiento empresarial.

Palabras clave: innovación abierta, entrada, salida, rendimiento empresarial, empresas familiares, empresas no familiares.

Influência das práticas de inovação aberta no desempenho dos negócios nas PMEs familiares e não familiares no México.

Resumo

A inovação aberta tornou-se um tópico de grande importância devido aos benefícios reconhecidos que traz para o desempenho dos negócios; no entanto, tem sido pouco abordada nas PME dos países em desenvolvimento. Portanto, este estudo tem como objetivo analisar e discutir a influência entre inovação aberta e desempenho comercial nas PMEs familiares e não familiares no México. Uma investigação baseada em pesquisa foi implementada em uma amostra de 308 empresas, os dados foram analisados através do modelo de equações estruturais e os resultados obtidos mostram que, para essas empresas, a saída e principalmente a entrada de conhecimento externo exercem influência positiva sobre desempenho de negócios.

Palavras-chave: inovação aberta, entrada, saída, desempenho comercial, empresas familiares, empresas não familiares.

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1. Introduction.

The concept of traditional innovation involves attributes, results and processes, and can also be seen as an enhancer of the company's progress (Morris, 2009). As such, innovation provides new ideas, products, strategies, and practices which create competitive advantages. Innovation helps the organizations to identify different opportunities for transformation, and take advantage of them (Tidd & Bessant, 2009), it is considered a fundamental aspect of any company that wishes to survive under the current competitive environment.

The evolution from closed traditional innovation towards a more open concept involves the use of ideas coming from the exterior of the organization alongside those from the interior, (Chesbrough, 2003). This transformation allows companies not only to use information exclusively created from the inside, but also to incorporate external viewpoints to obtain more benefits.

Undoubtedly companies nowadays are becoming more conscious of their inability to fully compete with others using only internally developed ideas. As a result, there is a stronger trend towards collaboration, including the development and adaptation of processes through sharing collaborative activities (Michelino, Caputo, Cammarano, & Lamberti, 2014; Tobiassen & Pettersen, 2018). Therefore, open innovation is seen as a new scenario where companies must leave their comfort zones and open themselves up to external professionals combining internal and external knowledge.

Some of the benefits of opening up innovation practices may be obvious for large multinational firms. However, in the field of small to medium enterprises (SMEs) in developing countries the picture is different (Chesbrough, 2010) and more so for family and non-family business. Regrettably, in these contexts studies are even scarcer, despite these types of firms being a great source of opportunity in the open innovation panorama, as they can contribute faster, specialize better and easily adapt to opportunities that emerge from beyond their particular market.

Additionally, as these benefits greatly enhance business performance, the capability to innovate is a critical element for competitive improvement in volatile markets (Rajapathirana & Hui, 2018). Open innovation prioritizes the development of new products and services that may become essential in a firm's performance (Hauser, Tellis, & Griffin, 2006), especially in family firms where pressures to innovate are higher in order to compete properly with other Open innovation includes inbound and outbound practices which, when exerted, may increase the company's strength. Both are primordial factors for the company's proper functioning and survival, and may increase its position in the highly competitive markets to which family businesses belong (McCann, Leon-Guerrero, & Haley, 2001). Open innovation has been considered as an essential topic on family firms investigations (De Massis, Sharma, Chua, & Chrisman, 2012), since it brings new ideas of products and processes to the ones that already exist. Furthermore, family businesses are considered as the

main engine of the economies worldwide, due to the huge contribution to the growth and stability they provide (Klein, 2000). Some other authors even suggest that such companies are the main generators of highest profits that contribute in a very high part of the world's wealth (Craig & Dirbrell, 2006). In addition, family firms enhance competitiveness, generate progress, and represent 85% of all organizations in OECD (Organization for Economic Cooperation and Development) countries (Van den Berghe & Carchon, 2003).

There is evidence to suggest that after the generalization of the concept of open innovation, many (principally large) companies began to implement it in their processes (Chesbrough & Crowther, 2006; Schroll & Mild, 2011; Sisodiya, Johnson, & Grégoire, 2013; Chesbrough, & Brunswicker, 2014; Ollila & Yström, 2015; Wang, 2018). In Europe and the United States of America these practices are mostly exercised and with very good results. However, in emerging economies (such as the state of Aguascalientes, Mexico) there are still certain limitations and ignorance of open innovation practices carried out within SMEs.

Within this panorama, the Mexican context may also be significant, since Mexico is the country with the highest number of family firms (La Porta, Lopez-de-Silanes, & Shleifer, 1999). However, to thrive it is necessary to face big challenges; most of these companies are founded to generate jobs and heritage but strength is needed to survive.

Therefore, the main purpose of this investigation is to contribute to the literature with empirical evidence of the influence that open innovation has on business performance in family and non-family SMEs in Aguascalientes, Mexico, through a survey-based quantitative research method and using structural equation modelling to analyse the obtained data.

The present article is organized into the following sections: section 2 consists of the literature review and hypotheses related to the influence of open innovation on business performance; section 3 explains the methodology used to test the hypotheses posited in the study; section 4 discusses the obtained results; and finally, section 5 addresses the conclusions, recommendations and limitations for future investigations.

2. Theoretical framework

Open innovation has gained popularity in recent years due to several studies in the literature which concur that this construct can be classified as one of the most important performance drivers for many companies (Hauser et al., 2006; Lichtenthaler, 2009; Lee, Park, Yoon, & Park, 2010; Mazzola, Bruccoleri, & Perrone, 2012; Chaston, 2013; Kuang-Peng & Chou, 2013; Caputo, Lamberti, Cammarano, & Michelino, 2016; Casprini, De Massis, Di Minin, Frattini, & Piccaluga, 2017; Park & Kwon, 2018). The concept is wide-ranging; it can be defined as a new set of forms that serve as a model in innovation administration (Gassmann, 2006), it uses sources of internal and external knowledge that help in the acceleration of innovation (Van de Vrande, De Jong, Vanhaverbeke, & De Rochemont, 2009), and it involves procedures related to external collaboration and cooperation

to promote the growth and development of new products or technologies (Freel, 2006).

According to Inauen and Schenker-Wicki (2011), over time it has become easier for certain companies to acquire knowledge and technological skills previously shared by other companies, which are available thanks to the transformation of traditional closed innovation towards more open innovation. With this change, companies can share their strategies, helping others to replicate good practices and discard those that were defective.

Moreover, closed innovation is diametrically opposed to open innovation (Park & Kwon, 2018); which implies that companies must change their way of viewing things, from assuming that only the best people work in their organizations, to admitting that not all the best people are part of the company (Chesbrough & Crowther, 2006). In short, they must change closed ideas for more open ones.

Consequently, companies have increasingly recognized that open innovation should be practiced in order to obtain external knowledge, experience and wisdom of workers who are not part of their workforce, and to acquire functional practices that have previously been carried out by other companies (Elmquist, Fredberg, & Ollila, 2009).

Additionally, open innovation encompasses any knowledge exchange between companies with the aim of boosting performance through the transformation of processes or products (Christensen, Olesen, & Kjaer, 2005; Lichtenthaler, 2011). Continuing with this perspective, open innovation embraces collaboration to achieve performance increases; therefore, firms would be wise to align these two variables to take the greatest advantage possible and turn it into profit. It is worth mentioning that in open innovation processes, companies have a strong interaction with their environment (Cooper, 2008), allowing them to obtain more knowledge about political, economic, cultural, social, and demographic factors that may affect the business. This knowledge may help in the generation of synergies, which has led several organizations, mainly in R&D intensive large firms (Spithoven, Clarysee, & Knochaett, 2010) and high tech large companies in developed countries to migrate from their current innovation system to a more open model.

Another approach of the concept is that for the correct implementation of open innovation practices, it is necessary to trust in companies' in-house capabilities, allowing them to express their technological management strategies together with the innovation processes. There is a spectrum of companies on a scale from completely closed innovation to those with fully open innovation processes (Hung & Chou, 2013). It is essential that companies know how to integrate only the knowledge they require and share only the information that may be useful for others, without risking the position of the company.

According to Henry Chesbrough, one of the pioneers of open innovation, over the past decade most of the academic attention has moved significantly from the old ideas of closed innovation to a more open philosophy (Hung & Chou, 2013), in which new concepts and understandings are readily admitted, allowing companies to adapt external knowledge to their

own processes to contribute to their internal acceleration of innovation.

For companies to remain profitable, it is necessary to understand that innovation should not be generated exclusively within organizational, on the contrary, it is essential to take advantage of external information that serves as a basis for implementing improvements. Companies must be willing to share knowledge that can also help other companies, and it is necessary to implement both inbound and outbound open innovation practices (Van de Vrande et al., 2009).

Regarding open innovation practices, several authors suggest that there are two ways of getting and sharing the knowledge to promote internal innovation and enlarge the market: inflows and outflows of information (Lichtenthaler, 2009; Chesbrough, 2010; Chiaroni, Chiesa, & Frattini, 2010). Companies practicing open innovation not only use their internal efforts and processes, but also attach external knowledge to generate value for customers (Van der Ploeg, 2011). Open innovation also provides tools that especially help family and non-family SMEs (Alberti, Ferrario, Papa, & Pizzurno, 2014; Basco & Calabrò, 2016; Casprini et al., 2017) to develop internal innovation activities, which are complemented with information from outside the company to create profitable innovation (Basco & Calabrò, 2016).

Specifically, a distinction can be made between the two directions of outbound and inbound open innovation (Lichtenthaler & Ernst, 2006; Spithoven et al., 2010; Mazzola et al., 2012; Michelino et al., 2014; Scuotto et al., 2017). The former explains the external sharing of technology in open function methods, involving the transfer of knowledge to the external environment (Lichtenthaler, 2009). It is also the practice of creating relationships among external associates to take innovations to the market quicker and to commercially use technological opportunities (Mazzola et al., 2012).

In contrast, it is recommended that outbound open innovation practices are implemented and replicated in similar organizations and within which the information can flow continuously without distortions (Chesbrough & Crowther, 2006). This allows the companies to focus on finding innovation activities that can be commercialized or licensed (Spithoven et al., 2010; Wang, 2018) outside the organization's boundaries. For large companies, is easier to generate innovation or to implement inbound innovation due to their organizational structure and the monetary resources available for these activities. However, SMEs despite the lack of the human and monetary resources required to produce innovation, are taking advantage of the information disseminated by big companies and attempt to replicate the same results according to their capabilities.

It is important to mention that every inbound practice coming from a company must be reciprocated by an equal outbound practice from another organization (Chesbrough & Crowther, 2006). In previous studies that have addressed practices of open innovation, inbound practices have been highlighted as exerting more influence on business performance, but fewer studies show the importance of outbound practices in business performance as these have been relatively abandoned (Lichtenthaler, 2009).

Within this context and taking into consideration the previously presented information the first hypothesis can be formulated:

- H1: the outbound practices exerted in the firms have a positive influence in the business performance.

Obtaining information on the company's external environment can occur through different business partners, customers, competitors and suppliers (Lichtenthaler, 2015; Santoro, Ferraris, Giacosa, & Giovando, 2016). Moreover, inbound practices certainly produce a positive influence on the firm's performance, since they incorporate and develop important concepts, procedures or technologies from outside which can be added to local innovation (Wang & Zhou, 2010; Michelino et al., 2014).

This practice exactly defines the art of taking advantage by exploiting other people's findings, trusting fully in different external research and development departments and not only in one's own (Chesbrough & Crowther, 2006). Companies need to supervise their context to acquire proper expertise and experience in addition to their own already-implemented processes, or research and develop new products to improve existing ones through scientific investigation (Spithoven et al., 2010) that can guide them to improved business performance. With this information, the second hypothesis can be formulated:

- H2: the inbound practices exerted in the firms have a positive influence in the business performance.

Companies might track inbound open innovation, which implies an outside-in process of gaining external knowledge (Lichtenthaler, 2015). Additionally firms can determine outbound open innovation, which describes an inside-out process of transmitting knowledge to the exterior environment. Based on what has previously been described, companies may follow a coupled mode of open innovation, which is a mixture of the outbound and inbound practices (Enkel, Gassmann, & Chesbrough 2009).

The growing importance of open innovation is evident in theory and in practice (Wang, 2018). Firms profit from these open innovations, such as through exposure to new knowledge, higher flexibility, adaptability to external technology and maximizing inner opportunities. A company needs to make sure it fully captures the value of its technology, which represents a major challenge in the organization (Arora, Fosfuri, & Gambardella, 2001). On the other hand, the potential obstacle is that the conventional approach to innovation in several companies is to be possessive by implementing a closed approach to innovation. Chesbrough (2003) considers that some firms have moved towards sharing, depending on their strategy, with outside organizations in order to gain competitive advantages through innovation. Nevertheless, it is fundamental to protect a business's intellectual property by rigorously regulating the information, knowledge or technology, which is shared with the exterior (Lichtenthaler, 2009). According to the literature, most family business

show a tendency to following inbound practices, and on the contrary non-family businesses use outbound practices of open innovation (Basco & Calabrò, 2016; Lambrechts, Voordeckers, Roijakkers, & Vanhaverbeke, 2017).

Family firms have a significant function in worldwide markets (Spanos, Tsipouri, & Xanthakis, 2008), not only because of their contribution to the economy (Porter, 2003), but also for the generation of employment (Morck & Yeung, 2003; Belausteguigoitia, & Balaguer, 2013). Many companies that are now considered successful started as family businesses. According to Dawson & Hjorth (2012), family firms are more likely to be effective and lucrative than other kinds of businesses. In addition, the International Finance Corporation (IFC) of the World Bank (2011) indicates that these companies are the oldest and most predominant form of commercial organization worldwide. Despite representing more than 70% of all firms however, they often do not survive across generations (Heck 2004; Gómez, Haynes, Núñez, Jacobson, & Moyano, 2007).

Family business practices are often different to other types of business, which may be due to the involvement of family members (Basco & Pérez-Rodríguez, 2009). To maintain a successful business requires skills and strategies along with empirically acquired expertise. Relevant research shows that only 30% of family companies survive to the second generation, and only 10% survive to the third, with the rest being sold or closed (Laforet, 2016). Another cause of failure during the first year of production is the lack of growth potential due to the absence of formal processes (Van Gils, Voordeckers, & Hagedoorn, 2008). Innovation in family and non-family SME's may be a key growth driver, as these companies are also a significant part of the global economy (Sraer & Thesmar, 2007). Although in recent literature there are a number of studies that have previously investigated innovation in family businesses (McAdam, Reid, & Mitchell, 2010; Brines, Shepherd, & Woods, 2013; Laforet, 2016; Steeger & Hoffmann, 2016; Rondi, De Massisa, & Kotlarb, 2018), open innovation in family firms (Lambrechts et al., 2017; Park & Kwon, 2018) and open innovation and business performance (Kuang-Peng & Chou, 2013; Wang, Chang, & Shen, 2015; Greco, Grimaldi, & Cricelli, 2016; Lazzarotti, Bengtsson, Manzini, Pellegrini, & Rippa, 2017; Wang, 2018), there are no studies on the influence of open innovation on business performance in family and non-family firms in an emergent economy like Mexico. For this reason, it is considered that more research is needed to empirically ground the picture of this influence, thereby contributing to business growth and stability.

Emphasizing the above there have been numerous studies over recent years in this field on large high-tech multinational companies, however, some matters still need additional clarification in developing countries (Zeng, Xie, & Tam, 2010; West, Salter, Vanhaverbeke, & Chesbrough, 2014), therefore further studies are recommended. This study helps different companies, like family and non-family firms in Aguascalientes, Mexico, to have a clearer understanding of the importance that open innovation practices have in business performance.

3. Methodology.

An empirical research in family and non-family firms in Aguascalientes was conducted in order to answer the two hypotheses that were established and tested using Structural Equation Modelling (SEM). For this study, a sample of 308 small and medium companies was considered, using the directory of the Business Information System for Mexico in the state of Aguascalientes which had registered 5,194 companies for the month of December 2016. For the purposes of this empirical study, only companies with between 5 and 250 employees were considered, meaning the directory was reduced to 1,261 companies. Likewise, the sample was selected randomly with a reliability level of 96% and a sampling error of $\pm 4.5\%$, obtaining a total sample of 308. The surveys were carried out from January to April 2016.

Data was obtained through a questionnaire designed to be answered by managers and/or owners of the selected companies, delivered personally to each of the 308 companies. Of the completed surveys obtained, 205 (66%) were considered family businesses and 103 (34%) non-family businesses. Finally, the survey collected information about the characteristics of each company (whether a family SME or a non-family SME), as well as the adoption and implementation of corporate social responsibility.

Likewise, for the measurement of open innovation the scale developed by Van de Vrande et al. (2009) was used, who also considered that open innovation can be measured through 7 items. The first two measure outbound open innovation practices and the remaining 5 measure inbound open innovation practices. All items were designed on a five-point Likert scale, with 1 = *Totally disagree* to 5 = *Completely agree* as limits. Additionally, business performance was measured through a scale of 3 items (1: return of investment; 2: profits compared to the competition; and 3: market participation compared to the competition) adapted from Tan and Litschert (1994) and measured by means of a five-point Likert scale, with 1 = *Totally disagree* to 5 = *Completely agree*.

A Multigroup Factorial Confirmatory Analysis (FCA) was implemented to evaluate the reliability and validity of the scales utilized in the study by using the method of maximum likelihood with the structural equation modeling software EQS 6.1 (Brown, 2006; Byrne, 2006). The reliability of the scales was evaluated by means of Cronbach's Alpha and the Composite Reliability Index (CRI) recommended by Bagozzi and Yi (1988). The results found are shown in Table 1, and they specify that the model had good data ($S-BX^2$ (df = 74) = 387.5822; $p < 0.000$; NFI = 0.796; NNFI = 0.790; CFI = 0.827; RMSEA = 0.079), and the values of both Cronbach's Alpha and the CRI were above 0.7 (Hair, Anderson, Tatham, & Black, 1995), which provided evidence of reliability and justified the internal reliability of the scales.

Table 1 illustrates the data obtained after applying the multigroup factorial confirmation analysis, proving the reliability of the scales and the correct data adjustment of the theoretical model.

As evidence of the convergent validity, the results of the multigroup FCA denoted that all items of the related factors

were significant ($p < 0.01$). The size of all the standardised factorial loads were above 0.60 (Bagozzi & Yi, 1988) and the Extracted Variance Index (EVI) of every construct of the theoretical model represented a value above 0.50 as established by Fornell and Larcker (1981). These standards indicate that the theoretical model presented a good data adjustment.

Table 2 shows the non-existing value of the unit, which proves the existence of discriminant validity of the proposed theoretical model.

Table 1. Internal consistency and convergent validity of the theoretical model

| Variable | Indicator | Loading factorial | Robust t-value | Cronbach's Alpha | CRI | EVI |
|--------------------------|-----------|-------------------|--------------------|------------------|-------|-------|
| Family business | | | | | | |
| Outbound open innovation | PI1 | 0.806*** | 1.000 ^a | 0.812 | 0.825 | 0.702 |
| | PI2 | 0.869*** | 16.443 | | | |
| Inbound open innovation | PI3 | 0.807*** | 1.000 ^a | 0.941 | 0.952 | 0.704 |
| | PI4 | 0.863*** | 27.838 | | | |
| | PI5 | 0.846*** | 22.658 | | | |
| | PI6 | 0.850*** | 19.600 | | | |
| | PI7 | 0.827*** | 21.637 | | | |
| Business performance | IR1 | 0.811*** | 1.000 ^a | 0.915 | 0.914 | 0.780 |
| | IR2 | 0.956*** | 19.288 | | | |
| | IR3 | 0.876*** | 22.143 | | | |
| Non-family business | | | | | | |
| Outbound open innovation | PI1 | 0.848*** | 1.000 ^a | 0.912 | 0.853 | 0.744 |
| | PI2 | 0.877*** | 16.443 | | | |
| Inbound open innovation | PI3 | 0.756*** | 1.000 ^a | 0.934 | 0.946 | 0.656 |
| | PI4 | 0.806*** | 27.838 | | | |
| | PI5 | 0.806*** | 22.658 | | | |
| | PI6 | 0.845*** | 19.600 | | | |
| | PI7 | 0.835*** | 21.637 | | | |
| Business performance | IR1 | 0.869*** | 1.000 ^a | 0.930 | 0.914 | 0.780 |
| | IR2 | 0.956*** | 19.288 | | | |
| | IR3 | 0.820*** | 22.143 | | | |

S-BX2 (df = 74) = 387.5822; $p < 0.000$; NFI = 0.796; NNFI = 0.790; CFI = 0.827; RMSEA = 0.079; a = parameters limited to this value in the identification process; *** = $p < 0.01$.

Source: own elaboration.

Table 2. Discriminant validity of the theoretical model

| Variables | Outbound open innovation | Inbound open innovation | Business performance |
|--------------------------|--------------------------|-------------------------|----------------------|
| Outbound open innovation | | 0.6-0.968 | 0.17-0.454 |
| Inbound open innovation | 0.6-0.968 | | 0.204-0.488 |
| Business performance | 0.17-0.454 | 0.204-0.488 | |

Note: above the diagonal, the confidence interval test of family firms is presented (square correlation). Below the diagonal, the confidence interval test of non-family firms is also presented, the estimation of the correlation of the factors with confidence interval of 95% is shown.

Source: own elaboration.

Considering the evidence of discriminant validity, the measurement is provided by the confidence interval test that can be seen in detail in Table 2. Firstly, with an interval of 95% reliability, none of the specific elements of the dormant factors of the correlation matrix had a value of 1.0 (Anderson & Gerbing, 1988). Consequently, based on these criteria, it can be said that the different measurements provided sufficient evidence of reliability as well as convergent and discriminant validity.

4. Results.

To acquire the results, a structural equation model (SEM) was developed and in the same way to answer the hypotheses formulated in this empirical study the EQS 6.1 (Brown, 2006; Byrne, 2006) software was used. Table 3 contains the results obtained from Family and Non-Family SEMs after applying the equations.

The results obtained in this empirical research presented in the table above, point out that for family business located in Aguascalientes, Mexico, the first hypothesis $\beta = 0.052$ $p < 0.05$, is not significant, meaning that outbound practices of open innovation do not have any effect on business performance. Nevertheless, the second hypothesis $\beta = 0.346$ $p < 0.05$, does indeed demonstrate a significant effect on business performance, which reveals that inbound practices

of open innovation in family business have a significant effect on performance. On the other hand, for non-family business also located in Aguascalientes, Mexico, the first hypothesis $\beta = 0.024$ $p < 0.05$ is not accepted, suggesting that the practice of outbound activities does not influence business performance. Finally, the second hypothesis, $\beta = 0.346$ $p < 0.05$, showed that inbound practices have a significant effect on business performance within non-family businesses in Aguascalientes (Mexico).

Based on the results found it is possible to assert that outbound practices of open innovation do not exert influence on business performance for either family or non-family businesses. However, inbound practices have a significant influence on business performance in both types of companies. In other words, family and non-family firms guide their efforts and activities towards inbound practices, like obtaining external knowledge or technology to help innovation, which allows them to significantly improve their business performance. It can also be shown that inbound practices for family businesses have a greater effect than on non-family business.

5. Conclusion.

This paper examines the influence of inbound and outbound practices of open innovation on the business performance of family and non-family businesses in Aguascalientes, Mexico. The results show the significant effects produced by inbound practices on business performance for both company types, which means that for these companies, the participation of external agents such as suppliers or clients greatly influences their innovation processes. In addition to activities developed based on external networks to support innovation processes, acquiring external knowledge and even human capital, it is very important to have holdings in new or established companies in order to gain access to their knowledge or to have other synergies. The purchase of innovation and development services from other organizations, such as universities, public research organizations, commercial engineers or suppliers also contributes to inbound practices. Other measures which may improve business performance include the purchase or use of intellectual property, like patents, copyrights or trademarks of other organizations.

On the contrary and following the obtained results, outbound practices for family and non-family business in Aguascalientes, Mexico, do not have an important effect on performance. In other words, the sale of licenses or royalty agreements to other companies to obtain the benefits of their intellectual property, patents or trademarks is not very relevant. It is neither important to start new businesses from the internal knowledge of the companies themselves, nor is it relevant in influencing business performance.

In general, the outcome of this investigation provides empirical evidence proving that outbound open innovation practices for family and non-family businesses in the state of Aguascalientes, Mexico, do not exert influence on business performance. On the other hand, inbound practices positively influence performance; this additionally shows that most open innovation practices have been neglected in small and medium

Table 3. SEM results

| Hypotheses | Structural relationship | Standardised coefficient | Robust t value |
|--|--------------------------|--------------------------|----------------|
| Family business | | | |
| H1: the outbound practices exerted in the firms have a positive influence in the business performance. | I. Outbound→ Performance | 0.052 | 0.160 |
| H2: the inbound practices exerted in the firms have a positive influence in the business performance. | I. Inbound→ Performance | 0.528** | 2.635 |
| Hypotheses | Structural Relationship | Standardised coefficient | Robust t value |
| Non-Family business | | | |
| H1: the outbound practices exerted in the firms have a positive influence in the business performance. | I. Outbound→ Performance | 0.024 | 0.070 |
| H2: the inbound practices exerted in the firms have a positive influence in the business performance. | I. Inbound→ Performance | 0.346** | 2.145 |

S-BX2 (df = 70) = 269.373; $p < 0.000$; NFI = 0.858; NNFI = 0.859; CFI = 0.890; RMSEA = 0.079; **= $p < 0.05$
Source: own elaboration.

companies. This paper also addresses this gap by studying the incidence of these practices within the Mexican context, specifically in Aguascalientes State.

Therefore, in order to significantly improve business performance, it is necessary for these companies to incorporate both outbound and inbound practices in equal proportion. This requires not only the promotion of knowledge acquisition on the basis of external networks to support innovation processes, but also reinforcement of the process of obtaining internal company knowledge. Promoted in tandem, these benefits could result in higher economic remuneration.

The results achieved from this study may also provide a different perspective for decision makers who lead these firms, helping them to improve, support and develop practices of open innovation even more by understanding the positive effect that these practices have on the business performance and competitiveness of SMEs. To do this, firms should begin working internally on activities to enhance or promote knowledge among all their members. Moreover, businesses need to be willing to sell or offer licenses or royalty arrangements to other enterprises to achieve the benefits of their intellectual property, patents or trademarks. This will eventually promote the growth of the local and regional economy. Additionally, the results found from this analysis will also allow the companies to incorporate more integration practices of open innovation as part of their business's global strategy.

This empirical research has some limitations, which must be taken into consideration with similar studies in the future. The first limitation is related to the characteristics of the organizations studied. The selected firms were only those SMEs employing between 5 and 250 employees, leaving aside those with fewer than 5 workers, which represent a considerable proportion of Mexican SMEs and a significant percentage in other countries with emerging economies. As a result, in future investigations, it will be important to contemplate this kind of company. This will help to contribute to supporting the results found in this study.

The second limitation relates to the scales used to measure both open innovation practices and business performance. In this case, only two dimensions were used to measure open innovation (i.e. outbound practices and inbound practices), with a total of 7 items, and only one dimension, with 3 items, to measure business performance. In future investigations, it will be indispensable to use other scales to confirm the obtained results.

Another limitation is that the survey was only distributed to SMEs in the state of Aguascalientes, Mexico, with a high concentration of this type of company in the state capital. Consequently, future research may contemplate other states of Mexico, or even other developing countries, to investigate if the achieved results are similar and whether a comparative study is appropriate.

The next limitation is that the questionnaire was only distributed among managers and/or owners of family and non-family SMEs. There was therefore an assumption that these people were familiar with open innovation practices and prevailing business performance. Future studies may consider using the same questionnaire with employees, clients and

even suppliers of family and non-family SMEs, to corroborate and expand the obtained results.

The final limitation identified for this study is the fact that only qualitative variables were considered for the measurement of open innovation practices and business performance. Hence, future research could use hard data from the company and quantitative variables such as R&D investment to confirm if there are significant differences in the results.

Finally, it is recommended to go beyond the results obtained in this paper to investigate and discuss the importance of outbound and inbound open innovation practices on business performance. Verification of the results of this study would be greatly facilitated by increasing the sample size, for example by including other Mexican states or even other countries.

Conflict of interest

The authors declare no conflict of interest.

References

- Alberti, F., Ferrario, S., Papa, F. & Pizzurno E. (2014). Search breadth, open innovation and family firms: evidence in Italian mid-high tech SMEs. *International Journal of Technology Intelligence and Planning*, 10(1), 29-48. <https://doi.org/10.1504/IJTIP.2014.066710>.
- Anderson, J. & Gerbing, D. (1988). Structural equation modelling in practice: a review and recommended two-step approach. *Psychological Bulletin*, 103(3), 411-423. <https://doi.org/10.1037/0033-2909.103.3.411>.
- Arora, A., Fosfuri, A. & Gambardella, A. (2001). *Markets for Technology: The Economics of Innovation and Corporate Strategy* (1 vol.). Cambridge, MA: MIT Press. <https://doi.org/10.1002/mde.1094>.
- Bagozzi, R. & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, 16(1), 74-94. <https://doi.org/10.1007/BF02723327>.
- Basco, R. & Calabrò, A. (2016). Open innovation search strategies in family and non-family SMEs: Evidence from a natural resource-based cluster in Chile. *Revista Latinoamericana de Administración*, 29(3), 279-302. <http://dx.doi.org/10.1108/ARLA-07-2015-0188>.
- Basco, R. & Pérez-Rodríguez, M. (2009). Studying the family enterprise holistically: evidence for integrated family and business systems. *Family Business Review*, 22(1), 82-95. <https://doi.org/10.1177/0894486508327824>.
- Belausteguigoitia, I. & Balaguer, A. (2013). Empresas familiares y no familiares en la bolsa mexicana de valores: comparación de rendimientos de 2006 a 2012, XVIII Congreso internacional de contaduría administración e informática, México, DF.
- Brines, S., Shepherd, D. & Woods, C. (2013). SME family business innovation: exploring new combinations. *Journal of Family Business Management*, 3(2), 117-135. <https://doi.org/10.1108/JFBM-01-2012-0002>.
- Brown, T. (2006). *Confirmatory Factor Analysis for Applied Research* (1st ed.). New York: The Guilford Press.
- Byrne, B. (2006). *Structural Equation Modeling with EQS, Basic Concepts, Applications, and Programming* (2nd ed.). New Jersey: LEA Publishers.
- Caputo, M., Lamberti, E., Cammarano, A. & Michelino, F. (2016). Exploring the impact of open innovation on firm performances. *Management Decision*, 54(7), 1788-1812. <http://dx.doi.org/10.1108/MD-02-2015-0052>.
- Casprini, E., De Massis, A., Di Minin, A., Frattini, A. & Piccaluga, A. (2017). How family firms execute open innovation strategies: the Loccioni case. *Journal of Knowledge Management*, 21(6), 1459-1485. <https://doi.org/10.1108/JKM-11-2016-0515>.
- Chaston, I. (2013). Independent financial advisors: open innovation and business performance. *The Service Industries Journal*, 33(6), 636-651. <http://dx.doi.org/10.1080/02642069.2011.622371>.
- Chesbrough, H. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology* (1st ed.). Boston, MA: Harvard Business School Press.
- Chesbrough, H. (2010). How smaller companies can benefit from open innovation. *Japan Spotlight*, 29(1), 13-15.

- Chesbrough, H. & Brunswicker, S. (2014). A Fad or a Phenomenon?: The Adoption of Open Innovation Practices in Large Firms. *Research-Technology Management*, 57(2), 16-25. <https://doi.org/10.5437/08956308X5702196>.
- Chesbrough, H. & Crowther, A. (2006). Beyond high tech: early adopters of open innovation in other industries. *R&D Management*, 36(3), 229-236. <https://doi.org/10.1111/j.1467-9310.2006.00428.x>.
- Chiaroni, D., Chiesa, V. & Frattini, F. (2010). Unravelling the process from closed to open innovation: evidence from mature, asset-intensive industries. *R&D Management*, 40(3), 222-245. <https://doi.org/10.1111/j.1467-9310.2010.00589.x>.
- Christensen, J., Olesen, M. & Kjaer, J. (2005). The industrial dynamics of open innovation evidence from the transformation of consumer electronics. *Research Policy*, 34(10), 1533-1549. <https://doi.org/10.1016/j.respol.2005.07.002>.
- Cooper, R. (2008). The stage-gate idea to launch process update, what's new, and NexGen systems. *Journal of Product Innovation Management*, 25(3), 213-232. <https://doi.org/10.1111/j.1540-5885.2008.00296.x>.
- Craig, J. & Dibrell, C. (2006). The natural environment, and firm performance: a comparative study. *Family Business Review*, 19(4), 275-88. <https://doi.org/10.1111/j.1741-6248.2006.00075.x>.
- Dawson, A. & Hjorth, D. (2012). Advancing Family Business Research through Narrative Analysis. *International small business journal*, 25(3), 339-355. <https://doi.org/10.1177/0894486511421487>.
- De Massis, A., Sharma, P., Chua, J. & Chrisman, J. (2012). *Family Business Studies: An Annotated Bibliography* (1st ed.). Cheltenham, UK: Edward Elgar Pub.
- Elmquist, M., Fredberg, T. & Ollila, S. (2009). Exploring the field of open innovation. *European Journal of Innovation Management*, 12(3), 326-345. <https://doi.org/10.1108/14601060910974219>.
- Enkel, E., Gassmann, O. & Chesbrough, H. (2009). Open R&D and open innovation: exploring the phenomenon. *R&D Management*, 39(4), 311-316. <https://doi.org/10.1111/j.1467-9310.2009.00570.x>.
- Fornell, C. & Larcker, D. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50. <https://doi.org/10.1177/002224378101800104>.
- Freel, M. (2006). Patterns of technological innovation in knowledge intensive business services. *Industry and Innovation*, 13(3), 335-359. <https://doi.org/10.1080/13662710600859157>.
- Gassmann, O. (2006). Opening up the innovation process: towards an agenda. *R&D Management*, 36(3), 223-228. <https://doi.org/10.1111/j.1467-9310.2006.00437.x>.
- Gómez, L., Haynes, K., Núñez, M., Jacobson, K. & Moyano, J. (2007). Socioemotional wealth and business risks in family-controlled firms: Evidence from Spanish olive oil mills. *Administrative Science Quarterly*, 52(1), 106-137. <https://doi.org/10.2189/asqu.52.1.106>.
- Greco, M., Grimaldi, M. & Cricelli, L. (2016). An analysis of the open innovation effect on firm performance. *European Management Journal*, 34(1), 501-516. <https://dx.doi.org/10.1016/j.emj.2016.02.008>.
- Hair, J., Anderson, R., Tatham, R. & Black, W. (1995). *Multivariate Data Analysis with Readings* (4th ed.). New York, NY: Prentice-Hall.
- Hauser, J., Tellis, G. & Griffin, A. (2006). Research on innovation: A review and agenda for Marketing Science. *Marketing Science*, 25(6), 687-717. <https://doi.org/10.1287/mksc.1050.0144>.
- Heck, R. (2004). A commentary on entrepreneurship in family vs. non-family firms: A resource-based analysis of the effect of organizational culture. *Entrepreneurship Theory and Practice*, 28(4), 383-389. <https://doi.org/10.1111/j.1540-6520.2004.00051.x>.
- Hung, K. & Chou, C. (2013). The impact of open innovation on firm performance: The moderating effects of internal R&D and environmental turbulence. *Technovation*, 33(11), 368-380. <http://dx.doi.org/10.1016/j.technovation.2013.06.006>.
- Inauen, M. & Schenker-Wicki, A. (2011). The impact of outside-in open innovation on innovation performance. *European Journal of Innovation Management*, 14(4), 496-520. <http://dx.doi.org/10.1108/14601061111174934>.
- Klein, S. (2000). Family business in Germany: significance and structure. *Family Business Review*, 13(3), 157-182. <https://doi.org/10.1111/j.1741-6248.2000.00157.x>.
- Kuang-Peng, H. & Chou, C. (2013). The impact of open innovation on firm performance: The moderating effects of internal R&D and environmental turbulence. *Technovation*, 33(10-11), 368-380. <https://doi.org/10.1016/j.technovation.2013.06.006>.
- La Porta, R., Lopez-de-Silanes, F. & Shleifer, A. (1999). Corporate ownership around the world. *Journal of Finance*, 54(2), 471-517. <https://doi.org/10.1111/0022-1082.00115>.
- Laforet, S. (2016). Effects of organizational culture on organizational innovation performance in family firms. *Journal of Small Business and Enterprise Development*, 23(2), 379-407. <https://doi.org/10.1108/JSBED-02-2015-0020>.
- Lambrechts, F., Voordeckers, W., Roijakkers, N. & Vanhaverbeke, W. (2017). Exploring open innovation in entrepreneurial private family firms in low and medium technology industries. *Organizational Dynamics*, 46(4), 244-261. <https://doi.org/10.1016/j.orgdyn.2017.05.001>.
- Lazzarotti, V., Bengtsson, L., Manzini, R., Pellegrini, L. & Rippa, P. (2017). Openness and innovation performance: an empirical analysis of openness determinants and performance mediators. *European Journal of Innovation Management*, 20(3), 463-492. <https://doi.org/10.1108/EJIM-06-2016-0061>.
- Lee, S., Park, G., Yoon, B. & Park, J. (2010). Open innovation in SMEs an intermediated network model. *Research Policy*, 39(2), 290-300. <https://doi.org/10.1016/j.respol.2009.12.009>.
- Lichtenthaler, U. (2009). Outbound open innovation and its effect on firm performance: Examining environmental influences. *R&D Management*, 39(4), 317-330. <https://doi.org/10.1111/j.1467-9310.2009.00561.x>.
- Lichtenthaler, U. (2011). Open innovation: past research, current debates, and future directions. *Academy of Management Perspectives*, 25(1), 75-93. <https://doi.org/10.5465/amp.25.1.75>.
- Lichtenthaler, U. (2015). A note on outbound open innovation and firm performance. *R&D Management*, 45(5), 606-608. <https://doi.org/10.1111/radm.12138>.
- Lichtenthaler, U. & Ernst, H. (2006). Attitudes to externally organizing knowledge management tasks: a review, reconsideration and extension of the NIH syndrome. *R&D Management*, 36(4), 367-386. <https://doi.org/10.1111/j.1467-9310.2006.00443.x>.
- Mazzola, E., Brucoleri, M. & Perrone, G. (2012). The effect of inbound, outbound and coupled innovation on performance. *International Journal of Innovation Management*, 16(6), 1-27. <http://doi.org/10.1142/S1363919612400087>.
- McAdam, R., Reid, R. & Mitchell, N. (2010). Longitudinal development of innovation implementation in family-based SMEs: The effects of critical incidents. *International Journal of Entrepreneurial Behavior & Research*, 16(5), 437-456. <https://doi.org/10.1108/13552551011071887>.
- McCann, I., Leon-Guerrero, A. & Haley, J. (2001). Strategic goals and practices of innovative family businesses. *Journal of Small Business Management*, 39(1), 50-59. <https://doi.org/10.1111/0447-2778.00005>.
- Michelino, F., Caputo, M., Cammarano, A. & Lamberti, E. (2014). Inbound and Outbound Open Innovation: Organization and Performances. *Journal of Technology Management & Innovation*, 9(3), 65-82. <http://dx.doi.org/10.4067/S0718-27242014000300005>.
- Morck, R. & Yeung, B. (2003). Agency problems in large family business groups. *Entrepreneurship Theory and Practice*, 27(4), 367-382. <https://doi.org/10.1111/1540-8520.t01-1-00015>.
- Morris, L. (2009). Business Model Innovation-The Strategy of Business Breakthroughs. *International Journal of Innovation Science*, 1(4), 191-204. <https://doi.org/10.1260/1757-2223.1.4.191>.
- Ollila, S., & Yström, A. (2015). "Authoring" Open Innovation: The Managerial Practices of an Open Innovation Director. *Research in Organizational Change and Development*, 23(1), 253-291. <https://doi.org/10.1108/S0897-301620150000023006>.
- Park, E. & Kwon, S. (2018). Effects of innovation types on firm performance: an empirical approach in South Korean manufacturing industry. *International Journal of Business Innovation and Research*, 15(2), 215-230. <https://doi.org/10.1504/IJBIR.2018.089144>.
- Porter, M. (2003). The economic performance of regions. *Regional Studies*, 37(6-7), 549-578. <https://doi.org/10.1080/0034340032000108688>.
- Rajapathirana, J. & Hui, H. (2018). Relationship between innovation capability, innovation type, and firm performance. *Journal of Innovation & Knowledge*, 3(1), 44-55. <https://doi.org/10.1016/j.jik.2017.06.002>.
- Rondi, E., De Massis, A. & Kotlarb, J. (2018). Unlocking innovation potential: A typology of family business innovation postures and the critical role of the family system. *Journal of Family Business Strategy*. <https://doi.org/10.1016/j.jfbs.2017.12.001>.
- Santoro, G., Ferraris, A., Giacosa, E. & Giovando, G. (2016). How SMEs Engage in Open Innovation: A Survey. *Journal of the Knowledge Economy*, 9(2), 561-574. <https://doi.org/10.1007/s13132-015-0350-8>.

- Schroll, A. & Mild, A. (2011). Open innovation modes and the role of internal R&D: An empirical study on open innovation adoption in Europe. *European Journal of Innovation Management*, 14(4), 475-495. <https://doi.org/10.1108/14601061111174925>.
- Scuotto, V., Del Giudice, M., Bresciani, S. & Meissner, D. (2017). Knowledge driven preferences in informal inbound open innovation modes. An explorative view on small to medium enterprises. *Journal of Knowledge Management*, 21(3), 640-655. <http://dx.doi.org/10.1108/JKM-10-2016-0465>.
- Sisodiya, S., Johnson, J. & Grégoire, Y. (2013). Inbound open innovation for enhanced performance: Enablers and opportunities. *Industrial Marketing Management*, 42(5), 836-849. <https://doi.org/10.1016/j.indmarman.2013.02.018>
- Spanos, L., Tsipouri, L. & Xanthakis, M. (2008). Corporate governance rating of family firms at the Athens exchange market. *Managerial Finance*, 34(7), 465-478. <https://doi.org/10.1108/03074350810874424>.
- Spithoven, A., Clarysee, B. & Knochaett, M. (2010). Building absorptive capacity to organize inbound open innovation in traditional industries. *Technovation*, 30(2), 130-141. <https://doi.org/10.1016/j.technovation.2009.08.004>.
- Sraer, D. & Thesmar, D. (2007). Performance and behavior of family firms: evidence from the French stock market. *Journal of the European Economic Association*, 5(4), 709-751. <https://doi.org/10.1162/JEEA.2007.5.4.709>.
- Steege, J. & Hoffmann, M. (2016). Innovation and family firms: ability and willingness and German SMEs. *Journal of Family Business Management*, 6(3), 251-269. <https://doi.org/10.1108/JFBM-09-2015-0036>.
- Tan, J. & Litschert, R. (1994). Environment-strategy relationship and its performance implications: An empirical study of Chinese electronics industry. *Strategic Management Journal*, 15(1), 1-20. <https://doi.org/10.1002/smj.4250150102>.
- Tidd, J. & Bessant, J. (2009). *Managing Innovation: Integrating Technological, Market and Organizational Change* (4th ed.). New York: John Wiley & Sons Inc.
- Tobiassen, A. & Pettersen, I. (2018). Exploring open innovation collaboration between SMEs and larger customers: The case of high-technology firms. *Baltic Journal of Management*, 13(1), 65-83. <https://doi.org/10.1108/BJM-01-2017-0018>.
- Van de Vrande, V., De Jong, J., Vanhaverbeke, W. & De Rochemont, M. (2009). Open innovation in SMEs: Trends, motives and management challenges. *Technovation*, 29(1), 423-437. <https://doi.org/10.1016/j.technovation.2008.10.001>.
- Van den Berghe, L. & Carchon, S. (2003). Agency relations within the family business system: an exploratory approach. *Corporate Governance*, 11(3), 171-179. <https://doi.org/10.1111/1467-8683.00316>.
- Van der Ploeg, F. (2011). Natural resources: curse or blessing? *Journal of Economic Literature*, 49(2), 366-420. <http://doi.org/10.1257/jel.49.2.366>.
- Van Gils, A., Voordeckers, W. & Hagedoorn, J. (2008). Nurturing innovation in family firms: the influence of managerial and family characteristics. The 8th IFERA Conference.
- Wang, C., Chang, C. & Shen, G. (2015). The effect of inbound open innovation on firm performance: Evidence from high-tech industry. *Technological Forecasting & Social Change*, 99(1), 222-230. <http://dx.doi.org/10.1016/j.techfore.2015.07.006>.
- Wang, P. & Zhou, Y. (2010). The Role of Outbound-Revealing Open Innovation: Theoretical Extension and Case Study. In 2010 IEEE International Conference on Industrial Engineering and Engineering Management, 5675620, 1890-1892. Macao, China.
- Wang, X. (2018). The effect of inbound open innovation on firm performance in Japanese manufacturing firms: comparative study between research center and business unit. *International Journal of Innovation Management*, 27(7), 1-35. <https://doi.org/10.1142/S1363919618500548>.
- West, J., Salter, A., Vanhaverbeke, W. & Chesbrough, H. (2014). Open Innovation: The Next Decade. *Research Policy*, 43(5), 805-811. <https://doi.org/10.1016/j.respol.2014.03.001>.
- World Bank. (2011). *Manual IFC de gobierno de empresas familiares*. Washington D.C.: International Finance Corporation (IFC), Banco Mundial.
- Zeng, S., Xie, X. & Tam, C. (2010). Relationship between Cooperation Networks and Innovation Performance of SMEs. *Technovation*, 30(3), 181-194. <http://doi.org/10.1016/j.technovation.2009.08.003>.