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TESIS DOCTORAL

INNOVACIÓN Y RENDIMIENTO EN EMPRESAS FAMILIARES NO COTIZADAS: ANTECEDENTES, EFECTOS MODERADORES Y MEDIADORES, Y CONSECUENCIAS

INNOVATION AND PERFORMANCE IN PRIVATELY HELD FAMILY FIRMS: ANTECEDENTS, MODERATING AND MEDIATING EFFECTS, AND CONSEQUENCES

TESIS PRESENTADA POR

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Table of content

Table of figures

Tables

ABSTRACT

In recent decades there has been a burgeoning and heated debate in the family business world about how family involvement influences innovation. Despite the progress made, the current comprehension of the specific antecedents affecting family firm innovation is limited, with a plethora of contradictory and inconclusive results. Consequently, more research is required to understand the unique but complex innovative behaviour of family firms.

In line with the above, the general objective of this thesis is to study the antecedents and consequences of innovation in the context of family firms. Specifically, we are going to investigate how different issues related to corporate governance bodies affect the innovation strategies of family firms and, ultimately, the obtained performance outcomes.

This general aim is developed through four specific objectives. The first objective is to provide an overview of the family firm innovation research field through a bibliometric study. The second objective is to examine the indirect effects of technological innovation efficiency in the relationship between family management and firm performance. The third objective is to investigate the moderating role of technological collaborations on the relationship between family management and product innovation efficiency. Finally, the fourth objective is to analyse how women's presence in different corporate governance structures affects innovation in family firms.

In order to achieve the aforementioned objectives, this thesis is structured in four chapters, plus an initial introductory section and a final section for conclusions.

The first chapter develops the first specific objective. In this regard, this chapter aims to contextualize the reader by identifying and synthesizing the key topics of the family firm innovation research field and by highlighting future research opportunities. Moreover, this chapter also proposes an integrative framework aimed at advancing the current knowledge on family firm innovation and identifying new research avenues to further develop the field.

Chapter two develops the second specific objective. Thus, this chapter analyses the mediating and moderating influence of technological innovation efficiency in the

relationship between family management and firm performance. The empirical results show that technological innovation efficiency mediates and moderates the impact of family management on firm performance.

Chapter three addresses the third specific objective. In this vein, chapter three analyses the moderating role of technological collaborations with different partners in the relationship between family management and product innovation efficiency. The findings reveal that the positive influence of family management on product innovation efficiency varies according to the type of technological partner with whom the collaboration agreement is established.

The fourth chapter corresponds to the fourth specific objective, which is to analyse how women's presence in different corporate governance structures affects innovation in family firms. In this regard, the results reveal that women's presence in general shareholders' meetings and in top management teams negatively influences product innovation in family firms.

Finally, in the conclusion section, the main contributions, practical implications, limitations and future research avenues are presented.

Hence, this thesis provides valuable contributions to the family firm innovation research field, especially with regard to innovation efficiency, technological collaborations and gender, and their effect on firm performance. Furthermore, this thesis provides interesting practical insights for the development of managerial policies in family firms.

RESUMEN

En las últimas décadas se ha producido un floreciente y acalorado debate en el mundo de la empresa familiar sobre cómo influye la participación familiar en la innovación. A pesar de los avances realizados, la comprensión actual de los antecedentes específicos que afectan a la innovación de las empresas familiares es limitada, con una plétora de resultados contradictorios y no concluyentes. En consecuencia, es necesario seguir investigando para comprender el singular pero complejo comportamiento innovador de las empresas familiares.

En línea con lo anterior, el objetivo general de esta tesis es estudiar los antecedentes y las consecuencias de la innovación en el contexto de las empresas familiares. En concreto, vamos a investigar cómo afectan diferentes cuestiones relacionadas con los órganos de gobierno corporativo a las estrategias de innovación de las empresas familiares y, en última instancia, a los resultados de rendimiento obtenidos.

Este objetivo general se desarrolla a través de cuatro objetivos específicos. El primer objetivo es proporcionar una visión general del campo de investigación sobre la innovación en las empresas familiares mediante un estudio bibliométrico. El segundo objetivo es examinar los efectos indirectos de la eficiencia de la innovación tecnológica en la relación entre la gestión familiar y el rendimiento de la empresa. El tercer objetivo es investigar el papel moderador de las colaboraciones tecnológicas en la relación entre la gestión familiar y la eficiencia en la innovación de productos. Por último, el cuarto objetivo es analizar cómo la presencia de la mujer en diferentes estructuras de gobierno corporativo afecta a la innovación en las empresas familiares.

Para alcanzar los objetivos mencionados, esta tesis se estructura en cuatro capítulos, más una sección inicial de introducción y una sección final de conclusiones.

El primer capítulo desarrolla el primer objetivo específico. En este sentido, este capítulo pretende contextualizar al lector identificando y sintetizando los temas clave del campo de investigación de la innovación en la empresa familiar y destacando las oportunidades de investigación futuras. Además, este capítulo también propone un marco integrador destinado a avanzar en el conocimiento actual sobre la innovación de las

empresas familiares y a identificar nuevas vías de investigación para seguir desarrollando el campo.

El capítulo dos desarrolla el segundo objetivo específico. Así, este capítulo analiza la influencia mediadora y moderadora de la eficiencia de la innovación tecnológica en la relación entre la gestión familiar y el rendimiento empresarial. Los resultados empíricos muestran que la eficiencia de la innovación tecnológica media y modera el impacto de la gestión familiar en el rendimiento empresarial.

El capítulo tres aborda el tercer objetivo específico. En este sentido, el capítulo tres analiza el papel moderador de las colaboraciones tecnológicas con diferentes socios en la relación entre la gestión familiar y la eficiencia en la innovación de productos. Los resultados revelan que la influencia positiva de la gestión familiar en la eficiencia de la innovación de productos varía según el tipo de socio tecnológico con el que se establece el acuerdo de colaboración.

El cuarto capítulo corresponde al cuarto objetivo específico, que consiste en analizar cómo la presencia de la mujer en las diferentes estructuras de gobierno corporativo afecta a la innovación en las empresas familiares. En este sentido, los resultados revelan que la presencia de las mujeres en las juntas generales de accionistas y en los equipos de alta dirección influye negativamente en la innovación de productos en las empresas familiares.

Por último, en la sección de conclusiones, se presentan las principales contribuciones, las implicaciones prácticas, las limitaciones y las futuras vías de investigación.

Así pues, esta tesis aporta valiosas contribuciones al campo de la investigación sobre la innovación en las empresas familiares, especialmente en lo que se refiere a la eficiencia de la innovación, las colaboraciones tecnológicas y el género, y su efecto sobre el rendimiento empresarial. Además, esta tesis aporta interesantes ideas prácticas para el desarrollo de políticas de gestión en las empresas familiares.

INTRODUCTION

1. Introduction

Family firms are the backbone of most industrialized and developed countries worldwide (Family Firm Institute, 2018), comprising two-thirds of all businesses operating throughout the world, generating 70-90% of annual global GDP and creating around 50-80% of jobs in most countries worldwide. Consequently, the family firm research field has experienced substantial growth in recent decades (Rovelli et al., 2021; Xi et al., 2015), being considered an interesting context to be investigated (Zellweger, 2017).

Within the family firm research field, one area that is gaining increasing momentum is that related to the implications of family involvement in business innovation (Bendig et al., 2020; Calabrò et al., 2019; Rondi et al., 2021). In this vein, the existing empirical results so far are inconclusive and the relationship between family involvement and innovation remains unclear. Accordingly, more research is urgently needed to better understand the unique but complex innovative behaviour of family firms (Casado-Belmonte et al., 2021).

The peculiar innovative behaviour of family firms, is grounded in the interplay between the family and the firm (Berent-Braun et al., 2018; Duran et al., 2016; Muñoz-Bullón et al., 2020). Family firm scholars are convinced that family firms have certain particularities that make them behave and innovate differently from other businesses (Carney et al., 2015; De Massis et al., 2013; Manzaneque et al., 2018). In this regard, family firms possess a singular set of governance structures (Arteaga & Escribá-Esteve, 2020; Daspit et al., 2018; Matzler et al., 2015), which favour the enhancement of sustained family-based competitive advantages that can lead to the development of unique innovation resources and capabilities (Habbershon & Williams, 1999; Martínez-Alonso et al., 2020b; Sirmon & Hitt, 2003). Nevertheless, there is little empirical research devoted to investigate which are the determinants of family firms' innovation strategies, and their ensuing impact on firm performance (Calabrò et al., 2019; Casado-Belmonte et al., 2021).

Hence, the general objective of this thesis is to study the antecedents and consequences of innovation in the context of family firms. Namely, we investigate how

distinct aspects related to corporate governance bodies impact on the innovation strategies of family firms and, ultimately, in their performance outcomes. This general aim is developed by means of four specific objectives that are explained below.

The first specific objective is to provide an overview of the family firm innovation research field, to detect and synthesize key topics and to outline future research opportunities. Specifically, by conducting a bibliometric analysis, we examine different aspects related to family firm innovation by applying both performance analysis and scientific mapping, through co-authorship, co-citation and co-word analyses. Additionally, we propose an integrative framework designed to advance the knowledge on available research paths on family firm innovation and to identify new research avenues to further develop the field.

After identifying the most recent and hot research trends in the family firm innovation field, our next step is to delve in those research areas that are currently generating more academic and professional debate. In this regard, our second objective is to focus on technological innovation efficiency, i.e., the firm's capability to maximize innovation outputs given a certain quantity of innovation inputs (Cruz-Cázares et al., 2013), and to study how and under what conditions such innovation efficiency shapes and affects the family management-firm performance relationship (Diéguez-Soto et al., 2019; Gallucci et al., 2015; Westhead & Howorth, 2006). In particular, we analysed the indirect effect, both in the form of moderation and mediation analyses, of technological innovation efficiency in the relationship between family management and firm performance.

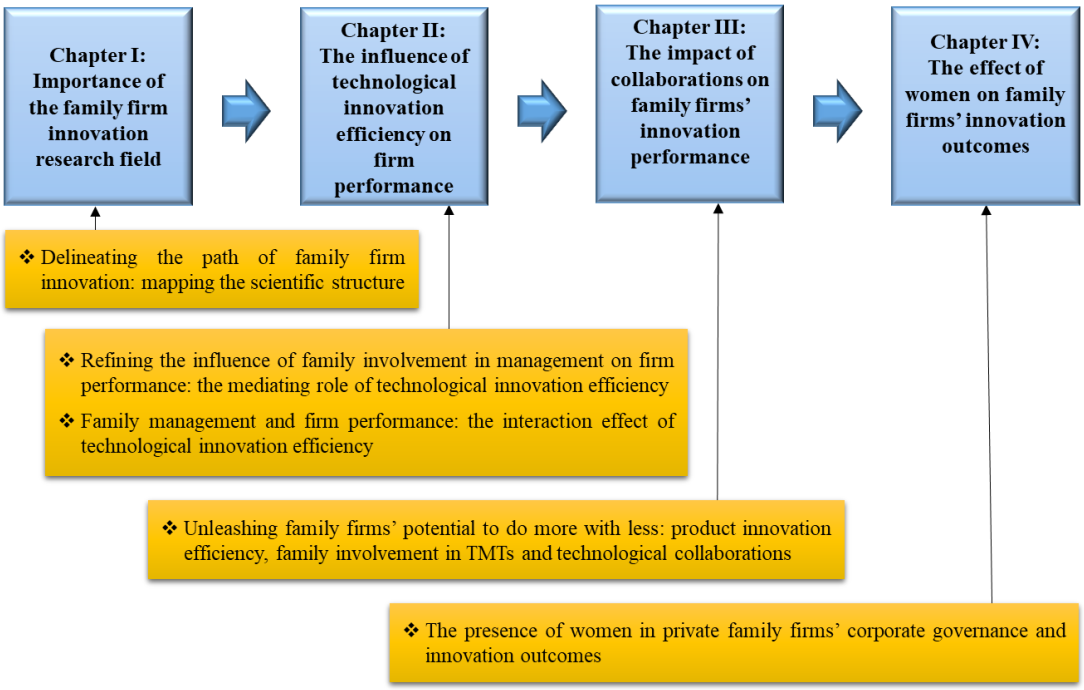
Once we proved that technological innovation efficiency plays an important role in enhancing the link between family management and performance, our third objective was to examine whether and to what extent collaboration with innovation partners influence the family management-product innovation efficiency relationship (Bigliardi & Galati, 2018; Feranita et al., 2017). In this regard, we examined the moderating role of technological collaborations with external partners, and more specifically, with suppliers, customers, competitors and research organizations, in the relationship between family management and product innovation efficiency.

Having demonstrated that the impact of family management on product innovation efficiency varies according to the type of technological partner selected, our fourth

objective was to determine how the presence of women in different corporate governance structures affects innovation in family firms. In particular, we analysed whether female participation in three corporate governance bodies, namely the general shareholders' meeting, the top management team and the board of directors, influences product innovation within family firms.

To meet the aforementioned objectives, this thesis consists of four chapters (see Figure 1), in addition to this introduction, and a final section containing the conclusions. References and appendices appear after each chapter.

Figure 1. Thesis structure



The first chapter, *Importance of the family firm innovation research field*, corresponds to the first publication that composes this thesis: "Delineating the path of family firm innovation: mapping the scientific structure" (Casado-Belmonte et al., 2021) and covers the first specific objective. This chapter provides an overall view of the family firm innovation research field, offering valuable information on, for instance, academic actors (including their institutions and countries), journals and scientific collaborations. In addition, our study also provides an integrative framework that points to inspiring research questions, such as the need to better understand the heterogeneous innovation behaviour of family firms, or how different SEW dimensions influence emerging

innovation forms in the family firm sphere, such as technological innovation efficiency or technological collaborations.

The results of our bibliometric analysis reveal the growing importance of the topic of family firm innovation worldwide, identifying a total of 72 countries publishing articles addressing innovation issues in family businesses. Our study also shows that De Massis A., Kotlar J., and Kraus S. are the three most productive authors on this topic and that the three specific family firm journals, namely Family Business Review, Journal of Family Business Strategy and Journal of Family Business Management, are the most productive in terms of innovation in family firms. The co-citation analysis enables recognising entrepreneurship, behavioural agency theory, resource-based view theory and agency theory as the pillars of the theoretical foundations and intellectual structure in the family firm innovation field. Finally, the co-word analysis allows identifying five clusters led by the keywords family firms, innovation, socio-emotional wealth, firm performance and internationalization, which represent the driving thematic sub-areas within family firm innovation research.

The second chapter, *The influence of technological innovation efficiency on firm performance*, encompasses two publications and covers the second specific objective, that is, determining how and when technological innovation efficiency influences the relationship between family management and firm performance.

On the one hand, the first study: "Refining the influence of family involvement in management on firm performance: the mediating role of technological innovation efficiency" (Martínez-Alonso et al., 2020a), analyses the mediating role of technological innovation efficiency on the relationship between family management and firm performance. On the other hand, the second study: "Family management and firm performance: the interaction effect of technological innovation efficiency" (Martínez-Romero et al., 2020), deals with the moderating influence of technological innovation efficiency on the family management-firm performance relationship.

Therefore, the second publication of this thesis (Martínez-Alonso et al., 2020a) investigates whether family management influences firm performance directly and indirectly through technological innovation efficiency. In so doing, we follow the calls of Chrisman et al. (2012) and Yeniaras et al. (2017) to examine the role of indirect strategic

mechanisms, such as in our case, technological innovation efficiency, in the family involvement-performance relationship.

In the same way as in the abovementioned study, the third paper that comprises this thesis (Martínez-Romero et al., 2020), analyses the moderating role of technological innovation efficiency in the relationship between family management and firm performance. Namely, we test the conditions under which technological innovation efficiency may encourage family managers to initiate changes in the manners in which innovation strategies are developed, with the ultimate goal of enhancing performance outcomes.

Both, the second and third publications composing this thesis were motivated by the inconsistencies found in previous works on the ways through which family management affects performance outcomes (Diéguez-Soto et al., 2019; Gallucci et al., 2015; Westhead & Howorth, 2006), and due to the growing interest in investigating how technological innovation efficiency impacts on family firm performance (Cruz-Cázares et al., 2013; Martínez-Alonso et al., 2020b).

Thereby, with the development of these two publications we deepen our understanding of how technological innovation efficiency helps to explain how and under what circumstances family managers can improve firm performance. In such a way, we shed light on the salience of technological innovation efficiency as the cornerstone that can support family managers in enhancing their performance outcomes.

Concerning the first publication in this second chapter, our empirical findings reveal that family management shows a beneficial impact on firm performance, measured as gross margin. Moreover, the results show that technological innovation efficiency fully mediates the relationship between family management and firm performance.

Regarding the second publication of the second chapter, our findings reveal that family management exert a negative effect on firm performance, measured as return on assets. Furthermore, the results show that technological innovation efficiency weakens the negative relationship between family management and firm performance.

The third chapter, *The impact of collaborations on family firms' innovation performance*, corresponds to the fourth publication of this thesis: "Unleashing family firms' potential to do more with less: product innovation efficiency, family involvement in TMTs and technological collaborations" (Martínez-Alonso et al., 2022b) and provides answers to our third specific objective, which is to analyse the moderating role of technological collaborations on the relationship between family management and product innovation efficiency. In particular, this chapter examines the specific moderating influence of technological collaborations with suppliers, customers, competitors and research organizations in shaping the family management-product innovation efficiency link.

This research was motivated by the current lack of understanding on how family firms deal with technological collaborations and the resulting impact on their innovation performance (Gjergji et al., 2022; Martínez-Alonso et al., 2022a; Rondi et al., 2021). Technological collaborations are often conceptualized as voluntary agreements between independent firms, which exchange and share resources such as capital, information, knowledge and technology to fulfil a common innovation goal (Un et al., 2010). Despite being a decisive factor in supporting more efficient innovations (Hernandez-Vivanco et al., 2018; Lazzarotti et al., 2017; O'Connor et al., 2021), research on technological collaborations in family businesses is still in a nascent stage of development (Feranita et al., 2017; Gjergji et al., 2019; Rondi et al., 2021).

The findings of our study reveal that family management positively influences product innovation efficiency. Our results also show that such positive effect is weakened as technological collaborations increase, and varies according to the partner type with whom the collaboration agreement is established. In particular, our findings indicate that collaboration with suppliers appear to be the least detrimental for product innovation efficiency in family firms, followed by collaborations with customers and research organizations.

The fourth chapter, *The impact of women on family firms' innovation outcomes*, relates to the fifth publication that forms part of this thesis: "The presence of women in private family firms' corporate governance and innovation outcomes" (Hernández-Cuevas et al., 2022) and addresses the fourth specific objective previously mentioned.

This chapter analyses the influence of women's presence in corporate governance structures on firms' innovation outcomes. In this regard, understanding how gender diversity influences innovation within family firms has become a crucial issue (Bannò et al., 2021; Hernández-Lara et al., 2021; Hernández-Lara & Gonzales-Bustos, 2020), as women's presence in corporate governance bodies brings certain advantages, such as greater creativity or problem-solving skills (Bianchi-Martini et al., 2012; Galia & Zenou, 2012; Miller & Triana, 2009), which are key to innovation success. With this in mind, our research analyses whether the inclusion of females in private family firms' corporate governance structures, namely, in general shareholders' meetings, top management teams and boards of directors, influences product innovation.

This research was motivated by the fact that, although increasing importance is given to the incorporation of women in corporate governance structures (Fenoy-Castaño et al., 2021; Maseda et al., 2021; Nájera-Vázquez & Martínez-Romero, 2020), their effects on the innovation performance of private family firms are almost non-existent to date (Calabrò et al., 2019; Casado-Belmonte et al., 2021; Scholes et al., 2021).

Our empirical results reveal that women's presence in general shareholders' meetings and in top management teams, has a significant negative effect on product innovation. On the other hand, the impact of women's presence in boards of directors was also negative, but not significant. In light of the obtained results, it seems that the presence of women in corporate governance gives rise to certain advantages, but at the same time, to different points of view which can break the balance of the firm (Sheridan et al., 2011).

Finally, the concluding section reveals the main findings obtained in the development of the present thesis. The conclusions section also emphasizes the main contributions of this thesis, acknowledges its limitations and suggests potential avenues for future research.

1.1. Regarding the format of the thesis

The regulation of the international Doctoral School of the University of Almería (EIDUAL) establishes two different modalities when presenting a thesis: "compendium of publications" thesis (Modality A) and "traditional" thesis (Modality B). The EIDUAL

regulations, based on the Royal Decree 99/2011 of 28 January, also establish the requirements to qualify for the international mention for the doctorate degree.

In recent years, there has been a clear preference among academics for the publication compendium mode, and we have thus opted for it. As such, this doctoral thesis is presented through this modality. According to EIDUAL regulations, this modality requires the thesis to be composed of at least three publications that meet the following conditions:

- Two contributions should be published or accepted for publication in journals pertaining to the first quartile of the Journal Citation Reports (JCR) ranking or in books whose publisher is in the top quartile of the discipline's ranking from the Scholarly Publishers Indicators (SPI) listings.

- A third contribution, other than the previous ones and not consisting of a conference publication, should be published or accepted for publication in journals pertaining to the second and third quartile of the JCR ranking or in books whose publisher is in the second quartile of the discipline's ranking from the SPI listings.

In addition, this thesis is eligible for the international mention of the doctorate degree. Consequently, in accordance with the abovementioned regulations, this thesis has been written in English and has been reviewed by two experienced and accredited PhDs from non-Spanish research centres. Furthermore, to be able to opt for the international mention, the PhD candidate should carry out a research stay of at least three months in an international research centre. To fulfil this requirement, the PhD Candidate has conducted a research stay for a period of three months in the Family Business Lab in the University Carlo Cattaneo – LIUC, under the supervision of professor Valentina Lazzarotti.

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CHAPTER I. IMPORTANCE OF THE FAMILY FIRM INNOVATION RESEARCH FIELD

DELINEATING THE PATH OF FAMILY FIRM INNOVATION: MAPPING THE SCIENTIFIC STRUCTURE

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DELINEATING THE PATH OF FAMILY FIRM INNOVATION: MAPPING THE SCIENTIFIC STRUCTURE

Abstract

Research on family firm innovation (FFI) has grown exponentially in recent years, as evidenced by the growing number of authors devoted to its study. However, to date, numerous questions remain unsolved about how family firms are coping with different innovation issues. In this context, this study aims to explore the scientific literature on FFI through performance indicators of scientific production, social networks of collaborations between authors and the intellectual and conceptual structures of the field. To accomplish this goal, bibliometric techniques are conducted, namely co-author, co-citation and co-word analyses. This study is carried out through a review of 975 published documents on FFI retrieved from the Web of Science and Scopus databases during the period 1987–2019. The findings reveal the richness of the FFI field and allows this large body of work to be organized into four theoretical roots and five thematic clusters. Additionally, this study proposes an integrative framework aimed at advancing new knowledge on the available research paths on FFI and identifying new research avenues to further develop the field. Hence, our research enriches the lively debate on FFI by offering a better understanding of the heterogeneous innovation behaviour of family firms.

Keywords: innovation, family firms, co-authorship, co-word analysis, co-citation, bibliometrics

1. Introduction

Research on innovation in the family firm context is advancing and gaining increasing momentum to the extent that it has become a subject of great popularity among academics, practitioners and consultants (Calabrò et al. 2019; Migliori et al. 2020; Strobl et al. 2020). Nevertheless, the most significant increase in family firm innovation studies has taken place during the last decade (e.g. Filser et al. 2016), and thus, scholarly research on family firm innovation remains a relatively young but expanding phenomenon.

Representing ubiquitous and significant organisational forms, family firms dominate the global economic landscape (De Massis et al. 2018b; La Porta et al. 1999). The latest data compiled by the Family Firm Institute (2018) indicate that family firms comprise two thirds of all businesses operating throughout the world, generate between 70% and 90% of annual global GDP and create around 50% to 80% of jobs in most countries worldwide. Beyond their economic importance, there is also great interest in recognising that family firms have certain particularities that make them behave and innovate differently to other businesses (Carney et al. 2015; De Massis et al. 2013). In this sense, family firms possess a singular ensemble of ownership, management and governance (Matzler et al. 2015), which encourages the enhancement of sustained family-based competitive advantages that may result in the development of unique innovation resources and capabilities (Habbershon and Williams 1999; Sirmon and Hitt 2003). Particularly, family firms are widely recognised for their extraordinary emotional attachment and strong commitment to the firm's survival (Arregle et al. 2007), their long-term orientation (Brigham et al. 2014), their multigenerational involvement (Kellermanns and Eddleston 2004), and their greater resilience in difficult times (Martínez-Romero and Rojo-Ramírez 2016), due to the unique interaction between the family and the firm (Habbershon and Williams 1999). Thereby, family firms are an appealing context within which to analyse the innovation phenomenon (Martínez-Alonso et al. 2018).

Innovation is an essential factor for the long-term firm survival and also for the economic performance of family firms (Hauck and Prügl 2015; Kellermanns et al. 2012). According to the Oslo Manual of the Organisation for Economic Co-operation and Development (2005, p. 46) innovation is defined as “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or

a new organisational method in business practices, workplace organisation or external relations". Generally, the implementation of innovations leads to an improvement in family firm performance (Martínez-Alonso et al. 2020b); however, innovation involves substantial risks, such as possible loss of both control and emotional endowment, which often make family firms reluctant to innovate (Chrisman and Patel 2012; Gómez-Mejía et al. 2014).

Given the greater theoretical and practical relevance of this topic in recent years (Calabrò et al. 2019), we detect a need to explore the evolution of the family firm innovation (FFI) path to identify both strengths and weaknesses in the extant literature and to envision future research lines. In view of the foregoing, the research goal of this study is to provide a delineation of the scientific foundation for research on FFI.

To accomplish such a goal, the present study employs bibliometric techniques, which help to discover, organize and examine information regarding a specific research field, based on performance indicators and science mapping (Baier-Fuentes et al. 2019b). Specifically, three different bibliometric methods are used, namely co-author, co-citation and co-word analyses. On the one hand, co-author analysis allows the identification of collaborations between authors and thus, the social structure of FFI research (Acedo et al. 2006). On the other hand, co-citation analysis allows the disclosure of the overall intellectual structure and theoretical foundations of FFI research (Randhawa et al. 2016). Finally, co-word analysis permits the exploration of interactions between research themes and emerging research trends of FFI research (López-Fernández et al. 2016). Given that distinct bibliometric methods have advantages and disadvantages, the combination of various analyses to explore research trends and dynamics within a discipline has become a powerful trend in bibliometrics (Leung et al. 2017).

Hence, this study offers several contributions to previous literature. First, it enriches the ongoing debate on innovation in family firms by means of an extensive bibliometric analysis to better understand antecedents and consequences of FFI, as well as the factors that drive family firm heterogeneity when conducting innovation processes. Second, by examining the linkages between the leading research themes, this study proposes an integrative framework aimed at identifying future research avenues to advance knowledge and further develop the field. Third, the present study goes beyond previous

FFI bibliometric analyses covering up to 2017, omitting the years of maximum scientific production, namely 2018 and 2019 (Aparicio et al. 2019; Filser et al. 2016). In this way, we show that the FFI is becoming an increasingly hot topic that will continue to grow in the near future. Fourth, this study is carried out based on the two most commonly used bibliometric data sources (Waltman and Noyons 2018), namely Web of Science and Scopus, covering a substantially larger body of documents than prior FFI bibliometric analyses which only focused on a single database. Finally, this study provides some valuable managerial insights for family firms' owners and managers, and family members in general, as well as for other stakeholders.

2. A synthesis of prior literature review articles on family firm innovation

The FFI field is still a young phenomenon that emerged from the close link between two promising research areas that have attracted the attention of the business world: innovation and family firms (Filser et al. 2016). The first document on the FFI topic was a book entitled "Manufacturing in Kitchener-Waterloo: A Long-term Perspective" by Walker D.F., published in 1987. This book provides an overview of how the creation of new (family) firms in the city of Kitchener (Canada) by German entrepreneurs who had migrated there during the 19th century made possible the development of the city's manufacturing industry, whose firms today are the legacy of that German family entrepreneurial spirit. Nevertheless, it is not until quite recently that more encouraging, and perhaps also more helpful, studies have examined the potential positive (negative) aspects and advantages (disadvantages) of family firms in managing innovation. These studies have led to a growing interest in FFI among scholars, firm managers, and consultants, especially, in the last decade. The expansion of the FFI field has been accompanied with a flourishing number of literature review articles that seek to systematise and integrate extant knowledge on the topic and guide its progress. The objectives of such studies vary substantially from those of our bibliometric review, since they synthesize existing research based on the most important findings, the main theoretical and empirical approaches, or elucidate other related issues to the primary topic.

The first attempt to integrate prior research on FFI was made by De Massis et al. (2013), who reviewed 23 articles on technological innovation in family firms. The authors

proposed a framework inspired by the work of Lumpkin et al. (2011), to show direct effects of family involvement on innovation inputs in terms of R&D expenditures, innovation activities such as leadership in new product development projects, and innovation outputs in terms of number of products. De Massis et al. (2013) also revealed the existence of the moderating effects of family involvement on such technological innovation steps. Although limited by the number of studies, but considering that FFI research was in an embryonic stage at that time, the theoretical and practical conclusions of this literature review were very insightful. Padilla-Meléndez et al. (2015) provided a broad overview of the relationships between determinants and dimensions of FFI, using the multidimensional framework of innovation proposed by Crossan and Apaydin (2010). These authors revealed that the environment and the family influence through ownership and generation are potential determinants that impact on innovation outcomes in family firms. Röd's (2016) literature review looked at how family factors affect the various stages of the FFI process. In doing so, Röd et al. (2016) developed a framework based on the concept of familiness and incorporated the family system as an influential context variable, demonstrating that family influence represents a double-edged sword with advantages and disadvantages for FFI processes. Fuetsch and Suess-Reyes (2017) reviewed the literature covering contributions on FFI and its association with firm performance, as well as, the components of family involvement, the essence of family firms, contextual factors, generations and lifecycles. Martínez-Alonso et al. (2018) compiled those articles analysing technological innovation from a socio-emotional wealth viewpoint, proposing a framework with a set of factors, such as performance hazard, CEO risk aversion, or family management that must be taken into account for the successful implementation of FFI strategies in the light of socio-emotional wealth aspects. Finally, Calabrò et al. (2019) developed a conceptual bridge to identify not only the main gaps, but also to reconcile the existing conflicting findings in prior FFI studies. To this end, Calabrò et al. (2019) reviewed the main linkages investigated to date in FFI literature, that is, direct relationships between family involvement and innovation and the moderating effects of family involvement on the link innovation-firm performance, and the theoretical lenses that shape and support such relationships.

The abovementioned literature reviews offer valuable insights into the FFI topic. Nevertheless, other methods and techniques are needed to enrich and complement these

review processes and to move FFI field forward (Aparicio et al. 2019; Filser et al. 2016). Furthermore, although the validity of systematic literature reviews has been widely demonstrated (Kraus et al. 2020a), the document selection process in some of these studies is not entirely clear due to the lack of transparency regarding the keywords selected, the subjectivity of the authors, and the way in which the articles are selected, from searches in online databases (e.g. Scopus) to hand searches in the journals closest to the study topic. Hence, bibliometric studies have emerged as important tools for improving the quality of reviews through its remarkably transparent, reproducible and iterative review process, which results in better evaluation and control of documents published in a specific subject area (Zupic and Čater 2015). In addition, bibliometric techniques can be applied to an extensive list of bibliographic references (Alayo et al. 2020), which provides a completely new perspective on the FFI field by complementing prior literature review articles.

3. Methodology

In order to identify the key elements of the FFI research field, the bibliometric analysis technique is followed, showing relevant information regarding authors, documents, and keywords (Cobo et al. 2011). As previous bibliometric studies have done (e.g. Terán-Yépez et al. 2020), this study follows five steps: (1) definition of the research field; (2) database selection, (3) research criteria adjustment, (4) codification of recovered material and (5) examination of the information. In this manner, the process gains clarity and is easily reproducible (Figure 1).

The first step is the identification of the core focus of this study, that is, FFI, in order to show information regarding scientific production and keywords co-occurrence analysis of this research field.

The second step is the database selection. Taking into account that the results of the analysis could vary depending on the selected database, and in line with Agramunt et al. (2020), the two most commonly employed bibliometric data sources, i.e. Web of Science (WoS, produced by Clarivate Analytics) and Scopus (created by Elsevier) are used in this study. Although Google scholar might offer additional coverage to WoS and Scopus, it has certain associated problems. First, it lists a great deal of non-academic sources including grey literature that is not peer-reviewed (Kraus et al. 2020a). Second, the search

algorithm is not reproducible since the results are shown based on prior searches and interactions (Gusenbauer and Haddaway 2020). Third, Google scholar is difficult to use for large-scale analysis (Waltman and Noyons 2018). Thus, the abovementioned limitations have dissuaded us from including it in our analysis.

Once the databases are selected, the next step is the research criteria adjustment. In this stage the research criteria is established with Boolean operators in order to obtain an accurate search and to ease large data capture. Accordingly, the parameters used to retrieve the search were: TITLE-ABS-KEY ("innovat*") AND ("famil* firm*" OR "famil* business*" OR "famil* own*" OR "famil* control*" OR "famil* enterprise*" OR "famil* compan*") from the title, abstract and keywords. The search was limited to the period 1987-2019, as the first document on this topic was published in 1987. The search in both databases (WoS + Scopus) was undertaken at the end of March 2020. With regard to the inclusion and exclusion criteria, only articles, reviews, books and book chapters, including open access and non-open access documents were considered (Capobianco-Uriarte et al. 2019). The numbers of documents from WoS were 739 and from Scopus 587, although there were 351 in common. Thus, the final sample consisted of 975 documents (Figure 2).

The fourth step is the codification of recovered material, which was downloaded in csv format and codified using Excel (version 2013) and VOSviewer (version 1.6.9). The data were pre-processed for the subsequent analysis. First, duplicated documents, which were in both databases, were deleted. Second, each document's abstract and title were reviewed to ensure that they met the search criteria. Third, documents with missing information were corrected.

Finally, the last step is the examination of the information. This phase is conducted using two bibliometric analysis techniques: performance analysis and science mapping (Cobo et al. 2011). First, following previous studies (Baier-Fuentes et al. 2020; Terán-Yépez et al. 2019), the performance analysis is based on productivity, taking into account the number of publications as the main indicator. Besides, the number of citations and the h-index are used to enrich the performance analysis, at the level of journals, authors and institutions. Its main purpose is to provide an updated picture of the research field by identifying the works that constitute its intellectual base (Alayo et al. 2020). Second,

science mapping aims to unveil the structure and dynamics of scientific fields (Zupic and Čater 2015). It is a spatial depiction of how disciplines, fields, authors, or papers relate to each other. This methodological approach is adapted to the purposes of the present study. Therefore, to examine different interesting aspects of the research field, we conduct scientific mapping based on co-author, co-citation and co-word analyses. First, co-author analysis enables the social network of a research field to be identified through the linkages between its most relevant authors and the sub-groups emerging from the collaborations (Acedo et al. 2006). This technique captures stronger social links than other relatedness measures, making it ideal for examining social networks (Zupic and Čater 2015). Second, co-citation analysis allows the intellectual structure and theoretical foundations of the research field to be revealed (Randhawa et al. 2016). Co-citation is defined as two publications which are cited together in one article (Mas-Tur et al. 2020). Accordingly, the co-cited references are thought to have similar or related concepts (Kraus et al. 2020b), showing the invisible development, relationships and influences of research (Ramos-Rodríguez and Ruíz-Navarro 2004). Third, co-word or co-occurrence analysis of keywords allows the conceptual structure of a scientific field to be established by generating a set of clusters that could be considered as conglomerations of semantic or conceptual bundles of topics addressed by a research field (Alayo et al. 2020). In other terms, the co-occurrence of keywords makes it possible to identify a research domain through the specific connections made between its keywords (Callon et al. 1983; López-Fernández et al. 2016). The keywords of an article reflect its main content, and the frequency of their occurrence and co-occurrence represent the most significant themes addressed by papers in a research area and how they are linked to each other (Zong et al. 2013). The combined use of these bibliometric methods yields to better and more robust results in the analysis of a research field (Randhawa et al. 2016), as they are considered complementary (Leung et al. 2017) and thus will reveal a bigger picture of the FFI domain. Finally, this study provides an integrative framework aimed at advancing new knowledge on the available research paths into FFI and identifying new and important research avenues to further develop the field.

Figure 1. Five-step bibliometric methodology flowchart

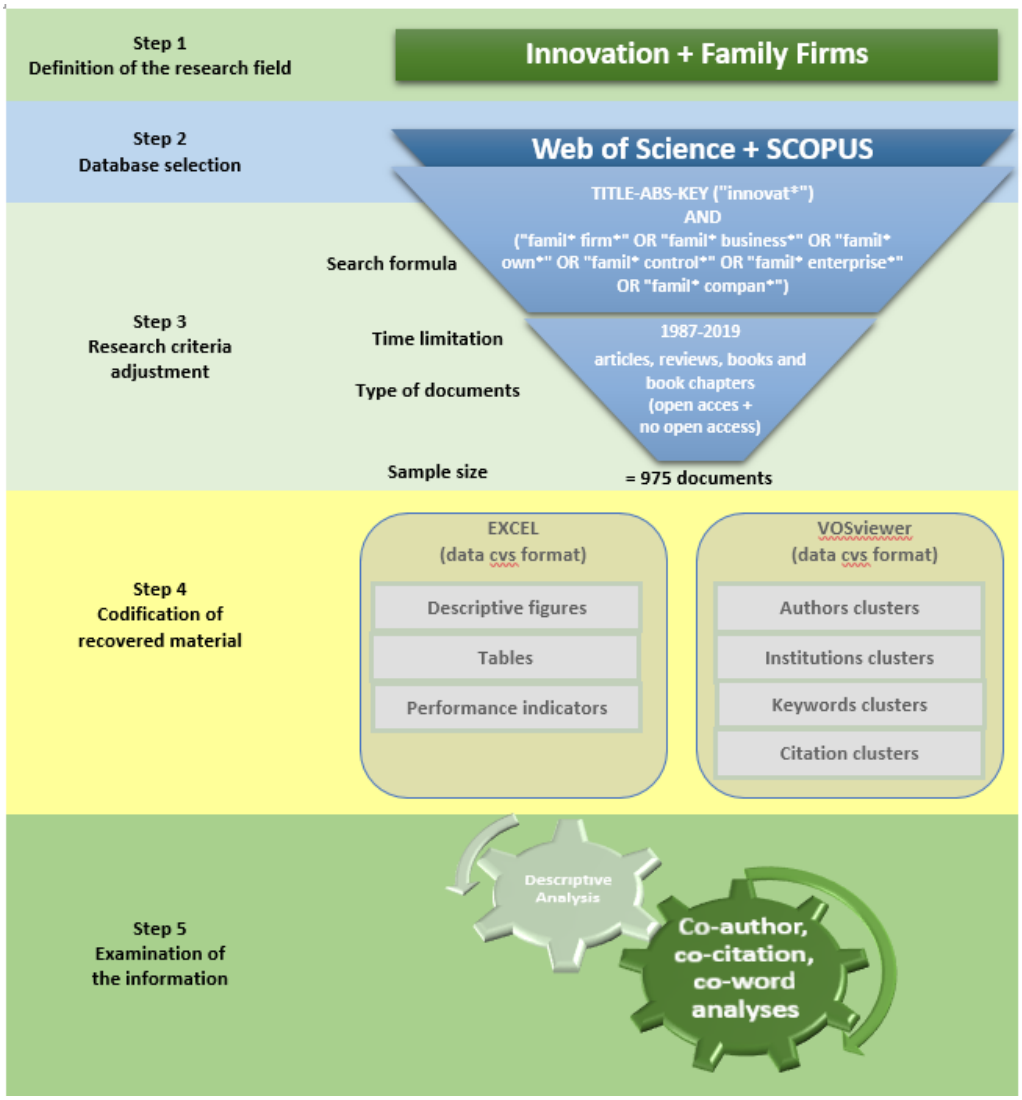
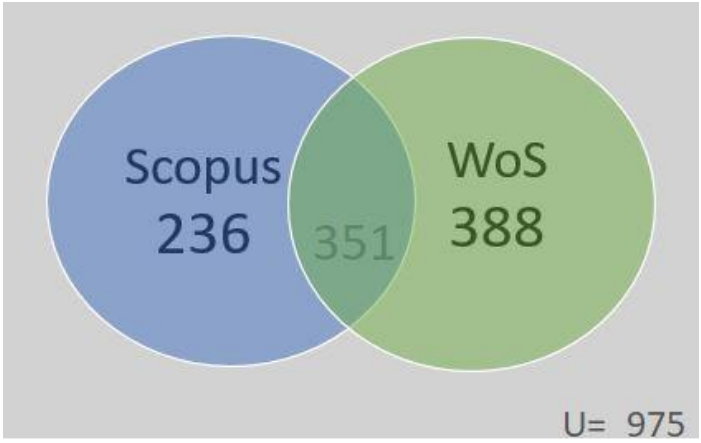


Figure 2. Final sample of documents



4. Results

The results are described and interpreted in three sub-sections. First, we show the descriptive analysis based on the examination of the scientific production and collaborations using performance and co-author analyses. Second, we present the co-citation analysis by examining publications that are frequently co-cited by other articles. Third, we show the co-word analysis through the investigation of keywords co-occurrence and their temporal evolution.

4.1. Descriptive and Performance Analyses

The summary of the coded data is shown in Table 1, which constitutes the data used to develop this bibliometric study. This represents a total of 975 documents by 2,507 authors affiliated with institutions in 72 countries and published in 458 journals, cited 16,635 times and using 69,748 references.

Table 1. Summary of data used

Data	FFI research
Number of documents	975
Number of journals	458
Number of authors	2,507
Number of countries	72
Number of citations	16,635
Number of references	69,748

Table 2 shows some of the main productive indicators of published documents per year such as number of documents, average citations, number of authors, average number of authors per articles, number of journals and countries that published at least 1 article in a specific year. Regarding the number of articles, an increasing trend can be observed, with the last years 2018 and 2019 being the most productive during the period with 133 and 162 published articles, respectively. Furthermore, the analysis of the number of citations revealed that 2007 is the year with the highest number of citations (1,620) and an average ratio of citations per article of 95.29, although 2005 stands out for the highest average citations per article (118.46) with a total of citations of 1,540. What is more, the number of authors has increased exponentially with 476 authors involved in 2019, showing a growing interest and an increasing number of collaborations among authors in

the FFI field. Moreover, this widespread research field has been accompanied by constant growth in the number of journals and countries publishing articles. In the last decade, 2009 accounted for 17 different journals and 12 different countries, whereas in 2019 there were 114 different journals and 43 different countries that published at least one article related to this research topic.

Table 2. Main characteristics of the data used

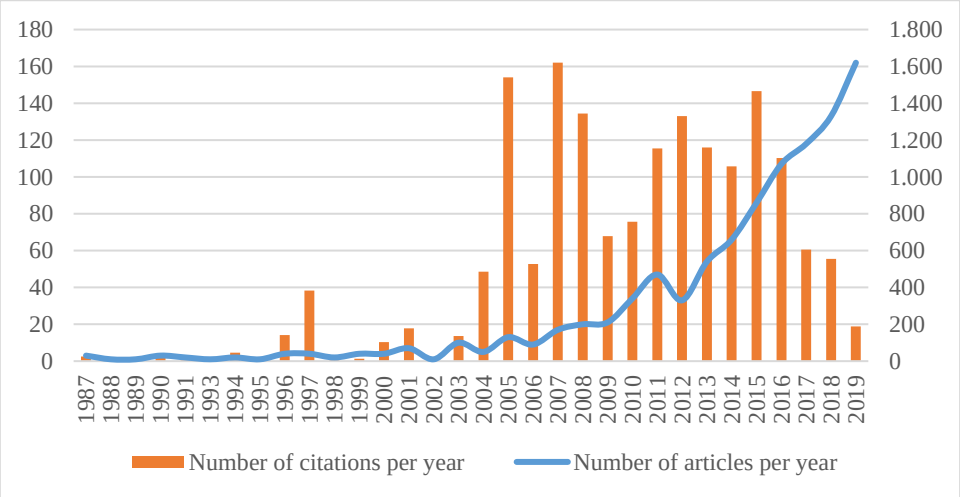
Year	A	C	C/A	AU	AUA	JA	COA
1987	3	25	8.33	7	2.33	3	2
1988	1	0	0.00	1	1.00	1	1
1989	1	0	0.00	1	1.00	1	1
1990	3	20	6.67	7	2.33	3	1
1991	2	8	4.00	4	2.00	2	1
1993	1	0	0.00	4	4.00	1	1
1994	2	46	23.00	3	1.50	2	2
1995	1	0	0.00	1	1.00	1	1
1996	4	142	35.50	6	1.50	4	3
1997	4	383	95.75	7	1.75	4	2
1998	2	11	5.50	3	1.50	2	1
1999	4	13	3.25	4	1.00	4	1
2000	4	103	25.75	4	1.00	4	4
2001	7	178	25.43	12	1.71	7	4
2002	1	0	0.00	4	4.00	1	1
2003	10	136	13.60	14	1.40	10	5
2004	5	485	97.00	8	1.60	5	2
2005	13	1,540	118.46	31	2.38	9	8
2006	9	527	58.56	15	1.67	6	5
2007	17	1,620	95.29	42	2.47	16	8
2008	20	1,344	67.20	50	2.50	19	10
2009	21	679	32.33	45	2.14	17	12
2010	34	756	22.24	70	2.06	25	14
2011	47	1,154	24.55	109	2.32	38	21
2012	33	1,331	40.33	80	2.42	27	14
2013	54	1,160	21.48	146	2.70	41	18
2014	66	1,058	16.03	156	2.36	59	22
2015	86	1,466	17.05	233	2.71	53	31
2016	107	1,102	10.30	298	2.79	73	33
2017	118	605	5.13	309	2.62	82	38
2018	133	555	4.17	357	2.68	101	43
2019	162	188	1.16	476	2.94	114	43

A: Number of published articles per year; C: Number of citations per year; C/A: Average number of citations per article; AU: Number of authors per year; AUA: Number of authors that published at least 1 article in a specific year; JA: Number of journals that published at least 1 article in a specific year; COA: Number of countries that published at least 1 article in a specific year.

Figure 3 shows the chronological distribution of the number of published articles on the subject. As can be seen, Figure 3 reveals an increase from 1987 to 2019 in both

number of articles and citations. The period could be divided in three sub-periods. First, from 1987 to 2004 is the initial phase where the number of publications was scarce and no year exceeded ten articles. In terms of citations, the most relevant years are 1997, 2001 and 2004 with a number of citations of 383, 178 and 485, respectively. Second, from 2005 to 2014 a take-off phase can be observed, in which it is evident that the field has attracted the attention of the research community. From 2005 to 2014, the number of published articles has exponentially increased from 13 to 66. Of particular relevance are 2005 and 2007 for the number of citations received by the articles published in each year (1,540 and 1,620, respectively). Third, the last period encompasses from 2015 onwards and is a flourishing productive period, dubbed as the splendour phase, where there is an increasing trend with around a hundred documents per year.

Figure 3. Evolution of published articles and citations from 1987 to 2019



4.1.1. Scientific production

With regard to the journals, Table 3 presents additional bibliometric indicators, such as citations, average citations per article, year of first publication, year of last publication and the h-Index. The most relevant journal is indisputably Family Business Review with 34 articles and 2,546 citations during the 1990-2019 period, years of the first and the last published articles, respectively. In second position, the Journal of Family Business Strategy and the Journal of Family Business Management stand out with 31 articles, followed by Entrepreneurship Theory and Practice with 21. Family business Review is also the most influential journal according to the number the citations (2,546), followed in second place by Entrepreneurship Theory and Practice (1,581) and, in third place by

Journal of Business Venturing, which despite not being listed in Table 3 because of its low article production on the subject, is the third most influential journal with a number of citations of 812 (results of the ten most influential journals according to the number of citations are available upon request from the authors). Entrepreneurship Theory and Practice becomes the first journal regarding the average number of citations per article (75.29). Furthermore, Entrepreneurship Theory and Practice also occupies the first position regarding the average number of citations per article since the year of the first published article, an indicator which tries to mitigate the impact of the year of publication, with a rate of 105.40. Moreover, the h-Index, as a quality index representing a balance between the number of publications and citations received by these publications, reveals that Family Business Review (23) ranks first, Entrepreneurship Theory and Practice (14) holds the second place and the Journal of Family Business Strategy (12) takes the third position. This indicator also shows that although Entrepreneurship Theory and Practice is ranked below the Journal of Family Business Management (7), it can be asserted that the former has exerted a greater influence on the FFI subject than the latter. Finally, the country of origin of the journals is worthy of mention. The journals are equally distributed between the United States, the United Kingdom and the Netherlands with three journals corresponding to each one. Germany also appears with one journal. This indicates that Europe is the region at the forefront of FFI.

Table 3. Ten most productive journals

Journal	A	COU	C	C/A	1st A	Last A	C/Y	h-index
Family Business Review	34	United States	2,546	74.88	1990	2019	87.79	23
Journal of Family Business Strategy	31	Netherlands	428	13.81	2010	2019	47.56	12
Journal of Family Business Management	31	United Kingdom	113	3.65	2011	2019	14.13	7
Entrepreneurship Theory and Practice	21	United States	1,581	75.29	2004	2019	105.40	14
Journal of Business Research	21	Netherlands	332	15.81	2000	2019	17.47	11
Small Business Economics	19	Netherlands	728	38.32	2000	2019	38.32	11
International Journal of Entrepreneurial Behavior & Research	19	United Kingdom	281	14.79	2008	2019	25.55	10
Asia Pacific Journal of Management	18	United States	311	17.28	2003	2019	19.44	9
Journal of Product Innovation Management	13	United Kingdom	571	43.92	1994	2018	23.79	10
International Entrepreneurship and Management Journal	13	Germany	103	7.92	2015	2018	34.33	6

A: Number of total articles; COU: Countries; C: Number of citations per year; C/A: Average citation per article; 1st A: Year of first published article; Last A: Year of last published article; C/Y: Average number of citations per year since the 1st A.

Table 4 shows the top twenty most cited articles published during the last decade taking into account the year of publication. The fact of considering the year of publication is a common practice to overcome the limitation that newer articles may experience when

only the total number of citations is regarded (Zupic and Čater 2015). De Massis et al. (2018a) is indisputably the leading article in the FFI subject with the highest number of citations per year (47.00). Exploring more specifically the research areas of these most influential articles, it is important to note that all of them have a common interest in innovation, in some cases analysing it from a resource-based view, and in others with particular emphasis on issues related to the ability and willingness paradox, family firms' heterogeneity and entrepreneurship. De Massis et al. (2018a) use the resource-based view foundations to explore innovative Mittelstand firms and identify six distinctive but highly interdependent features (e.g. preference for self-financing), which enable such firms to efficiently orchestrate their resources to innovate and outperform their competitors in the global market. In a similar way, Duran et al. (2016), the second most influential article (43.33 citations per year), reveal that although family firms invest less in innovation, they achieve a higher conversion rate of innovation inputs into innovation outputs, and therefore, have higher innovation outputs than non-family firms. Jaskiewicz et al. (2015) introduce the concept of entrepreneurial legacy and theorize that it motivates current and next generation family owners to engage in strategic activities, such as innovation, which foster transgenerational entrepreneurship. Finally, it is also worth mentioning the article of Chua et al. (2012), who provide a more comprehensive understanding of family firms' heterogeneity and point out that the particular vision and goals of the family influence strategic decisions, including that of innovation.

4.1.2. Scientific collaborations

In this section, co-author analyses are applied to establish a structure of the social networks based on collaborations between authors, which enables an analysis at the level of institutions (Zupic and Čater 2015).

The ten most productive authors on FFI are displayed in Table 5. The ten authors represent eleven institutions, seven countries and two regions, Europe and North America. It is worth mentioning that the affiliation indicated in Table 5 belongs to the last year (2019) and three authors are affiliated to two different institutions, namely, De Massis A., Kotlar J., and Chrisman J.J. De Massis A. belongs to the Free University of Bozen-Bolzano (Italy) and is also affiliated to Lancaster University (United Kingdom). In the same vein, Kotlar J. is affiliated to both Lancaster University (United Kingdom)

and the Politecnico of Milan (Italy). Likewise, Chrisman J.J. is affiliated to Mississippi State University (United States) and also with the University of Alberta (Canada). The double affiliation is shown in the network of institutions (Figure 4), forming a strong network of collaborations between such institutions.

With regard to number of articles, the main author is De Massis A. with a total of 30 articles on the topic and 1,050 citations since 2012. He is followed by Kotlar J. and Kraus S., both of whom have 14 articles. However, when the number of citations is considered, the second most cited author is Frattini F. with a total of 695 citations since 2013 and the third most cited is Nordqvist M. with 682 citations since 2007. In this vein, Nordqvist M. stands as the author with the highest ratio of citations per article (97.43), followed by Kammerlander N. (58.33) and Frattini F. (51.82). Moreover, concerning the h-index, the three most influential authors are De Massis, A (30), Kraus, S (17), and Frattini, F (10). Finally, it is worth mentioning that six of these ten authors have started publishing on this topic in the last eight years, from 2012 onwards, this being an indicator of the growing popularity of the FFI field among academics.

Figure 4 shows seven clusters of collaborations between authors that have a minimum of five documents in common. The first cluster (red) is led by De Massis A., who is considered the most productive author according to the number of published articles and total citations. He could be considered the leader of the main European network having relationships with Kotlar J., Frattini F., Nordqvist M., and Kammerlander N. The second cluster is led by Chirico F. and Kellermanss F.W. with collaborations with Eddleston K.A. and Sieger S. The third cluster (blue) is led by Kraus S., one of the most productive authors who collaborates with Calabrò A., Kallmuenzer A. and Peters M. The fourth cluster (yellow) is led by Chrisman J.J., who works together with Chua J.H. and Daspit J.J. The fifth cluster (purple) is the Spanish cluster made up of Iturralde T., Arzubiaga U. and Masseda A. belonging to the University of Basque Country. The sixth cluster (light blue) is from the University of North Carolina composed by Welsh D.H.B. and Memili E. The last cluster (orange) is formed by Wright M. and Lumpkin G.T. from Syracuse University (USA) and the University of Ghent (Belgium).

Table 4. Twenty most cited articles published in the last decade taking into consideration the year of publication

Title	Authors	Journal	Year	TC	C/Y
Innovation with Limited Resources: Management Lessons from the German Mittelstand	De Massis, A; Audretsch, D; Uhlaner, L; Kammerlander, N	JPIM	2018	47	47.00
Doing more with less: Innovation input and output in family firms	Duran, P; Kammerlander, N; van Essen, M; Zellweger, T	AMJ	2016	130	43.33
Entrepreneurial legacy: Toward a theory of how some family firms nurture transgenerational entrepreneurship	Jaskiewicz, P; Combs, JG; Rau, SB	JBV	2015	146	36.50
Sources of Heterogeneity in Family Firms: An Introduction	Chua, JH; Chrisman, JJ; Steier, LP; Rau, SB	ETP	2012	242	34.57
The Ability and Willingness Paradox in Family Firm Innovation	Chrisman, JJ; Chua, JH; De Massis, A; Frattini, F; Wright, M	JPIM	2015	118	29.50
Research on Technological Innovation in Family Firms: Present Debates and Future Directions	De Massis, A; Frattini, F; Lichtenthaler, U	FBR	2013	172	28.67
Product Innovation in Family versus Nonfamily Firms: An Exploratory Analysis	De Massis, A; Frattini, F; Pizzurno, E; Cassia, L	JSBM	2015	106	26.50
R&D investments in family and founder firms: An agency perspective	Block, JH	JBV	2012	174	24.86
Should I stay or should I go? Career choice intentions of students with family business background	Zellweger, T; Sieger, P; Halter, F	JBV	2011	191	23.88
Risk abatement as a strategy for R&D investments in family firms	Patel, PC; Chrisman, JJ	SMJ	2014	119	23.80
Socioemotional Wealth as a Mixed Gamble: Revisiting Family Firm R&D Investments With the Behavioral Agency Model	Gomez-Mejia, LR; Campbell, JT; Martin, G; Hoskisson, RE; Makri, M; Sirmon, DG	ETP	2014	114	22.80
Innovation and performance in latin-american small family firms	Maldonado-Guzmán G., Marín-Aguilar J.T., García-Vidales M.	AEFR	2018	22	22.00
An analysis of the interplay between organizational sustainability, knowledge management, and open innovation	Lopes, CM; Scavarda, A; Hofmeister, LF; Thome, AMT; Vaccaro, GLR	JCP	2017	41	20.50
Innovation through tradition: Lessons from innovative family businesses and directions for future research	De Massis, A; Frattini, F; Kotlar, J; Petruzzelli, AM; Wright, M	AMP	2016	61	20.33
Tradition and innovation in Italian wine family businesses	Vrontis, D; Bresciani, S; Giacosa, E	BFJ	2016	60	20.00
Tracing the Roots of Innovativeness in Family SMEs: The Effect of Family Functionality and Socioemotional Wealth	Filser, M; De Massis, A; Gast, J; Kraus, S; Niemand, T	JPIM	2018	18	18.00
Innovativeness in family firms: a family influence perspective	Kellermanns, FW; Eddleston, KA; Sarathy, R; Murphy, F	SBE	2012	123	17.57
Firm Innovation in Emerging Markets: The Role of Finance, Governance, and Competition	Ayyagari, M; Demirguc-Kunt, A; Maksimovic, V	JFQA	2011	136	17.00
Psychological ownership, knowledge sharing and entrepreneurial orientation in family firms: The moderating role of governance heterogeneity	Pittino, D; Martinez, AB; Chirico, F; Galvan, RS	JBR	2018	17	17.00
The Agile Innovation Pendulum: A Strategic Marketing Multicultural Model for Family Businesses	Thrassou A., Vrontis D., Bresciani S.	ISMO	2018	17	17.00

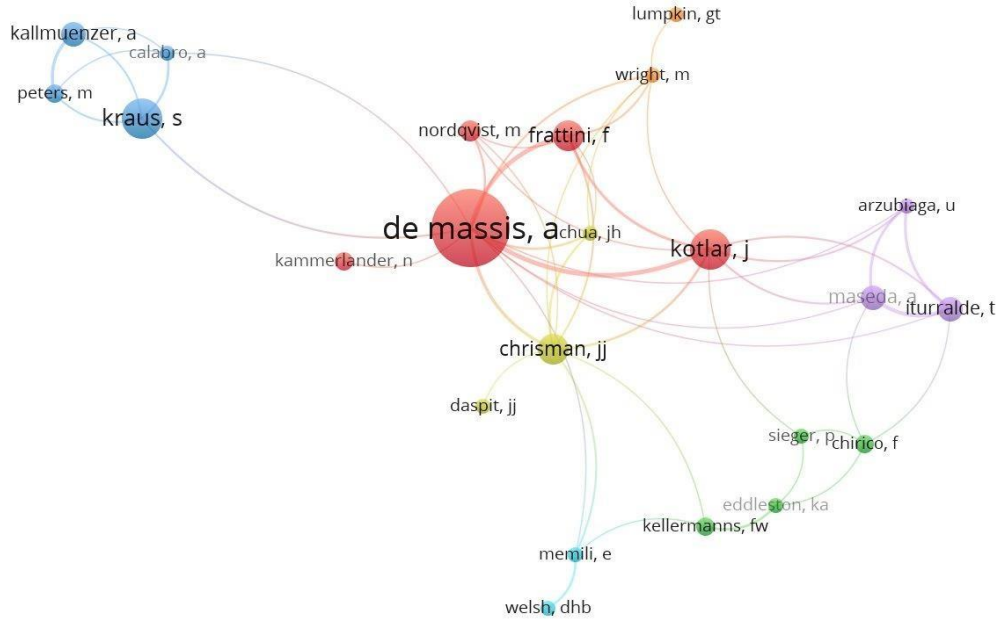
TC: Total cites; C/Y: Average number of citations per year from the publication date of the article; JPIM: Journal of Product Innovation Management; AMJ: Academy of Management Journal; JBV: Journal of Business Venturing; ETP: Entrepreneurship Theory and Practice; FBR: Family Business Review; JSBM: Journal of Small Business Management; SMJ: Strategic Management Journal; AEFR: Asian Economic and Financial Review; JCP: Journal of Cleaner Production; AMP: Academy of Management Perspectives; BFJ: British Food Journal; SBE: Small Business Economics; JFQA: Journal of Financial and Quantitative Analysis; JBR: Journal of Business Research; ISMO: International Studies of Management and Organizations.

Table 5. The top ten most productive authors on FFI

Author	A	C	C/A	1st A	Last A	h-Index	Country	Affiliation
De Massis, A	30	1,050	30.38	2012	2019	30	Italy/ United Kingdom	Free University of Bozen-Bolzano/ Lancaster University
Kotlar, J	14	341	16.27	2012	2019	9	Italy/ United Kingdom	Politecnico Milan/ University of Lancaster
Kraus, S	14	159	8.90	2010	2019	17	Italy	Free University of Bozen-Bolzano
Frattini, F	11	695	51.82	2013	2019	10	Italy	Politecnico Milan
Giacosa, E	11	84	5.30	2014	2019	4	Italy	University Turin
Chrisman, J.J	10	619	45.89	2011	2019	8	United States/ Canada	Mississippi State University/ University of Alberta
Kallmuenzer, A.	8	56	1.75	2016	2019	6	France	La Rochelle Business School
Craig, J.	8	416	1.75	2006	2017	8	United States	Northwestern University
Nordqvist, M	7	682	97.43	2007	2018	7	Sweden	Jönköping International Business School
Kammerlander, N	6	350	58.33	2013	2018	6	Germany	WHU - Otto Beisheim School of Management

A: Number of published articles per year; C: Number of citations per year; C/A: Average number of citations per article; 1st A: Year of first published article; Last A: Year of last published article.

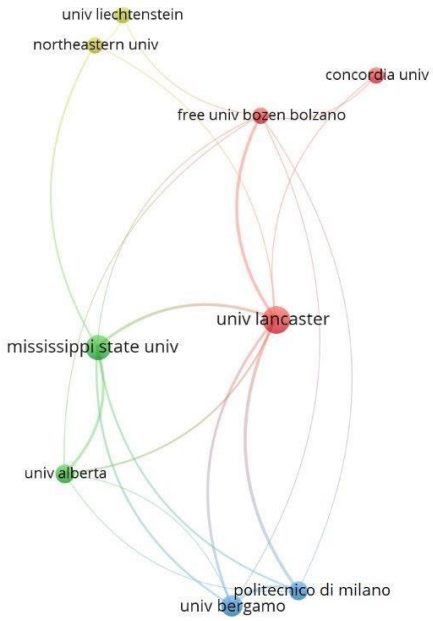
Figure 4. Network collaborations between authors from 1987 to 2019



Collaborations between authors give rise to international networks among different institutions. Figure 5 shows such networks, which take into account ten or more common scientific studies among researchers, with four clusters identified. The main cluster (red) is the most productive inasmuch as it includes three universities, Lancaster University (United Kingdom), the Free University of Bozen-Bolzano (Italy) and Concordia University (Canada), which are linked with the other three clusters. The green cluster is led by Mississippi State University (United States) and the University of Alberta (Canada). The yellow cluster is made up of the Northeastern University (United States) and the University of Liechenstein (Liechenstein). Finally, the blue cluster is the Italian network, including Bergamo University and the Politecnico de Milan. Thus, there are two

intracontinental (green and blue) and two international (red and yellow) networks. As can be seen, the Italian institutions show strong connections between them and with the most proactive institutions, namely Lancaster University (United Kingdom).

Figure 5. Network of co-authorship-based cooperation between institutions from 1987 to 2019



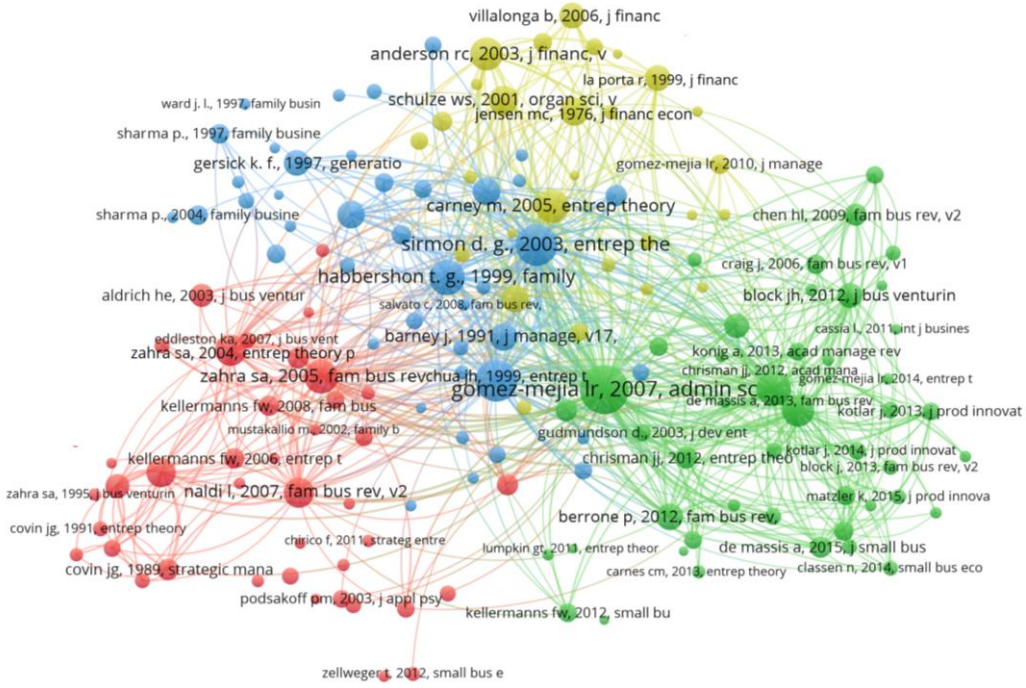
4.2. Co-citation Analysis

The next step in our bibliometric analysis is to reveal the intellectual structure and theoretical foundations of FFI research. The co-citation networks of the references in FFI are displayed in Figure 6. The conducted analysis discloses the key theories and seminal papers that form the core of FFI foundations. The FFI co-citation network establishes four clusters.

The first cluster (red) is composed of 50 papers, covering the period from 1977 to 2015. The main contributors are Zahra (2005), Naldi et al. (2007) and Zahra et al. (2004). The core element characterizing the cluster is entrepreneurship, with a specific focus on entrepreneurial orientation (Lumpkin and Dess 1996), of which innovativeness is one of its main dimensions. This set of studies mainly focuses on analysing how distinct characteristics of the firm (e.g. organizational culture or financial control), the family (e.g. CEO founder tenure or family ownership) and external factors (e.g. environment

dynamism or technological opportunities) affect family firms' entrepreneurial behaviour, and, in turn, their performance outcomes compared to non-family firms. Additionally, the cluster also proposes extending entrepreneurial orientation scales to provide a more detailed description of corporate entrepreneurship in long-lived family firms (Zellweger and Sieger 2012).

Figure 6. Co-citation network in the FFI research field from 1987 to 2019



The second cluster (green) is composed of 47 papers, spanning from 2003 to 2016. The top cited articles are those by Gómez-Mejía et al. (2007), Chrisman and Patel (2012) and De Massis et al. (2013). This cluster mainly relies on behavioural agency theory, as well as on the most recent socioemotional wealth and mixed gamble perspectives. The heart of the cluster is made up of papers seeking to better understand how family firms cope with socioemotional factors when undertaking risk-taking strategic choices, such as technological external acquisitions (Kotlar et al. 2013) or adoption of discontinuous technologies (König et al. 2013). This cluster also includes articles trying to identify mechanisms and factors that explain how family firms 'do more with less' in their technological innovation processes (Duran et al. 2016). The seminal paper on socio-emotional wealth by Gómez-Mejía et al. (2007) deserves recognition as a key article

explaining how family firms can be both risk willing and risk averse when conducting their decision-making processes.

The third cluster (blue) is composed of 44 papers, ranging from 1987 to 2012. The most cited articles are those of Sirmon and Hitt (2003), Chua et al. (1999) and Habbershon and Williams (1999). This cluster appears to rely on strategic management, focusing mainly on the resource-based view. The contributions of this cluster highlight the ways in which family goals, relationships and resources need to be managed to create competitive advantages that will enable more successful innovations and subsequent improvements in firm performance. In particular, studies from this cluster focus on the study of social capital (e.g. Arregle et al. 2007), which as a highly valuable resource derived from relationships between individuals and businesses, has the potential to affect many firms' activities, such as innovation (Sirmon and Hitt 2003). Moreover, this cluster stands out for including the seminal papers of Barney (1991) concerning the resource-based view, Habbershon and Williams (1999) on the concept of familiness, and that of Chua et al. (1999) on the classic definition of a family firm.

The fourth cluster (yellow) is composed of 37 papers, spanning from 1963 to 2012. The main contributors are Carney (2005), Schulze et al. (2001) and Anderson et al. (2003). This cluster encompasses studies that, under the agency theory (Jensen and Meckling 1976), try to understand the effect of family corporate governance on value creation, firm growth or financial performance. Namely, the studies making up this cluster seek to identify the repercussions of the existence or of the non-existence of agency costs on family firms' outcomes (e.g. Gómez-Mejía et al. 2001). Some core elements in this cluster are family ownership, control and management (Villalonga and Amit 2006), family dynamics and altruism (Schulze et al. 2001), and founding family ownership (Anderson et al. 2003). It is worth noting the most cited paper in this cluster, Carney (2005), which emphasizes that family firms' competitive advantage stems from their system of corporate governance.

A synthesis of the main features of the clusters is presented in Table 6.

Table 6. Identified clusters in co-citation analysis

Cluster	Colour in the network	Number of papers	Time spam	Top cited papers
1	Red	50	1977-2015	Zahra (2005), Naldi et al. (2007), Zahra et al. (2004)
2	Green	47	2003-2016	Gómez-Mejía et al. (2007), Chrisman and Patel (2012), De Massis et al. (2013)
3	Blue	44	1987-2012	Sirmon and Hitt (2003), Chua et al. (1999), Habbershon and Williams (1999)
4	Yellow	37	1963-2012	Carney (2005), Schulze et al. (2001), Anderson et al. (2003)

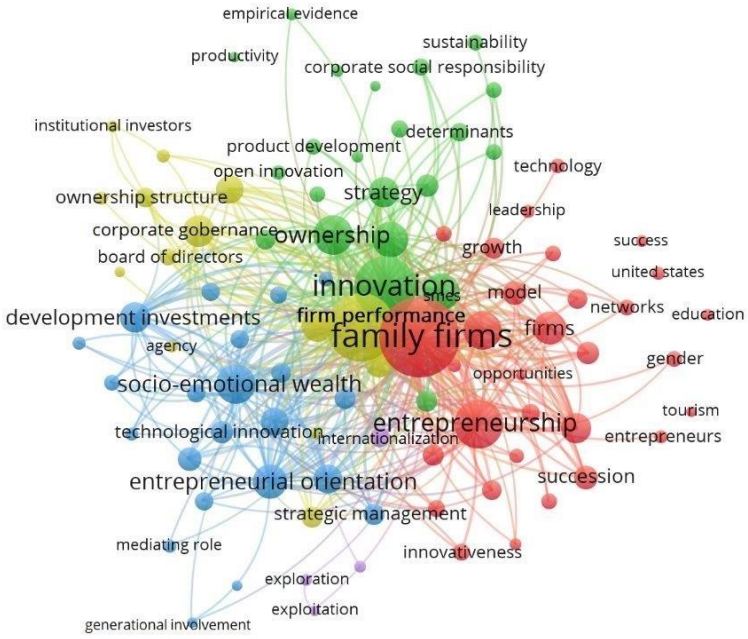
4.3. Co-word Analysis

4.3.1. Identification and comprehensive analysis of semantic clusters

An examination of the content of the articles enables the main trends in FFI research to be recognised and potential research avenues to be identified. Figure 7 shows the network with the recognition of five thematic clusters that group together the principal keywords. The main clusters identified are: "family firms" (red), "innovation" (green), "socio-emotional wealth" (blue), "firm performance" (yellow), and "internationalization" (purple). We determine the cluster name according to the keyword that is in the main node and thus, is better connected with the rest of the cluster keywords (López-Fernández et al. 2016). Figure 7 is of great value for future researchers who want to explore a specific topic within the FFI field, to the extent that these keywords and their associated relationships will help them to identify the most important themes on the subject. Drawing on the cluster identification, the main co-words will be discussed in an attempt to re-organize and consolidate the extant literature.

The first cluster is the red one, dubbed "Family Firms" since it is the main node in the cluster (López-Fernández et al. 2016). Family firms are ubiquitous and significant organizational forms or businesses of economies worldwide (La Porta et al. 1999), which, as previously commented, contribute to boosting the gross domestic product and to employment generation on a global scale (De Massis et al. 2018b).

Figure 7. Network of keywords used from 1987 to 2019



Until now, there has been no consensus regarding the conceptualization of family firms, either in the economic (Ariza et al. 2005) or in the legal field (Rodríguez 2006). Indeed, nowadays there is no universally accepted definition of family firm (Martínez-Romero 2018; Zellweger 2017), with more than ninety different definitions having been identified in Europe (Mandl 2008). However, it is true that most studies dealing with family firm issues take the definition of Chua et al. (1999) as reference. These authors stated that a family firm is a business "governed and/or managed with the intention to shape and pursue the vision of the business held by a dominant coalition controlled by members of the same family or a small number of families in a manner that is potentially sustainable across generations of the family or families" (Chua et al. 1999, p. 25).

The lack of a distinct definition of the family firm has made it difficult to draw comparisons between studies and to integrate theories (Hernández-Linares et al. 2018; Kellermanns et al. 2012), which in turn, converts the family firm research field into a still growing area of investigation (Benavides-Velasco et al. 2013; Xi et al. 2015).

Specifically, a recent research stream highlights the interest of analysing the existing heterogeneity within the pool of family firms (Chua et al. 2012; Jaskiewicz and Dyer 2017). In this regard, it is widely accepted that family firms are highly heterogeneous in

goals (Chrisman et al. 2012), governance structures (Carney 2005), or resources (Habbershon et al. 2003), which could substantially affect the behaviour and outcomes of some family firms in relation to others (Jaskiewicz and Dyer 2017). In this vein, research has endeavoured to illustrate the relevance of family in innovative behaviour and how the search for innovative solutions could lead to competitive advantage and success in family firms (Pitchayadol et al. 2018).

Taking into account other relevant nodes in this cluster, entrepreneurship and entrepreneur stand out as relevant and connected keywords. Entrepreneurship is a prominent topic since it has been widely recognized as a critical aspect for the survival and growth of family firms (Acs and Armington 2004; Classen et al. 2012), and is regarded as a driver of innovation (Bhaskaran 2004). Previous studies have often referred to entrepreneurship as the ability and willingness to undertake, arrange and manage a business venture along with any of the accompanying risks in order to obtain benefits and have also recognized that families are the source of oxygen that fuels the fire of entrepreneurship (López-Fernández et al. 2016; Rogoff and Heck 2003). In this respect, several authors (e.g. Casillas et al. 2010) posit that family firms offer a unique context for entrepreneurship as these firms intrinsically own a unique bundle of resources and capabilities, namely familiness (Habbershon and Williams 1999), which encourage the ability to seize opportunities and the development of investments. In this vein, the figure of the entrepreneur is highlighted in research, depicted according to their leadership style. Moreover, some academic studies have highlighted training and education in entrepreneurial skills for young generations as relevant in the family organization (Looi and Khoo-Lattimore 2015; Umirzakova et al. 2016), with a lack of education or training being a hindrance to innovativeness (Hausman 2005).

What is more, literature has revealed that culture has a radical effect on firm innovativeness (Çakar 2006; Herbig and Dunphy 1998). Thus, family culture is one of the categories of the innovation capability model (Lawson and Samson 2001) due to the fact that family culture improves the ability of families to be strategically flexible, which in turn, positively impacts on firm innovativeness and performance (Craig et al. 2014; Duréndez et al. 2011). Some authors have stated that family culture might lead to firm innovativeness through the creation of an environment and by sharing the firm vision and strategy, thereby fostering innovation (Bhaskaran 2004; Pitchayadol et al. 2018).

In addition, one of the main keywords is networks. Opening the doors to potential stakeholders such as suppliers, customers or universities to develop technological collaborations or networks is considered a means through which the family firms' innovative potential is unlocked (Calabrò et al. 2019). In this regard, networking relationships are known as social capital. Studies have investigated the role of family social capital to develop innovations (Letonja and Duh 2015; Pucci et al. 2020). Certain studies have analysed the impact of social capital on different types of innovation strategies, namely, radical or incremental (Alrubaishi and Robson 2019) whereas others have delved into the impact of different forms of social capital, distinguishing between external or internal (Lazzarotti et al. 2017; Sanchez-Famoso et al. 2014) or by differentiating according to geographical dimensions (Basco and Calabrò 2016; Ombrosi et al. 2019), finding inconclusive results.

Furthermore, closeness between customers and firm managers in family firms may ease the process of identifying unmet needs and thus enable the impetus for innovation. Accordingly, the inter-organizational trust, generated by such closeness, together with communication and cooperative competency become factors that instigate innovation (Hausman 2005; Sivadas and Dwyer 2000).

Finally, although succession is considered a subtle stage in a firm's lifecycle (Leiss and Zehrer 2018), it brings an ideal opportunity to achieve new innovative postures (Rondi et al. 2019). Research has been based on the notion that family firms tend to become less entrepreneurial across generations (De Massis et al. 2013; Kotlar and Sieger 2019). Namely, the abovementioned studies have focused on the relationship between predecessors and successors to maintain family firms' innovativeness, highlighting some factors that impact on the successors' innovative posture, such as entrepreneurialism, knowledge creation and transfer, and social capital (Letonja and Duh 2015). Moreover, recent studies have analysed the effects of intra-family succession on the typology of innovation (Rondi et al. 2019).

The second cluster is built around the keyword "Innovation". Innovation is considered one of the greatest challenges faced by family firms, since it is the engine that drives these businesses to survive and to remain competitive in the long-term (Kellermanns et al. 2012; Manzaneque et al. 2018). Studies analysing the innovative behaviour of family

firms often emphasize the ability and willingness paradox (e.g. Chrisman et al. 2015), as a means of explaining the unusual patterns of family firms when developing innovations. This paradox demonstrates that family firms are less willing to innovate because they are risk-averse in order to maintain family control over the firm. Nevertheless, when family firms decide to innovate, they show an exceptional ability to obtain better innovative results compared to their non-family counterparts. Prior literature has made endless efforts to unravel this paradox and to shed light on the issue. In this respect, a set of articles (e.g. Kotlar et al. 2013) have focused on analysing the effect of family involvement in management, ownership and/or governance, in different innovation strategies (i.e. research and development investments, external technology acquisition) and outcomes (i.e. number of product innovations). Several papers (e.g. Kellermanns et al. 2012; Memili et al. 2015) examine the moderating role of different family and innovation variables in the achievement of organisational outcomes. An important part of these studies (e.g. Hatak et al. 2016) have focused on analysing when and to what extent certain family variables (e.g. family involvement in management and/or ownership) reinforce or weaken the effect that distinct innovation forms (e.g. innovative culture) exert on firm performance.

On the other hand, whereas most family firm literature has merely focused on directly linking different innovation inputs and innovation outputs to organizational outcomes, very recent fresh research (Manzaneque et al. 2020; Martínez-Alonso et al. 2020a) is giving increasing importance to the assumption that the efficiency with which innovation inputs are transformed into innovation outputs is a key to improving financial performance (Cruz-Cázares et al. 2013). Thus, if family members are aware of the possibility of maximizing their innovation outputs by investing a certain amount in research and development, they will not be so reluctant to innovate, thereby fostering a culture of efficiency through which they will obtain higher performance outcomes.

Another important keyword which stands out in this cluster is small and medium enterprises (SMEs). SMEs are the backbone of regional economies, have an indisputable importance worldwide (Ahluwalia et al. 2017; Kraiczy 2013) and most of them are family firms (Mura and Mazák 2018). Although SMEs might lack financial resources, human capital, and suffer from over-involvement of owners and managers in decision-making, their flexibility to respond to changing environmental needs and the operational expertise

of owners, may encourage them to seek innovation solutions (Hausman 2005). Thus, academic research has tried to link the characteristics of family SMEs to innovativeness and explain the importance of innovation for them. In such a way, innovativeness is regarded as one of the core elements affecting SME performance (Pitchayadol et al. 2018), being considered as the key for thriving and competing (Hausman 2005). Moreover, innovation in SMEs has pushed firms to become leaders in their niches, being deemed as the force for innovation in some regions (Kraiczy 2013). Academic studies have tried to elucidate whether the driver of innovation success may be the family influence within SMEs. Some of the results emphasize characteristics such as family power, experience and culture as enablers of innovativeness in family SMEs (Pitchayadol et al. 2018).

In addition, other words included in this cluster are sustainability, sustainable development and corporate social responsibility. Although the debate concerning whether family firms have a greater commitment to sustainability than their non-family counterparts is ongoing (Adomako et al. 2019), family firms are less likely than other firms to implement sustainable innovations (Cuadrado-Ballesteros et al. 2017; Doluca et al. 2018). Nevertheless, the premise of achieving sustainable development and the requirement of proactive actions to tackle environmental and social challenges is a general concern at all levels (Casado-Belmonte et al. 2020). In this vein, innovation is part of the decision-making process that enhances growth and sustainability. Thus, innovative activities should be pursued to integrate sustainable activities into the strategy of the firm. In such a context, innovation is deemed as the driving force behind sustainable development, and is becoming a key for survival in a competitive environment (Mura and Mazák 2018).

Furthermore, corporate social responsibility refers to sustainability reporting and is regarded as a way of communicating sustainability issues, connecting environmental and social responsibility with financial performance (Terán-Yépez et al. 2020). Research in this line has focused on the analysis of the relationship between sustainable activities and innovation (Wagner 2010), grounded on the potentiality of innovation to achieve sustainability without counteracting profitability, and the effect of family involvement on such a relationship (Adomako et al. 2019; Wagner 2010). Although some studies state that the implementation of environmental-related activities by family firms could

differentiate them from their non-family counterparts in certain phases of the firm life cycle (Doluca et al. 2018), results are not conclusive.

Finally, another main word included in this cluster is systems. Research has emphasized the importance of an appropriate established management system in order to promote creativity and innovation (Ince 2018). Studies have shown that management control systems have a positive influence on family firm performance (Duréndez et al. 2011). Similarly, family managed firms that utilize management control systems and produce technological innovation are much more prone to generate better performance (Ruiz-Palomo et al. 2019). In this way, the conjunction of the use of formal management control systems with technological innovation could lead to obtain better performance outcomes.

The third cluster is labelled "Socio-emotional Wealth". This approach has become the most potential dominant paradigm in the family firm research field (Gómez-Mejía et al. 2007; Martínez-Romero and Rojo-Ramírez 2016). By Socio-emotional Wealth (hereafter, SEW), Gómez-Mejía et al. (2007, p. 106) referred to "non-financial aspects of the firm that meet the family's affective needs, such as identity, the ability to exercise family influence, and the perpetuation of the family dynasty". These nonfinancial aspects have been stated to be the drivers of family firms' strategic behaviours (Martínez-Romero et al. 2020b), as decisions are taken with the ultimate goal of SEW preservation (Fitz-Koch and Nordqvist 2017). In other words, SEW preservation is the reference point for family firms' organizational behaviours and decisions (Sciascia et al. 2015). This implies that family firms tend to operate once they have evaluated how strategic decisions might impact on their SEW endowment (Berrone et al. 2010; Gómez-Mejía et al. 2011). Generally speaking, some authors have considered that SEW may act as a constraint on innovation inasmuch as family members would invest less in innovation to avoid a loss of family control (Alonso-Dos-Santos and Llanos-Contreras 2019; Block 2012). Due to SEW concerns, family firms have a lower innovative orientation than non-family firms.

Another topic included in this cluster is Entrepreneurial Orientation (EO). EO constitutes one of the most analysed terms within the entrepreneurship literature (Casillas and Moreno 2010; Wiklund 1999). EO has been defined as a strategic posture that implies a willingness to be proactive, risk-taking and innovative (Covin and Slevin 1989;

Schepers et al. 2014). That is, EO depicts those practices and policies that provide the foundations for entrepreneurial behaviours, decisions and activities (Garcés-Galdeano et al. 2016). As mentioned above, family firms are usually reluctant to undertake entrepreneurial activities (Garcés-Galdeano et al. 2016; Martínez-Alonso et al. 2018), due to the fact that they often give higher priority to preserving their SEW endowment. Despite the long-lasting relevance of the topic in the entrepreneurship literature, in the family firm research field the EO research stream has received increased attention in the last decade, being mostly related to performance estimates, studying the mediating or moderating role of SEW in this relationship (Andrade-Valbuena et al. 2019; Schepers et al. 2014). In this vein, the positive relationship EO-performance is found to be particularly important when family ownership is combined with active family management and control (Lee and Chu 2017), suggesting the potential advantages of EO when active family governance alleviates agency problems and enables stewardship behaviours. In addition, other studies have found that when performance is below expectations, family firms show an increased innovative orientation (Alonso-Dos-Santos and Llanos-Contreras 2019; Patel and Chrisman 2014).

In addition, absorptive capacity, competitive advantage and dynamic capabilities are keywords included in this cluster. In this regard, familiness deemed as the unique bundle of resources linked to family involvement, may impact on the firm's dynamic capabilities, namely on the absorptive capacity by which innovation outcomes are altered (Daspit et al. 2019). Although the dynamic capability perspective is widely used in management, in the family firm field it is scarce. Therefore, taking into account the relevance of knowledge-related capabilities on the long-term orientation of family firms, much remains to be clarified regarding family influence on dynamic capabilities, uncovering if this influence is a help or a hindrance.

Additionally, the understanding on how firms develop dynamic capabilities through innovation, has drawn attention from the research community. Family firms use technological innovation to nurture their competitive advantage. Regarding technological innovation two types are distinguished: product and process innovation (Utterback and Abernathy 1975). Research has shown that the particularities of family firms differ from non-family firms with regards to product innovation orientation and organization of the innovation process (De Massis et al. 2015). In such a way, the combination of

technological innovation with innovative capability and high levels of EO in top management teams (innovation decisions should be approved and authorized by firm managers) could help to transform innovation inputs into profits (Joshi and Srivastava 2015). Nevertheless, the investigation dealing with process innovation is scarce and further research is required (Diéguez-Soto et al. 2018).

The cluster "Firm performance" encompasses those studies where innovation strategy is explored in relation to performance in family firms. In this vein, the decision of a family firm to partake in innovative behaviour can be quite complex, since family firms often serve two, sometimes competing goals: that of economic efficiency and that of family social interests (Kellermanns et al. 2012). In this vein, the firm is expected to achieve financial and market success, while the family demands employment, identity, and wealth with long-term aspirations (Sun et al. 2019).

The extant research grounded in the potentiality of family firms to 'do more with less' (Duran et al. 2016; Martínez-Alonso et al. 2020a) makes it necessary to focus on firm performance. Although literature has shown that there exist complex arrays of systemic features that influence firm performance (Habbershon et al. 2003), a co-alignment of multiple factors is required to increase firm performance (Chirico et al. 2011). Nevertheless, academic research has exalted innovativeness as one of the core components affecting performance (Moreno-Gómez and Lafuente 2020; Pitchayadol et al. 2018).

Therefore, there exists a flourishing field of research exploring how innovativeness interacts with family influence to affect firm performance (Cliff and Jennings 2005). On the one hand, some studies often analyse the moderating effect of the different governance forms, namely the involvement in management, ownership and the characteristics of the board of directors in the relationship between innovation and performance (Diéguez-Soto et al. 2016; Hatak et al. 2016). On the other hand, other studies deal with the direct impact of family involvement on firm performance, with innovativeness acting as either a moderator (Kellermanns et al. 2012) or a mediator (Chong et al. 2013) in the relationship.

In this vein, the concept of involvement has been widely studied. Family involvement in management or the participation of family members on the board of directors might be a double-edged sword due to agency threats. However, research has highlighted that firms

with greater family involvement in management experience superior performance or firm value (Dyer 2006; Kellermanns et al. 2012). Furthermore, performance offers relevant feedback to managers that lead them to improvements in their innovation decisions (Lv et al. 2019). In addition, family involvement in ownership is studied through ownership structure, deemed as a proxy for the developmental stage of the firm (Gersick et al. 1997; Holy 2006). While the ownership is concentrated in the early stages of its life cycle, the generational ownership dispersion in later stages is considered to impact negatively on firm performance due to the increasing discord and competing interest (Gersick et al. 1997). Finally, external involvement, such as institutional involvement of private equity and banks has been analysed as elements that could moderate the relationship between family involvement and innovation investment (Cirillo et al. 2019; Gómez-Mejía et al. 2014). In this regard, institutional investors can modify the impact of family ownership on research and development decisions, encouraging managers to undertake risky investments, and subsequently benefit firm performance. Accordingly, Cirillo et al. (2019) have shown that the impact on innovation strategies may be different depending on the type of institutional investors.

While research has traditionally focused on the agency problems of non-family managers, literature on stewardship theory has highlighted the natural incentives of managers to act in the interest of the firm and its owners. Thus, an unresolved dialectic has persisted, focusing on opportunism and overlooking the drivers of non-family managers' behaviour (Kotlar and Sieger 2019). In this vein, the combination of agency and stewardship mechanisms requires further research to enrich the understanding of entrepreneurial gaps between family and non-family managers (Kotlar and Sieger 2019).

The fifth cluster is labelled "Internationalization". In this group, studies try to bridge three major concepts: innovation, internationalization and sustainable competitive advantage (Vătămănescu et al. 2019). Motivated by the resource-based view stating that family firms are naturally entrepreneurial and innovative, some studies show that family firms are more innovative and internationalized than nonfamily firms (Singh and Gaur 2013; Singh and Kota 2017) partly due to their social capital (Mzid et al. 2019). Additionally, there are studies that analyse the impact of international activities on innovation and firm performance with the moderating or mediating role of family governance (Tsao and Lien 2013) and there are also studies investigating the relationship

between research and development investments and the degree of internationalization (Lin and Wang 2019; Ossorio 2018).

With regards to the strategy of expanding overseas, international activities might bring about both advantages and agency problems. Notwithstanding the above, family involvement in management alleviates agency problems associated with internationalization due to family firms experiencing positive benefits from internationalization in terms of innovation and performance (Ossorio 2018; Tsao and Lien 2013).

Other concepts included is this cluster are exploration and exploitation. Family firms can take an exploration or exploitation approach to incorporate innovation as part of their internationalization process (Ratten and Tajeddini 2017). In this vein, research has focused on strategies of exploration or exploitation as common accepted ways to categorize learning processes and innovation (Gupta et al. 2006; Strobl et al. 2020). While exploration focuses on developing new knowledge and building competences associated with changes and experimentation that enable the formation of new relationships, products and methods (Goel and Jones 2016), exploitation is associated with value creation through existing or slightly modified competences, built on existing knowledge and is something which allows organizations to realize the advantages of improvements. Exploitation is regarded as the steps taken after an opportunity has been explored and is commercially viable. Both exploration and exploitation are part of the opportunity identification process that affects firm performance (Gupta et al. 2006) and literature has studied the concept of organizational ambidexterity, i.e. the ability in family firms to balance exploring and exploiting activities at the same time (Allison et al. 2014; Hiebl 2015).

In addition, another keyword included in this cluster is controlled firms. This topic depicts the diverse risk preferences of different owner categories towards internationalization, namely family owners and institutional investors. In this way, the interaction between institutional investors and controlling family ownership structure has been recently studied. Results are inconclusive and the supportive or refractive behaviour of institutional investors in family controlled firms seems to be depend on the type of institutional investors (Panicker et al. 2019).

4.3.2. Research trends

For a better analysis of the evolution of the keyword analysis, the period must be divided in sub-periods. The temporal evolution has been examined by considering the keywords timelines and the frequencies were normalized by the total number of keywords in each time sub-period (Agramunt et al. 2020). Table 7 shows the evolution of keywords in the whole period and the three sub-periods. The first sub-period encompasses 1987-2004 and is considered the initial phase, where the number of articles per year does not exceed 10. The three keywords with higher co-occurrence are innovation, company information and sales. It is worth noting that there is only one article that includes family firms as a keyword. Specifically, family firm is included as a keyword in "Internationalisation of the family business: a longitudinal perspective" by Graves and Thomas (2004), which empirically shows that innovation commitment in family firms is associated with higher export intensity. This fact shows that previous studies in this sub-period included the concept of family but only in the title or in the abstract.

The second sub-period encompasses 2005 to 2014 and is dubbed as take-off phase as during this period the number of articles increased slowly but steadily. The three words with highest co-occurrence are family firms, firm performance and innovation. It is surprising that firm performance is even more used as a keyword than innovation, despite the latter being one of the keywords used in the search formula. This finding reveals that research has traditionally analysed innovation efforts under the lens of performance. Other relevant emergent words in this sub-period are entrepreneurship, SMEs, ownership, management and agency. The construct of entrepreneurship gains interest in this sub-period as a motor theme with which to achieve an innovation commitment. SMEs stands out as a common type of business within family firms and is other relevant keyword used in the studies of this sub-period. In addition, the relevance of the keywords ownership, management and agency epitomize the unresolved problems of agency between ownership and managers. Finally, entrepreneurial orientation is an emerging issue that has recently started to be included in the documents.

Table 7. Evolution of the most used keywords

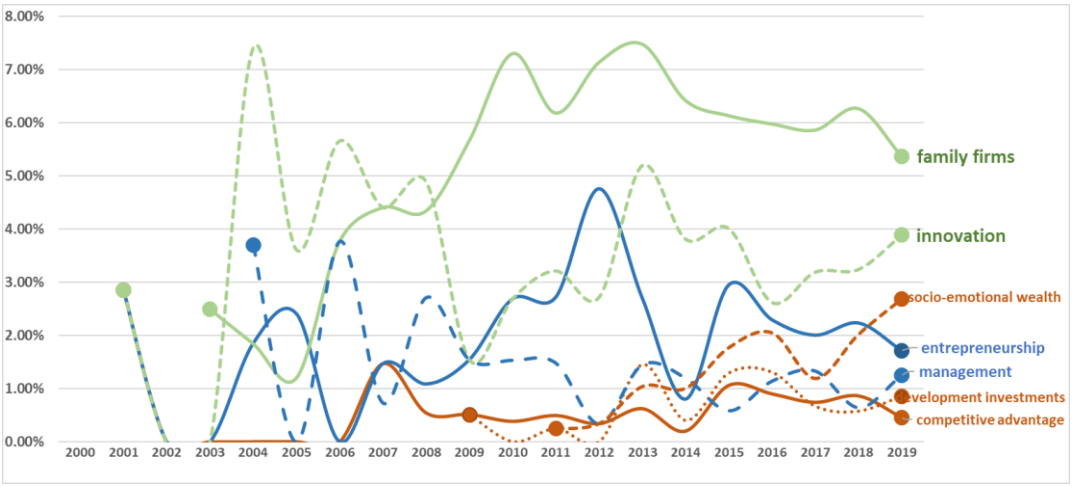
Rank	Keywords	1987-2019		Keywords	1987-2004		Keywords	2005-2014		Keywords	2015-2019	
		A	%		A	%		A	%		A	%
1	**family firms**	547	18.83%	**innovation**	5	2.26%	**family firms**	161	6.22%	**family firms**	385	5.88%
2	firm performance	408	14.04%	company information	4	1.81%	firm performance	104	4.02%	firm performance	303	4.63%
3	**innovation**	323	11.12%	sales	4	1.81%	**innovation**	96	3.71%	**innovation**	222	3.39%
4	entrepreneurship	201	6.92%	marketing	3	1.36%	entrepreneurship	58	2.24%	entrepreneurship	141	2.15%
5	socio-emotional wealth	144	4.96%	australia	2	0.90%	smes	40	1.55%	socio-emotional wealth	132	2.02%
6	ownership	130	4.48%	customer satisfaction	2	0.90%	ownership	39	1.51%	business	97	1.48%
7	smes	125	4.30%	entrepreneurs	2	0.90%	management	35	1.35%	ownership	90	1.37%
8	business	121	4.17%	entrepreneurship	2	0.90%	agency theory	30	1.16%	smes	84	1.28%
9	management	105	3.61%	growth	2	0.90%	firms	27	1.04%	entrepreneurial orientation	82	1.25%
10	agency theory	102	3.51%	investments	2	0.90%	business	24	0.93%	agency theory	72	1.10%
11	entrepreneurial orientation	102	3.51%	leadership	2	0.90%	corporate governance	24	0.93%	management	68	1.04%
12	firms	88	3.03%	management	2	0.90%	strategy	24	0.93%	corporate governance	60	0.92%
13	corporate governance	85	2.93%	manufacturer	2	0.90%	perspective	22	0.85%	development investments	60	0.92%
14	perspective	76	2.62%	personnel	2	0.90%	entrepreneurial orientation	20	0.77%	firms	60	0.92%
15	strategy	73	2.51%	precast concrete	2	0.90%	risk-taking	20	0.77%	perspective	54	0.82%
16	risk-taking	72	2.48%	raw materials	2	0.90%	research and development	19	0.73%	risk-taking	52	0.79%
17	development investments	71	2.44%	strategic management	2	0.90%	governance	18	0.70%	governance	51	0.78%
18	governance	70	2.41%	technology	2	0.90%	knowledge	15	0.58%	competitive advantage	50	0.76%
19	competitive advantage	63	2.17%	**family firms**	1	0.45%	model	15	0.58%	strategy	49	0.75%

The third sub-period depicts the splendour phase encompassing 2015 to 2019. In this sub-period the number of articles is around a hundred and increased constantly up to 163 in 2019. The analysis of the co-occurrence keywords suggests several important aspects in this sub-period. First, family firms, firm performance and innovation continue to be basic and consolidated themes. Similarly, entrepreneurship and entrepreneurial orientation remain as basic topics as part of the innovation process in family firms. It is worth noting that socio-emotional wealth is an emergent keyword that did not appear in previous sub-periods. In this vein, the pursuance of innovation is connected to the socio-emotional endowment inherent to family firms. What is more, competitive advantage appears as an incipient concept, showing the emerging interest for discovering innovation postures that lead to competitive advantages.

Figure 8 shows the temporal evolution of keywords. The motor themes, represented in green, are family firms and innovation. They can be considered consolidated terms that stand out as the main keywords throughout the period. The terms entrepreneurship and management are represented in blue and these are also basic issues related to the FFI field since they appear in all sub-periods as the most cited keywords. Finally, the topics that appear in brown, namely socio-emotional wealth¸ development investments and competitive advantage, are emerging subjects that have appeared in the last sub-period.

Despite being cited in previous sub-periods, it is not until the last sub-period that these keywords appear as the most cited.

Figure 8. Normalized frequency of occurrence for each keyword among papers published in the considered period

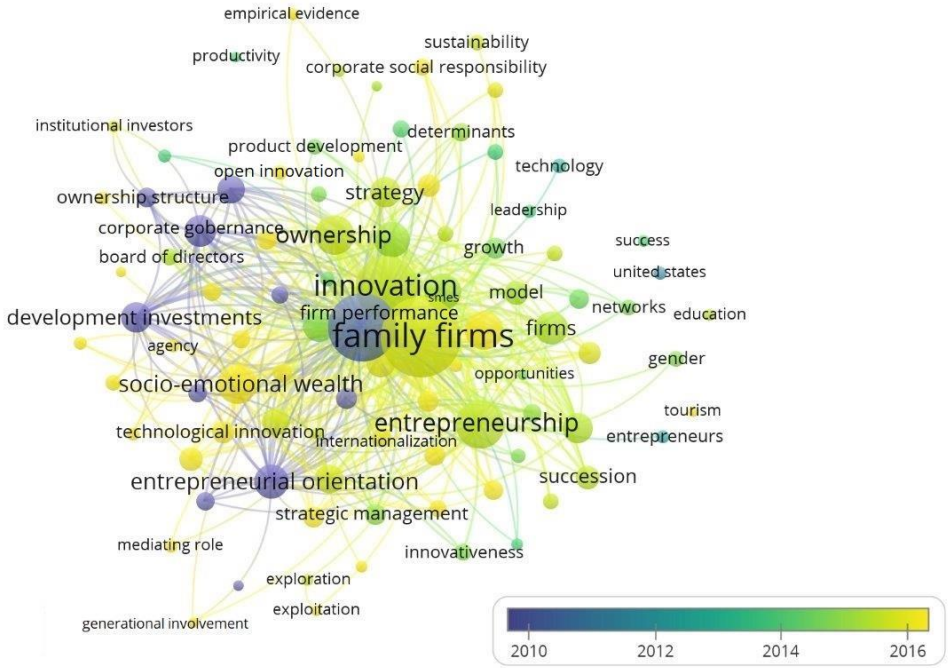


4.3.3. Challenging opportunities

The analysis of the keyword tendency, as can be seen in Figure 8, allows the detection of the most used keywords in the last years and the ensuing challenging opportunities. Figure 9 shows the overlay of keywords tendency, where the emergent topics are represented in yellow. As stated earlier, the network of socio-emotional wealth stands as a core concept on FFI. Moreover, technological innovation and open innovation appear as strategies for acquiring innovative capabilities in family firms.

In addition, the sustainability topic has gained interest and relevance. In this vein, related topics such as corporate social responsibility and sustainable development appear in yellow. This shows the growing awareness in family firms that achievement of sustainability and innovation go hand in hand. Finally, the network of internationalization together with the strategies of exploration and exploitation appear in yellow, showing the current challenge in family firm research to obtain competitive advantages based on an innovation posture through expanding overseas.

Figure 9. Temporal evolution of keywords network



5. General overview of identified clusters, research trends, and challenging opportunities: detection of future research avenues

After conducting a thorough evaluation of each cluster, analysing the research trends, and the challenging opportunities, we have organized the five clusters into a framework, which is shown in Figure 10, in order to provide more information on the relationships between the different clusters. The aim of this framework is to shed new light on future research avenues that might be further explored in an effort to advance FFI research. These research lines and gaps are not intended to be exhaustive, but to serve as a framework to guide future studies on the subject.

The examination of the link between "Family Firms" and "Innovation" clusters is at the heart of this bibliometric analysis. Although family firm scholars have increasingly acknowledged that family firms are a very heterogeneous group of entities (Jaskiewicz and Dyer 2017), little is known about the ways in which such heterogeneity affects the ability and willingness of family firms to innovate, as the results remain inconclusive (Calabrò et al. 2019). This is because the sources of heterogeneity within family firms are quite diverse (e.g. Chua et al. 2012), ranging from their resources (i.e. familiness) or governance mechanisms (i.e. family ownership and/or management), to their values or

their culture, and thus, determining which ones are most likely to affect the way innovation is conducted is a rather complex issue.

Moreover, innovation is considered to be a multidimensional phenomenon (Rosenbusch et al. 2011) and therefore, the particularities of each innovation type (e.g. organizational innovation) can lead to different challenges for the pool of family firms and in turn, cause them to behave in very different ways (Li and Daspit 2016). Accordingly, we call for more research on the heterogeneous innovation behaviour of family firms, to better understand how these firms shape the strategic decision-making process related to innovation. Specifically, an interesting research avenue could relate to the study of how the internal composition of the family firms' management, ownership or board of directors (in terms of generations represented, family branches, gender, tenure and educational diversity) (Barkema and Shvyrkov 2007) affects decisions to adopt and implement innovations. Furthermore, literature should focus on analysing some unexplored innovation issues such as open innovation (Gjergji et al. 2019), and technological innovation efficiency (Martínez-Alonso et al. 2020a), which may help family firms resolve the paradox in the manner they carry out distinct aspects of the innovation process.

With regards to the "Socio-emotional wealth" cluster, it can be argued that although SEW has become a hot topic in family firm research, with an emerging body of theoretical and empirical applications (Sanguino et al. 2020), its links with FFI remain an underdeveloped subject, representing a good opportunity for future research. Most of the seminal studies on the impact of SEW on FFI show that family firms invest less in innovation and prefer innovation projects that imply less of a threat to family control (e.g. Block et al. 2013). Similarly, other studies analysing the moderating role of SEW find that it weakens the benefits derived from family firms' entrepreneurial efforts to obtain firm performance (e.g. Schepers et al. 2014).

Nevertheless, more recent research questions this negative view, suggesting that SEW also has a bright side that can be conducive to innovation (Miller and Le Breton-Miller 2014). For example, Hauck and Prügl (2015) demonstrate that family adaptability and family members' closeness to the firm are positively related to the perception of the succession phase as an opportunity for innovation, while the opposite applies to

intergenerational authority and the history of family ties. Therefore, more research is needed on this bright side of SEW, to unravel its hidden power to promote FFI.

Moreover, some authors (e.g. Martínez-Alonso et al. 2018) have recently highlighted the necessity to further investigate how the different SEW dimensions (i.e. family control and influence, identification of family members with the firm, binding social ties, emotional attachment and renewal of family bonds through dynastic succession) identified by Berrone et al. (2012) influence FFI. Up to now, the scarce research on the subject has focused merely on analysing how such SEW dimensions affect innovativeness (Filser et al. 2018; Lazzarotti et al. 2020) and technological innovation capabilities (Fitz-Koch and Nordqvist 2017). Hence, more research on how SEW dimensions might have an impact across different family contexts (family firms with varying levels of family involvement in management, ownership and board of directors) and types of innovation (e.g. product, process, organizational, and service innovation) is urgently needed.

The identification of "Firm performance" as a cluster, highlights that investigating the influence of innovation on performance outcomes continues to be a recurring theme within the family firm area (Fuetsch and Suess-Reyes 2017; Martínez-Alonso et al. 2018). This is because FFI is increasingly seen as the engine that enables family firms to perform better, and therefore ensuring their long-term survival (Manzaneque et al. 2018). However, despite numerous efforts to shed light on this prominent relationship, there are still important emerging gaps in the extant literature that need to be filled. For example, current knowledge on the way in which innovation inputs convert into innovation outputs (i.e. technological innovation efficiency) drives family firm performance is still at an embryonic stage. In this regard, Martínez-Alonso et al. (2020b) reveal a positive effect of technological innovation efficiency on a specific indicator of firm performance, namely firm growth, and show that such effect is greater in family managed firms than in non-family managed firms. However, as performance is a complex construct with different dimensions that might not be necessarily related (Casillas et al. 2010), more research is required for the abovementioned results to be extrapolated. Accordingly, future studies based on the effect of innovation variables on firm performance should include multidimensional measures covering different financial, as well as emotional, performance indicators (Yeniaras et al. 2017). Going further, alternative performance indicators such as measures related to corporate social responsibility, sustainable

development or sustainable performance could be analysed in relation to innovation (Székely and Knirsch 2005).

It would also be interesting to increase the understanding of the effect of open innovation on family firm performance (Gjergji et al. 2019). Open innovation can provide firms with significant resources and knowledge to encourage efficiency and the novelty of innovation performance (Lazzarotti et al. 2017), and therefore lead to better firm performance. However, in the family firm context, the implications of open innovation on firm performance remain largely overlooked. The paucity of studies in this area provides significant possibilities for future research, such as analysing the impact of collaborations with external partners on firm performance, while considering certain family characteristics as potential moderators or mediators, such as family commitment, internal and external social capital, or generational diversity.

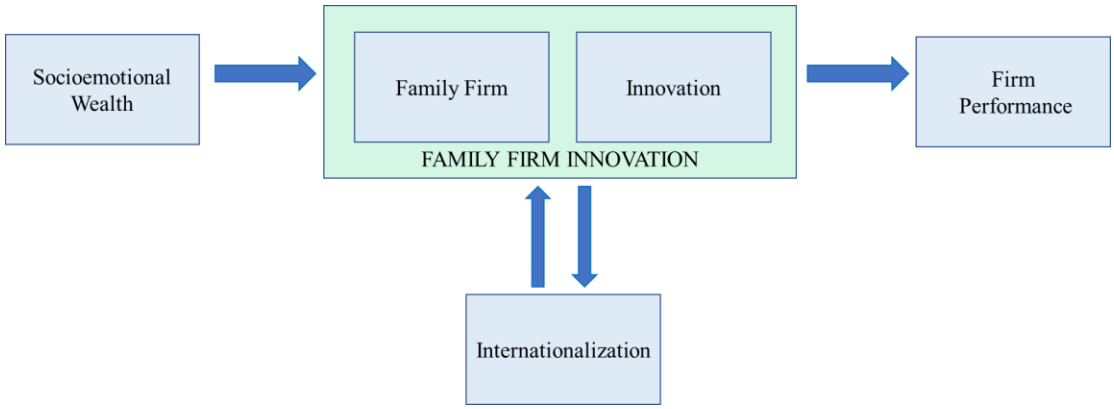
Finally, the recognition of the cluster "Internationalization" reveals that despite the great importance of this research trend during the last years (e.g. Casprini et al. 2020), existing studies dealing with both innovation and internationalization are scarce within the family firm field (e.g. Purkayastha et al. 2018).

In this vein, very recent research has investigated the internationalization-innovation relationship focusing exclusively on family firms to further extend the concept of family firm heterogeneity (Sánchez-Marín et al. 2020). Sanchez Marín et al. (2020) analyse the moderating effect that family involvement in management and the generational stage has on the link between export activity and product innovation. Inspired by Sánchez Marín et al. (2020), we proposed that not only family involvement in management nor the generational stage can act as moderators in the internationalization-innovation relationship. On the contrary, other family characteristics such as family involvement in ownership, the presence of family vs. professional CEO or founder vs. post-founder CEO, or family presence on the board of directors, might moderate the link between internationalization and innovation.

On the other hand, the international business literature insinuates that the innovation-internationalization relationship can be multidirectional as they can be considered as complementary strategies (Golovko and Valentini 2011). In other words, innovation might influence internationalization (Lin and Wang 2019) and vice versa,

internationalization may exert an impact on innovation (Sánchez-Marín et al. 2020) in family firms. Thereby, given the inconclusiveness of the innovation-internationalization relationship, different calls for further research on the topic have been made (e.g. Alayo et al. 2020).

Figure 10. Integrative framework on family firm innovation research



6. Discussion and conclusion

The aim of this bibliometric study was to offer an overview of the FFI field, to detect and synthesize key topics and outline future research opportunities. The present study is based on performance analysis and scientific mapping by co-author, co-citation and co-word analyses. It includes a total of 975 documents published in 458 journals by a total of 2,507 authors and encompasses the 1987-2019 period.

The performance analysis evidences the growing interest in the FFI research field around the word, with a total of 72 countries publishing articles dealing with innovation issues in family firms. The analysed period can be divided in three sub-periods, which have been identified as initial phase (1987-2004), take-off phase (2005-2014) and the splendour phase (2015-2019). The last sub-period shows an exponential increase of the number of publications and number of citations, suggesting that FFI research is in a developing stream that is expected to continue increasing in the future. Focusing on researchers, the three most productive authors are De Massis A., Kotlar J., and Kraus S. In this regard, the most productive author is also the author of the most influential article on the field, i.e. Innovation with limited resources: management lessons from the German Mittelstand. Concerning journals, the three specific journals on family firms, namely Family Business Review, Journal of Family Business Strategy and Journal of Family

Business Management are the most productive. Nevertheless, taking into consideration the most influential journals, Family Business Review continues to occupy the first position while Entrepreneurship Theory and Practice and Journal of Business Venturing appear in second and third position, respectively.

The co-author analysis identified clusters of social networks between authors of different institutions, who collaborate directly or indirectly, to advance the knowledge in this field. The obtained findings highlight the strength of the international relationships engendered by co-authorship.

The co-citation analysis recognised four clusters mainly based on (1) entrepreneurship, (2) behavioural agency theory, (3) resource-based view and (4) agency theory, which constitute the pillars of the theoretical foundations and intellectual structure in the FFI research field.

With regards to the co-word analysis, five thematic clusters have been identified, led by the following keywords: (1) family firms, (2) innovation, (3) socio-emotional wealth, (4) firm performance and (5) internationalization. The establishment of the clusters enables the organization of the literature regarding these motor thematic sub-areas within FFI research and the identification of the main developed topics. The family firms cluster encompasses topics that try to identify or help to clarify the understanding of how the particular features of family firms may affect their potential to innovate. The innovation cluster focuses on the peculiarities of family firms' innovative behaviour. The third cluster around socio-emotional wealth highlights its consideration as the driver of family firms' strategic diagrams as well as its contingent role in various relationships involving different innovation issues. The fourth thematic cluster, led by firm performance, shows the well-developed subfield exploring how innovativeness interacts with family influence to affect firm performance. Finally, the fifth cluster epitomized those studies that have tried to underscore the role of internationalization in terms of innovation.

This study makes several contributions to the extant literature. First, it allows the consolidation of FFI as a solid and powerful research field by means of the interplay of two different investigation domains that have prevailed within management research in recent years: innovation and family firms. In doing so, this study complements the lively debate on FFI (e.g. Calabrò et al. 2019) by providing a broad understanding of the

background and consequences of FFI and how the idiosyncratic and heterogeneous behaviour of family firms may have a determining influence on the way innovation processes are carried out. Therefore, the present article delves into the underpinnings of FFI research and unveils its main trends and its challenging opportunities.

Second, and coupled with the above, an integrative framework is provided to open up an agenda to guide future researchers into this promising research field. This framework points out, among other issues, the urgent need to better understand the heterogeneous innovation behaviour of family firms, the way in which different SEW dimensions have an impact on emerging innovation forms, such as technological innovation efficiency and open innovation, or the freshly discovered two-way relationship between FFI and internationalization. Similarly, this framework also encourages future research to analyse how the abovementioned emerging innovation forms might influence performance indicators that go beyond purely financial measures, such as sustainability indicators.

Third, to the best of the authors' knowledge, this study is the first FFI bibliometric review to include the years of maximum scientific production, namely 2018 and 2019. This continuous increase in scientific production is a faithful reflection of the growing interest in the field, which might be explained by different reasons: on the one hand, the clear importance of family firms as ubiquitous entities in economies throughout the world and their proven importance as leaders in their market niches due to their unique idiosyncrasies for innovation (Duran et al. 2016); and, on the other hand, the embeddedness of their innovative commitment as a way to achieve competitive advantages, which are fundamental for ensuring their long-term survival and transgenerational wealth creation (Martínez-Alonso et al. 2018).

Finally, this study carries out a bibliometric analysis covering two major databases, namely WoS and Scopus. The interaction of the two databases permits a substantially larger body of documents to be covered in comparison to previous FFI bibliometrics (e.g. Aparicio et al. 2019), enabling the inclusion of the most relevant documents on this topic. Of the 975 analysed documents, only 351 were in both databases, meanwhile 388 were exclusively in WoS and 236 solely in Scopus. These numbers emphasize the importance of considering both databases. Besides, by covering documents from WoS and Scopus, we overcome the limitations of those bibliometric studies which focus exclusively on one

data source (Alayo et al. 2020). In this manner, this study addresses a broader spectrum of FFI issues with the aim of generating a more holistic and robust understanding of the FFI research field.

Regarding the managerial insights derived from this bibliometric study, family firms' owners, managers, and directors, and family firm members in general, could benefit from a complete overview of the academic actors (authors and institutions) who are steadily cultivating the FFI domain. The identification of FFI researchers, their institutions and countries, and therefore, their most influential publications, allow family firm members to comprehend how the FFI research field operates. Furthermore, family firm members may also benefit from an approximation to various current research trends that are of managerial interest. Accordingly, family firm members could ascertain how academic actors are attempting to support firms by comprehending diverse phenomena related to innovation issues. For instance, family managers must be aware of the need to develop an innovative culture and mentality within the family firm to promote the generation of new ideas and exploit their innovation potential (Matzler et al. 2015). Or for example, they should learn how to balance emotional and financial considerations when dealing with innovative strategic decisions (Martínez-Romero et al. 2020a). In this regard, consultants and practitioners must also be able to recognize those factors that might influence strategic choices to adequately implement innovative projects (Martínez-Alonso et al. 2018). Finally, the identification of the ongoing research trends in the FFI domain, enables family firm members to keep in touch with controversial topics that might help them to overcome certain barriers in their firms.

This study is not exempt of limitations, which lie in the constraints of bibliometric techniques. First, despite the advantages of using WoS and Scopus databases, there is the possibility that other relevant documents, only available in alternative databases (e.g. ABI Inform/ProQuest), have been excluded. Needless to say, this is an endemic problem to all bibliometric studies (Jacsó 2008). Second, documents such as national journals, conference proceedings, and editorial material are excluded from the search formula, despite perhaps being equally influential in FFI research (Baier-Fuentes et al. 2019a). Third, some documents from the WoS database did not contain any keywords, and hence, the assigned keywords by WoS were utilised to conduct the co-word analysis. These keywords, despite being less exhaustive than the authors' keywords, have been proved to

be as effective as the latter when investigating the knowledge structure of a scientific field (Zhang et al. 2016). Finally, this study has been developed under the co-author, co-citation, co-word analyses, eschewing other bibliometric techniques such as bibliographic coupling (e.g. Tiberius et al. 2020). The use of alternative bibliometric techniques may be a valuable complement to our findings. In any case, the abovementioned limitations provide directions to how future bibliometric studies can be strengthened or improved.

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CHAPTER II. THE INFLUENCE OF TECHNOLOGICAL INNOVATION EFFICIENCY ON FIRM PERFORMANCE

REFINING THE INFLUENCE OF FAMILY INVOLVEMENT IN MANAGEMENT ON FIRM PERFORMANCE: THE MEDIATING ROLE OF TECHNOLOGICAL INNOVATION EFFICIENCY

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REFINING THE INFLUENCE OF FAMILY INVOLVEMENT IN MANAGEMENT ON FIRM PERFORMANCE: THE MEDIATING ROLE OF TECHNOLOGICAL INNOVATION EFFICIENCY

Abstract

Determining what factors influence firm performance constitutes an essential issue in both the management and the family firm research fields. This paper, building on the resource-based view perspective, develops a mediation model that involves a unique intervening mechanism, namely, technological innovation efficiency (TI efficiency), with the potential to explain the inconsistencies found in prior work on the ways through which family involvement in management affects performance outcomes. Regression analyses utilising a longitudinal sample of 1,118 Spanish private firms largely support the hypothesized mediating relationship, revealing that TI efficiency leads to richer firm performance in family firms with active family involvement in management. Overall, our findings help elucidate the black box of performance outcomes within family firms and make several contributions to theory and practice.

Keywords: family firm, family involvement in management; firm performance; technological innovation efficiency; resource-based view

1. Introduction

Investigating how family involvement in ownership and in management influences firm performance is gaining increasing momentum in management research (Dyer, 2018; Hansen and Block, 2020; Yeniaras et al., 2017). This over-whelming attention is not surprising given that family firms, defined as businesses 'dominantly controlled by a family with the vision to potentially sustain family control across generations' (Zellweger, 2017, p. 22), represent ubiquitous and significant organisational forms worldwide1 (La Porta et al., 1999). However, up to now, the incidence of family involvement, namely in management, as an unequalled resource, on firm performance still remains unclear (e.g. Diéguez-Soto et al., 2019b) with studies indicating positive (Gallucci et al., 2015; Sciascia et al., 2014), negative (Diéguez-Soto et al., 2019b; Miralles-Marcelo et al., 2014) or even non-significant (Westhead and Howorth, 2006) associations between the two constructs.

According to the extant literature, a significant research gap persists in the family firm domain regarding how family firms with family involvement in management can boost their performance outcomes. Since enhanced performance is regarded as one of the most critical determinants of family firms' sustained value creation and long-term survival (Dyer, 2006), it is extremely important to more precisely understand the manners through which performance can be improved in this type of firms. This is consistent with recent calls to include an examination of the role of indirect strategic mechanisms in the family involvement-performance debate (Chrisman et al., 2012; Yeniaras et al., 2017), inasmuch as existing research on family influence (Chrisman et al., 2005) has largely neglected other intervening mechanisms equally or even more relevant than family involvement in management.

Therefore, building on the resource-based view (RBV; Habbershon and Williams, 1999), the aim of this study is to refine the family management-performance relationship by introducing an unexplored intervening mechanism, namely, technological innovation

[1] Estimates suggest that family firms account for two-thirds of all businesses operating across the world, generate around 70-90% of annual global GDP, and create approximately 50-80% of jobs in most countries worldwide (Family Firm Institute, 2018).

efficiency (henceforth TI efficiency), as the cornerstone to help explain how family involvement in management influences firm performance. TI efficiency, defined as a firms' capability to maximize innovation outputs given a certain quantity of innovation inputs (Cruz-Cázares et al., 2013), is a reflection of family managers' actions in orchestrating resources and in exploiting the bundle of family firms' distinctive intangible assets (Carnes and Ireland, 2013; Muñoz-Bullón et al., 2019). The unique resources of family firms with an active family management promote sustained competitive advantages (Habbershon and Williams, 1999), which lead to increased TI efficiency, and in turn, to greater firm performance. Hence, we propose a mediation model to address the indirect effect of TI efficiency in the relationship between family involvement in management and firm performance. To test the suggested relationships, we apply random-effects regression analysis to a longitudinal sample of 1,118 Spanish private firms over the period 2010-2016.

Our article contributes to the literature in several ways. First, it extends the current family firm research on organizational outcomes (Dyer, 2018; Hansen and Block, 2020), by formally investigating TI efficiency as a mediating variable in the family management-firm performance relationship, thus adding clarification to the black box of performance outcomes within family firms (Pittino et al., 2019). Moreover, although very fresh research is investigating different associations between family involvement, technological innovation and firm performance (e.g. Diéguez-Soto et al., 2019b), most of it is centred on analysing conditional (moderating) effects. However, to the best of our knowledge, this is the first paper that introduces TI efficiency as a unique intervening mechanism through which performance outcomes could be enhanced in family firms with family involvement in management. Additionally, the consideration and operationalization of TI efficiency constitutes a contribution itself: On the one hand, prior studies have generally focused on the effect of either innovation inputs or outputs on firm performance (e.g. Diéguez-Soto et al., 2016), obviating that the key to improving firm performance is the efficiency with which technological innovation is undertaken (Cruz-Cázares et al., 2013). On the other hand, the way in which TI efficiency is measured, i.e. the ratio of number of product innovations to R&D expenditure, supposes a novelty compared to previous research that operationalize it by examining innovation inputs and outputs in separate models (Matzler et al., 2015), or by regressing innovation inputs into

innovation outputs (Manzaneque et al., 2020). Finally, this study also responds to the call for further investigation on the relationship between TI efficiency and firm performance within a family firm context (Martínez-Alonso et al., 2020).

The remainder of this paper is structured as follows. The next section reviews relevant prior literature and advances our hypotheses. The third section describes the data and methodology. The fourth section reports the results while the fifth section presents the discussion.

2. Theoretical background and hypotheses development

2.1. Family involvement in management and firm performance from a resource-based view perspective

The RBV has been a widely adopted theoretical framework when studying the performance of family firms (e.g. Hansen and Block, 2020; Hatak et al., 2016; Yeniaras et al., 2017). The essence of RBV is that firms differ in their resource endowments and that this resource heterogeneity matters and results in differential performance (Barney, 1991; Tokarczyk et al., 2007). More specifically, for a business to achieve and maintain competitive advantages that generate attractive organisational outcomes, these resources need to be valuable, rare, not easy to imitate, and non-substitutable (Barney, 1991).

Under this view, family firms are complex and dynamic entities, rich in distinctive, intangible resources (Habbershon et al., 2003), and the RBV has the potential to help identifying whether those resources may become into family-based competitive advantages and lead to higher firm performance (Cabrera-Suárez et al., 2001; Habbershon and Williams, 1999). Among family firms' resources, family involvement in the firm, which is conceived as the product of family relationships built over time, is the most valuable and difficult to imitate resource (Colbert, 2004; Hatch and Dyer, 2004), solely available to family firms (Shinnar et al., 2013). Family involvement represents a source of sustained competitive advantages because it is unique, inseparable, synergistic and difficult to duplicate (Nordqvist, 2005). Habbershon and Williams (1999) pointed out that what really makes family firms unique is the involvement of family members in the business, especially when that involvement occurs from an early age, because it allows the generation of socially complex tacit knowledge that is difficult to codify and therefore,

cannot be easily imitated by others (Berman et al., 2002; Danes et al., 2009). Thus, family involvement can create familiness (Habbershon et al., 2003), that is, an idiosyncratic set of resources and capabilities arising from the interaction between the family and the firm life, which may yield sustained competitive advantages whether the family firm uses them appropriately.

Moreover, when analysing the effect of family involvement on firm outcomes it is common to distinguish between two family dimensions: family involvement in ownership and in management (Cabrera-Suárez and Martín-Santana, 2015; Sciascia and Mazzola, 2008). However, it has been argued that it is the family involvement in management, as opposed to mere ownership, which determines the firm outcomes (Gallucci et al., 2015; Martínez-Romero et al., 2020), since the former enables an active family participation in decision-making as well as in the monitoring and execution of businesses' strategies and activities (Hambrick and Mason, 1984; Vandekerkhof et al., 2018), and therefore, implies a greater direct incidence on firm settings, such as performance outcomes (Diéguez-Soto et al., 2019b).

According to certain scholars (e.g. Sirmon and Hitt, 2003), family involvement in management may exert a negative effect on firm performance. In this respect, some negative attributes of human capital, such as parental altruism, managerial entrenchment or the recruitment of family members on the basis of nepotism (Dyer, 2006; Gómez-Mejía et al., 2001), might cause family managers to utilize firm resources merely to fulfil family preferences (Bertrand and Schoar, 2006), thereby jeopardizing the firms' financial outcomes.

Contrary to this negative view, several authors have found that family involvement in management originates family-specific capabilities, which subsequently, have positive impact on firm performance (e.g. Allouche et al., 2008). In this vein, family managers possess a strong sense of commitment to the firm (Chrisman et al., 2012; Le Breton-Miller et al., 2011), inasmuch as they are well aware that the survival of the firm and the family harmony, largely depend on their degree of effectiveness in managing the firm (Le Breton-Miller and Miller, 2013). In other words, family managers do their work with superior commitment because they perceive firm performance as an extension of their own well-being (Ward, 1988). Because of this, family members actively involved in

management positions are expected to be more productive and more efficient than non-family managers (Habbershon and Williams, 1999; Matzler et al., 2015). Nevertheless, this high commitment of family managers may have a socially contagious effect and lead to an increase in the commitment and dedication of non-family employees to the family firm (Barsade, 2002; Zahra et al., 2008), which is critical to achieve greater performance outcomes (Hatak et al., 2016).

Family involvement in management also embeds the firm with other positive attributes of human capital such as unusual motivation, increased trust, cement loyalties and an unique family language that enable all family firms' members to communicate and exchange ideas, feedback and expectations of each other in a more efficient and private way (Kellermanns and Eddleston, 2007; Tagiuri and Davis, 1996). Likewise, family managers may take advantage of these positive attributes to effectively communicate the history, values and identity of the family firm to potential stakeholders (e.g. customers), thus leading to beneficial firm performance (Gallucci et al., 2015).

According to the reviewed literature built on the RBV, there is a prevailing positive effect of family involvement in management on firm performance. Hence, we propose the following hypothesis:

H1. There is a positive relationship between family involvement in management and firm performance

2.2. Family management and firm performance: the mediating role of technological innovation efficiency

Traditionally, family firms have been adverse to hiring external managers on the top management team in an attempt to retain family control (Le Breton-Miller et al., 2011; Vandekerkhof et al., 2015), and therefore may lack the appropriate human resources for developing innovation strategies (Sirmon and Hitt, 2003). In this sense, family managers have been found to be hostile towards innovation investments (Block, 2012; Migliori et al., 2020; Muñoz-Bullón and Sánchez-Bueno, 2011). However, despite their unwillingness to innovate, family managers' ability to achieve innovation outcomes has been demonstrated to be higher than those of their non-family counterparts (Duran et al., 2016; Matzler et al., 2015). This innovation paradox (e.g. Chrisman et al., 2015) has

prompted family firms' scholars to analyse the conversion rate of innovation inputs into innovation outputs (Duran et al., 2016), i.e. TI efficiency, and particularly its antecedents with the aim of unlocking family firms' innovation potential (Rondi et al., 2019).

Drawing on RBV arguments, we propose that family involvement in management, as a key determinant of family firm's ability to innovate (Chrisman et al., 2015; Diéguez-Soto et al., 2018), is a precondition for enhancing TI efficiency. In this regard, family members actively involved in top management teams, being the main decision-makers in family firms and representing the interface between the family and the firm (Vandekerkhof et al., 2015), constitute one of the most important manifestations of familiness (Ensley and Pearson, 2005; Minichilli et al., 2010). Although this familiness may be regarded as a possible source of disadvantages due to the lack of necessary internal resources to develop innovations (because of, among other reasons, family firms are reluctant to opening the business' doors to outsiders (König et al., 2013)), this resource restriction could encourage family managers to pursue a more efficient or parsimonious (Carney, 2005; Muñoz-Bullón et al., 2019) transformation of innovation inputs into innovation outputs. Particularly, familiness has the potential to affect family firms' innovate efforts (Carnes and Ireland, 2013), motivating more effective innovation behaviours (Hsu and Chang, 2011; Röd, 2016), and its effects are mainly observed in the orchestration of the firms' resources by family managers (Sirmon et al., 2011).

In terms of human capital, as family managers have been involved in the business since their early infancy, they are endowed with a deep, largely tacit knowledge of their firm's resources, routines and stakeholders (Cabrera-Suárez et al., 2001; Von Krogh et al., 2000). Therefore, family managers are intimately familiar with how the firm's internal processes and systems work (Sirmon and Hitt, 2003) and also encourage the exchange and dissemination of such knowledge throughout the firm (Patel and Fiet, 2011). Hence, the creation and accumulation of this valuable knowledge internally generated in the firm is essential to reap such advantageous human capital (Diéguez-Soto et al., 2016; Zahra et al., 2007) and will enable a more effective resource orchestration, and therefore, a more efficient conversion of innovation inputs into innovation outputs. Another essential component of familiness, i.e. social capital (Pearson et al., 2008), is typified by the desire to maintain the firm's reputation in relation to interested outside parties (Dunn, 1996), as well as to cultivate and develop long-standing relationships with both firm-internal and

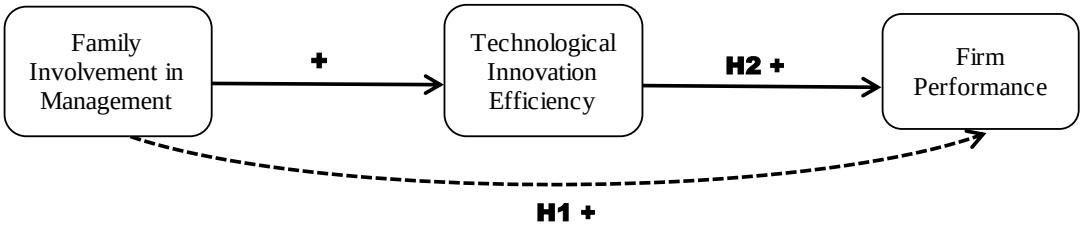
external stakeholders (Berrone et al., 2012; Miller and Le-Breton-Miller, 2005). Indeed, the establishment of quality, strong ties with firms' potential stakeholders (e.g. suppliers) provides family managers with valuable technological resources and knowledge (Das and Teng, 2000; Feranita et al., 2017) that may foster higher efficiency in turning innovation inputs into innovation outputs. Besides, social capital facilitates the participation of family managers in open innovation projects (Bigliardi and Galati, 2018). These projects promote an exchange of ideas, experiences and opportunities among network members (Miles et al., 2005; Zahra et al., 2007), which helps to reduce the mental rigidity of family managers and to develop better cost-efficiency strategies (Diéguez-Soto et al., 2016; Uhlaner et al., 2013), leading to greater TI efficiency.

Accordingly, TI efficiency should have a direct association with improved firm performance. TI efficiency allows businesses to better leverage existing resources to get enhanced innovation outcomes (Guan and Chen, 2010). Moreover, TI efficiency helps businesses to become more competitive in today's increasingly dynamic and complex resource-constrained environments (Duran et al., 2016). TI efficiency also promotes more fluid communications between firm members (Diéguez-Soto et al., 2018), the exchange of valuable ideas through different departments (Bammens et al., 2015), and consequently, better decision-making quality (Vandekerkhof et al., 2018), to the extent that TI efficiency is usually accompanied by a greater commitment to the care and protection of firm resources. In other words, TI efficiency represents a powerful engine that can lead to richer performance outcomes (Cruz-Cázares et al., 2013). Then, family involvement in management is expected to have a decisive effect on the turning of innovation inputs into innovation outputs and thereby, to influence the impact of TI efficiency regarding the achievement of firm performance (Martínez-Alonso et al., 2020). This suggests an indirect relationship in which TI efficiency mediates the relationship between family involvement in management and firm performance. We thus propose:

H2. The relationship between family involvement in management and firm performance is mediated by TI efficiency

The theoretical model with the proposed relationships between family involvement in management, firm performance, and TI efficiency is summarized in Figure 1.

Figure 1. Theoretical model.



3. Research method

3.1. Sample and data sources

The hypothesized relationships are checked on a representative sample of Spanish private firms from the Survey on Business Strategies (ESEE). This is a yearly survey conducted by the State Partnership of Manufacturing Equity foundation on behalf of the Spanish Ministry of Industry and is composed of manufacturing firms. One of the most important ESEE's characteristics is its sampling process that ensures the representativeness of the Spanish manufacturing industry. The data comprise the whole population of Spanish manufacturing businesses with 200 or more employees, and include a stratified random sample of 5% of the population of firms with at least 10, but fewer than 200 employees. Following the arguments of Dorling and Simpson (1999), the compilation of data by a public organism guarantees the quality of the information and implies a high response rate, a high level of active involvement and the representativeness of the population. Furthermore, the Spanish manufacturing industry is an ideal context for analysing the mediating effect of TI efficiency on the family management-performance relationship for several reasons: first, manufacturing firms play a crucial role in the innovation investment made in Spain, accounting for 47.5% of total TI expenditure in relation to other industries (CEOE, 2018); second, around 4 out of 10 Spanish firms developing TI belong to the manufacturing industry (CEOE, 2018); and third, manufacturing firms find in innovation the driving force to prevent the high degree of obsolescence they usually experience in their products in order to maintain and strengthen their market competitiveness (Kotlar et al., 2013). This database has been employed by numerous researchers to analyse innovation and related issues (e.g. Cruz-Cázares et al., 2013; Muñoz-Bullón et al., 2019; Nieto et al., 2015). The survey question about whether the firm is publicly listed enabled us to pinpoint private firms. In total, our sample consists

of an unbalance panel of 6,503 firm-year observations covering 1,118 private firms, of which 612 are family firms and 506 are non-family firms, operating across twenty manufacturing subindustries between 2010 and 2016. Table 1 offers a more detailed view of the sample.

Table 1. Sample description.

Sample composition by family/non-family firm		
	N	%
Family firms	3,558	54.71
Non-Family firms	2,945	45.29
Total	6,503	100.00
Sample composition by size[a]		
	N	%
Large-size firms	2,711	41.69
Medium-size firms	1,225	18.83
Small-size firms	2,567	39.48
Total	6,503	100.00
Sample composition by subindustry		
	N	%
1. Meat industry	302	4.64
2. Foodstuffs and snuff	851	13.08
3. Drinks	144	2.22
4. Textiles and clothing	395	6.08
5. Leather and footwear	229	3.52
6. Timber industry	192	2.96
7. Paper Industry	280	4.31
8. Graphics	250	3.84
9. Chemical and pharmaceutical products	451	6.94
10. Rubber and plastic	386	5.93
11. Non-metallic mineral products	423	6.51
12. Ferrous and non-ferrous metals	189	2.90
13. Metal products	828	12.73
14. Agricultural and industrial machinery	416	6.40
15. Computer, electronic and optical products	120	1.85
16. Electrical machinery and material	220	3.38
17. Motor vehicles	291	4.47
18. Other transport equipment	125	1.92
19. Furniture industry	259	3.98
20. Other manufacturing	152	2.34
Total	6,503	100.00

Note: [a]Large, medium, and small-size firms have been identified according to the European Commission's criterion (2003/361/CE, 6th may).

3.2. Measures

3.2.1. Dependent variable

Firm performance. In this paper, *firm performance* is assessed using gross margin, conceptualized as the difference between sales and the cost of goods sold scaled by sales (De Massis et al., 2018). Gross margin is considered an income statement measure with better predictive power than others accounting ratios (Fama and MacBeth, 1973; Martínez-Romero et al., 2019). Indeed, investors rely on gross margin, because it also provides information regarding forecasting revenues and earnings persistence (Lento and Sayed, 2015). The use of gross margin for measuring firm performance is highly suitable for our study as it depicts the firms' financial wealth and reflects managers' influence in organizational outcomes. Moreover, gross margin provides certain advantages regarding other common accounting-based indicators (e.g. ROA or ROE) in that it only takes into account operating incomes and expenditures. That is, gross margin does not include non-cash expenses, such as amortizations, nor taxes or interests derived from financial investments, which is advantageous for obtaining a more reliable performance measure in private firms (De Massis et al., 2018; George, 2005).

3.2.2. Independent variables

Technological innovation efficiency. An optimal measure of innovation efficiency should include both, innovation output and innovation input (Cruz-Cázares et al., 2013; Guan and Chen, 2010). Thus, as a proxy of *TI efficiency*, we calculated the ratio of number of product innovations (innovation output) to R&D expenditure (innovation input) (e.g. Martínez-Alonso et al., 2020). According to this measurement, TI efficiency is enhanced when with the same amount of R&D expenditure more product innovations are produced or when less R&D expenditure is needed to produce the same amount of product innovations (Guan and Chen, 2010). The utilisation of a ratio allows capturing the firms' efficiency in turning innovation inputs into the innovation outputs (Xie et al., 2020). The ESEE provides the total amount of money that each firm invests in R&D and the number of product innovations that each firm carries out.

Family involvement in management. The influence of family managers on decision-making is considered an objective measure of family impact on the firm (Cruz et al., 2010;

Kotlar et al., 2014a; Muñoz-Bullón et al., 2019). This paper utilizes the ESEE data to include both family ownership and family management as indicators of family influence on firm decision-making (Kotlar et al., 2014a; Manzaneque et al., 2020; Nieto et al., 2015). Accordingly, we define *family involvement in management* as the active participation of the controlling family in firm management for those firms that are family owned (Diéguez-Soto et al., 2019b). In this regard, for determining whether the firm is a family firm or not, we first utilized a question from the survey concerning whether the firm is controlled or not by a family. Then, for all those firms that are family owned, we used another question from the survey that indicates the number of owners and their immediate relatives holding top managerial positions. In view of this argumentation, family involvement in management is measured as continuous variable including the number of members of the owner-family involved in the top managerial team of the firm (Kotlar et al., 2013).

3.2.3. Control variables

Several control variables have been used to account for possible alternative explanations. Because of management capabilities are built on experience and knowledge accumulated over the years (Ruiz-Jiménez and Fuentes-Fuentes, 2016), we controlled for *firm age*. Firm age is measured as the natural logarithm of the number of years between the business foundation and the observation year (Cabrera-Suárez and Martín-Santana, 2015). Due to larger organizations usually have greater innovation potential and more sophisticated planning and monitoring systems that may influence firm performance (Sciascia et al., 2014), we used *firm size* as a control variable, measured by the natural logarithm of total assets (Yeniaras et al., 2017). Since firms with higher financial resources are more likely to achieve superior firm performance, we controlled for *leverage,* computed as the ratio of the firm's debt to total assets (Matzler et al., 2015). Given that dependence on customers may compromise firms' performance, we employed *customer bargaining power* as a control variable, calculated as the percentage of sales earned from the three major customers (Kotlar et al., 2014b). Moreover, as business sectors may have distinct degrees of propensity in relation to TI efficiency and firm performance, we controlled for *industry effect* (Manzaneque et al., 2020) by including twenty dummy variables representative of each subindustry (see Table 1 for a detailed

description of each subindustry). Finally, to control for potential *year effects*, we included seven dummy variables for the different years covered in our paper.

3.3. Estimation methodology

In order to examine the proposed hypotheses, we used a panel data methodology. This technique enables controlling for unobservable heterogeneity, which refers to the specific behaviour and features of each sampled firm. Although a distinction between fixed-effects and random-effects is often required when using panel data, we utilised random-effects due to the time-invariant nature of industry dummies precludes us from using fixed-effects (Diéguez-Soto and López-Delgado, 2019a; González et al., 2013).

To check the relationships between family involvement in management, TI efficiency and firm performance, we followed the framework of Baron and Kenny (1986). This framework supports mediation when four conditions are fulfilled: first, the dependent variable must be affected by the independent variable; second, the mediating variable must be affected by the independent variable; third, the dependent variable must be affected by the mediating variable, which is assessed by examining on the dependent variable the concurrent influence of the independent and mediating variables; and fourth, the impact on the dependent variable by the independent variable has to be less significant than under the first condition (partial mediation) or become non-significant (full mediation) when concurrently analysing on the dependent variable the influence of both the independent and the mediating variables (Baron and Kenny, 1986).

In the light of the abovementioned considerations, we applied different regression models to our data depending on the nature of the dependent variable utilized in each case. Thus, we performed random-effects GLS regression models to capture the effect of control variables, family involvement in management, and TI efficiency on firm performance in Models 1, 2, and 4. Subsequently, we run a random-effects Tobit regression model to test the effect of family involvement in management on TI efficiency in Model 3, as the latter variable is left-censored (TI efficiency does not contain negative values and presents numerous observations with values equal to 0). In this vein, scholars have demonstrated that Tobit models are the best approach when the dependent variable is censored (e.g. Greene, 2003), which can potentially avoid inconsistent parameter estimates and overcome any possible bias (Chen et al., 2013; Gao and Chou, 2015).

Additionally, once the regression models were executed, we used the Sobel (1982) test to check the significance of the mediating effect. The Sobel test is highly appropriate for our purpose (Hayes, 2018), since the utilisation of a large sample size entails the existence of computer limitations (Agarwal et al., 2016), and thus bootstrapping approaches are not applicable in our particular case (Hayes and Preacher, 2010; Imai et al., 2010). Finally, to confirm the mediating results, we estimated confidence intervals by employing a Monte Carlo Method (Selig and Preacher, 2008).

4. Results

Table 2 reports some descriptive statistics (i.e. mean and standard deviation) and correlations of the variables. Correlation coefficients were relatively low and consistent with our expectations. Likewise, the individual values of the variance inflation factor did not exceed 1.09, being significantly lower than the critical value of 10, proposed as a warning level in prior studies (Neter et al., 1989). Thereby, multicollinearity among independent variables is not a concern in our study.

Table 3 presents, by stage, the results of the random-effects regression models. We begin the regression analysis by introducing only control variables (Model 1). Model 2 shows a beneficial impact of family involvement in management on firm performance (β = 0.0078; $p < 0.01$). This strong positive relationship between family involvement in management and firm performance is coherent with previous literature (e.g. Gallucci et al., 2015), and therefore H1 is supported. In Model 3, we demonstrate the relationship between family involvement in management and TI efficiency. The positive and significant coefficient of family involvement in management (β = 0.060; $p < 0.01$) indicates that as the number of family members actively involved in management increases, the obtained TI efficiency is higher. Model 4 presents the mediation results. Both TI efficiency and family involvement in management are simultaneously introduced in this model. Whereas the impact of TI efficiency on firm performance is strongly positive and significant (β = 0.0053; $p < 0.01$), family involvement in management becomes non-significant compared to Model 2 (β = 0.004; *n.s.*). Hence,

Table 2. Descriptive statistics and correlations.

	Mean	SD	1	2	3	4	5	6	7
1. Firm performance	0.33	0.18	1.00						
2. Firm age	3.32	0.60	-0.11***	1.00					
3. Firm size	15.95	1.95	-0.07***	0.09***	1.00				
4. Leverage	0.50	0.24	-0.18***	-0.14***	0.05***	1.00			
5. Customer bargaining power	46.27	28.70	0.19***	-0.15***	-0.01	0.05***	1.00		
6. Family involvement in management	0.92	1.05	0.09***	-0.04***	-0.10***	-0.04***	-0.10***	1.00	
7. TI efficiency[a]	0.03	0.40	0.05**	-0.02	-0.01	0.01	-0.02	0.04**	1.00
VIF				1.03	1.03	1.09	1.03	1.04	1.01

Note: N = 6,503 observations. [a]TI efficiency has been rescaled by multiplying it by 1,000. ***Significant at 1%, **Significant at 5%.

Table 3. Regression analysis results-mediating effect of TI efficiency on the family management-firm performance relationship.

	Model 1 (GLS)		Model 2 (GLS)		Model 3 (Tobit)		Model 4 (GLS)	
DV:	**Firm performance**		**Firm performance**		**TI efficiency**		**Firm performance**	
Variable	**Coef.**	**S. Error**	**Coef.**	**S. Error**	**Coef.**	**S. Error**	**Coef.**	**S. Error**
Independent variable/mediator								
Family involvement in management			0.0078***	0.0023	0.0600***	0.0224	0.0040	0.0025
TI efficiency[a]							0.0053***	0.0013
Controls								
Firm age	-0.0333***	0.0073	-0.0332***	0.0072	-0.0631	0.0437	-0.0013	0.0085
Firm size	-0.0304**	0.0024	-0.0301**	0.0025	-0.0182*	0.0170	-0.0190*	0.0033
Leverage	-0.1168***	0.0186	-0.1164***	0.0185	0.1376	0.1147	-0.1239***	0.0205
Customer bargaining power	0.0006***	0.0002	0.0007***	0.0002	-0.0031***	0.0010	0.0004**	0.0002
Industry dummies	Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes	
Constant	0.4651***	0.0297	0.4568***	0.0299	-0.3628*	0.1879	0.3365***	0.0353
Log likelihood					-1376.450			
R^2: within	0.0132		0.0129				0.0241	
between	0.2160		0.2274				0.1967	
overall	0.1619		0.1693				0.1609	

Note: N = 6,503 observations. [a]TI efficiency has been rescaled by multiplying it by 1,000. ***Significant at 1%, **Significant at 5%, *Significant at 10%.

Table 4. Mediation model test statistics.

Firm performance	**c**	**a**	**SE_a**	**b**	**SE_b**	**Z**	**MCMAM 95% CI**	
TI efficiency	0.0040	0.0600	0.0224	0.0053	0.0013	2.239**	0.00007263	0.0006321

Note: Z (Sobel test) = a x b/sqrt($a^2SE\_b^2 + b^2SE\_a^2$). **Significant at 5%. MCMAM (Monte Carlo Method for Assessing Mediation) 95% CI = 95% confidence interval on the indirect effect using 20,000 repetitions.

the results in Table 3 (Models 1-4) indicate that TI efficiency fully mediates the relationship between family involvement in management and firm performance (Baron and Kenny, 1986), and thus H2 is supported. Moreover, the results also comply with the required conditions for mediation established by Baron and Kenny (1986): in Table 3, Model 2 represents the first condition; Model 3 responds to the second condition; and Model 4 enables the analysis of both the third and fourth conditions.

Then, Table 4 reports the results of Sobel (1982) test and Monte Carlo confidence intervals (Selig and Preacher, 2008). The z-column includes the statistic of the Sobel test with its significance. The last columns of the table show the bottom and top limits of a 95% confidence interval representative of the indirect effect utilising a Monte Carlo method with 20,000 repetitions. The Sobel test indicates that the mediating effect of TI efficiency is significant ($z = 2.239$, $p < 0.05$). The Monte Carlo Method also shows the significance of the mediating effect, as the 95% confidence interval does not include the value zero.

4.1. Robustness checks

To give robustness to our results, we developed additional checks. First, we used a simplified representation of our independent variable by building a categorical variable operationalized as 1 when one or more members of the owner-family hold posts in the top managerial team of the firm and 0 otherwise (Cruz and Nordqvist, 2012; Sirmon et al., 2008). The results (Table 5) were very similar to those obtained in the main analysis. Second, we conducted a sensitivity analysis by utilizing an alternative firm performance measure, i.e. ROA. The results were also similar but slightly less significant than those obtained for gross margin. Concretely, H1 was supported with the same level of significance, but the H2 was somewhat less significant. Furthermore, we re-estimated the Sobel test and the confidence intervals of Monte Carlo method for both robustness checks, either with the categorical variable of family management and with ROA. The results were comparable to those presented in Table 4, but again slightly less significant when using ROA as the dependent variable. The results of these latest robustness checks can be obtained from the authors.

Table 5. Robustness check results.

	Model 1 (GLS)		Model 2 (GLS)		Model 3 (Tobit)		Model 4 (GLS)	
DV:	**Firm performance**		**Firm performance**		**TI efficiency**		**Firm performance**	
Variable	**Coef.**	**S. Error**	**Coef.**	**S. Error**	**Coef.**	**S. Error**	**Coef.**	**S. Error**
Independent variable/mediator								
Family involvement in management			0.0222***	0.0065	0.1256**	0.0533	0.0104	0.0067
TI efficiency[a]							0.0055***	0.0014
Controls								
Firm age	-0.0324***	0.0072	-0.0317***	0.0072	-0.0613	0.0437	0.0010	0.0085
Firm size	-0.0310**	0.0022	-0.0307**	0.0026	-0.0204*	0.0177	-0.0215*	0.0034
Leverage	-0.1165***	0.0182	-0.1160***	0.0182	0.1420	0.1157	-0.1266***	0.0208
Customer bargaining power	0.0007***	0.0002	0.0007***	0.0002	-0.0031***	0.0010	0.0004**	0.0002
Industry dummies	Yes		Yes		Yes		Yes	
Year dummies	Yes		Yes		Yes		Yes	
Constant	0.4335***	0.0299	0.4183***	0.0309	-0.3398*	0.1851	0.3043***	0.0357
Log likelihood					-1377.858			
R^2: within	0.0134		0.0130				0.0226	
between	0.1831		0.2010				0.1376	
overall	0.1370		0.1489				0.1074	

Note: N = 6,503 observations. [a]TI efficiency has been rescaled by multiplying it by 1,000. ***Significant at 1%, **Significant at 5%, *Significant at 10%.

5. Discussion and conclusions

5.1. Theoretical implications

The primary purpose of this study was to analyse whether family involvement in management influences firm performance directly and indirectly through TI efficiency. We argue and empirically confirm that as family involvement in management increases, the obtained performance outcomes are richer, which is partly explained by the family managers' distinctive ability to achieve greater efficiency in turning innovation inputs into innovation outputs.

Our findings yield several important implications to previous literature. We fill a gap in existing knowledge regarding how family involvement influences firm performance (e.g. Dyer, 2018; Hansen and Block, 2020), by developing a novel mediation model to better understand the intervening mechanisms through which family involvement in management affects performance outcomes. In doing so, we apply RBV theory, which offers an appropriate means for analysing how the distinctive set of intangible resources of family firms (familiness), result in sustained competitive advantages, which lead to enhanced TI efficiency, and in turn, to improved firm performance (Cabrera-Suárez et al., 2001; Habbershon and Williams, 1999). The consideration of TI efficiency as a unique intervening mechanism in the relationship between family involvement in management and firm performance is of utmost importance given that knowing how to improve performance levels is crucial for family firms, as enhanced performance favours value creation (Martínez-Romero et al., 2019) and ensures the long-term survival of this type of firms (Dyer, 2006). Moreover, the inclusion of TI efficiency as a mediating variable allows refining our comprehension concerning the existing inconclusive findings on the family management-firm performance relationship (e.g. Diéguez-Soto et al., 2019b; Gallucci et al., 2015), contributing to open up the black box of performance outcomes within family firms (Pittino et al., 2019). Indeed, to the best of the authors' knowledge, this work is pioneering in identifying family involvement in management as a critical resource to unlock family firms' potential to innovate efficiently, and in examining how TI efficiency impacts on the performance behaviour of such firms. This is particularly noteworthy because, while existing research analysing distinct linkages among family involvement, technological innovation, and firm performance mainly focuses on

conditional (moderating) effects (e.g. Diéguez-Soto et al., 2016; Garcés-Galdeano et al., 2016; Kotlar et al., 2013), research examining mediating effects on the abovementioned relationships is practically non-existent (Calabrò et al., 2019). Furthermore, this manuscript uses a fresh approach in the calculus of TI efficiency, and thus, its incorporation into our model represents a relevant contribution for the following reasons. First, using the number of product innovations as innovation output is more appropriate than utilizing the number of patents or patent citations (Block et al., 2013; Liu et al., 2017; Lodh et al., 2014), because patents can underestimate the firms' ability to innovative, inasmuch as many businesses do not usually apply for patents due to, among other motives, their inability to cope with the expense and long time involved in the patenting process (Kalantaridis and Pheby, 1999). Second, by using the ratio of number of product innovations to R&D expenditure, we surpass both, a research stream that measures TI efficiency by considering innovation inputs and innovation outputs in distinct models (e.g. Matzler et al., 2015), and a research stream that assesses such efficiency as the effect of innovation inputs on innovation outputs by means of regression models (e.g. Manzaneque et al., 2020).

This study also offers new insights into the debate on the antecedents of TI efficiency in family firms (Duran et al., 2016). We show that family involvement in management is an important precondition that enables family firms to fully exploit their familiness, which is beneficial for the development of the ability to efficiently transform innovation inputs into innovation outputs. Through this, we go beyond previous literature (Duran et al., 2016; Lodh et al., 2014), by revealing that nurturing such distinctive ability for achieving greater TI efficiency, requires not only the presence of a family CEO within the top management team, but also the active involvement of other family members.

Moreover, this manuscript responds to the call for more investigation on the impact of TI efficiency on firm performance in family firms (Martínez-Alonso et al., 2020). Whereas most studies have primarily focused on merely linking different innovation forms to performance outcomes (e.g. Craig et al., 2014; Diéguez-Soto et al., 2016; Spriggs et al., 2013), we build upon the notion of Cruz-Cázares et al. (2013) considering that the efficiency with which technological innovation is undertaken is the key to increasing firm performance and we translate this insight to the family firm domain. Thereby, we expand on the innovation-performance relationship by providing empirical evidence that whether

family firms want to become competitive and, thus, improve their performance outcomes, besides developing and combining different R&D strategies (Diéguez-Soto et al., 2019b; Muñoz-Bullón et al., 2019), they must also be very efficient in turning innovation inputs into innovation outputs.

Additionally, this work has certain implications for research on family business heterogeneity (Chua et al., 2012). Prior studies have confirmed that both family involvement in ownership and in management are primary sources of family firm heterogeneity, as they can differently influence family goals, resources, and behaviours (Daspit et al., 2018; Melin and Nordqvist, 2007). We extend these arguments by suggesting that those family firms with a greater number of family members actively involved in the firm management are able to obtain superior firm performance. This consideration is very valuable to the extent that overcomes the limitations of previous studies, which have not taken into account such family firm heterogeneity, and have identified the family influence by using dichotomous variables that leave out many characteristics of the family essence (Kotlar et al., 2014b; Sirmon et al., 2008).

5.2. Practical implications

Our article offers some practical implications, which provide knowledge that is extensively applicable by both managers and practitioners. First, in the light of the obtained findings, it seems more than evident that family firms with family involvement in management should emphasize their unique bundle of resources (e.g. Habbershon and Williams, 1999) to enhance their performance outcomes. Therefore, family managed firms should implement efficient organizational routines and normative frameworks involving all firm members, such as teamwork (Cohen and Bailey, 1997), information sharing across functions and firm departments (Zahra et al., 2004), and coordination and collaboration programs (Gunday et al., 2011). In this regard, family managers should provide incentives and mindsets that facilitate firm members to assimilate and transform tacit knowledge into explicit knowledge (Un and Asakawa, 2015), to be spread along the whole organization. Likewise, family managers should ensure the commitment of all firm members (Cassia et al., 2012), both family and non-family, toward the business outcomes, through, for example the care of their firm members' satisfaction and motivation and the

equal treatment to all firm members regardless of whether they belong to the business family or not.

On the other hand, our findings reveal how performance outcomes can be accentuated through the achievement of higher TI efficiency in family firms with family members in their top management teams. Thereby, to enhance firm performance through TI efficiency, family managers have to encourage the development of an innovative culture and mentality within the business to fully promote the generation of new ideas and exploit the innovation potential (Matzler et al., 2015). Furthermore, family managers should not be forced to invest heavily in R&D, instead, they should make the most of their limited innovation resources, because it does not matter how much they invest, but what they get from such investments (Cruz-Cázares et al., 2013). In other words, innovation outcomes are achievable without the requirement of large innovative investments (Fuetsch and Suess-Reyes, 2017). Additionally, the development of greater interactions between family managers and strategic planning processes may also improve family managers' innovative ability, by enriching their understanding for their strategies, goals and behaviour (Hsu and Chang, 2011), which in turn, would benefit the increase of firm performance (Fuetsch and Suess-Reyes, 2017). Moreover, in those cases in which family managers do not have the likelihood to promote their innovative ability in the short run, they should centre on strategic planning in an attempt to ameliorate their firms' competitiveness (Eddleston et al., 2008).

Finally, policymakers and public authorities can also contribute to the improvement of family managed firms' outcomes through the promotion of specific initiatives and innovation plans that boost TI efficiency, inasmuch as these policies entails positive externalities for society (Antolín-López et al., 2015). Specific efforts may include but not limited to initiatives such as fiscal incentives for innovation investments and subsidies for acquiring innovative infrastructures, which allows the obtaining of higher innovation outputs given a certain amount of innovation inputs (Matzler et al., 2015), in order to sustain a virtuous circle of innovation that enhances firms' innovation success (Greco et al., 2017). Besides, policymakers should give support to family managed firms for obtaining information regarding market needs and trends, to guide them in the innovation strategic planning.

5.3. Limitations and future research avenues

The present study is not without limitations. Nevertheless, these limitations bring with them new opportunities to initiate future research. First, although this paper only focuses on the Spanish manufacturing industry, which is particularly well suited to the research aim, it may further limit the possibility of generalizing our findings. Future studies should be conducted in countries other than Spain to augment the external validity of our results, especially in high-technology regions or industries. Second, our results can be expanded by using some qualitative research methods, such as multiple cases (e.g. De Massis et al., 2015) or direct interviews with firm members (e.g. Kammerlander and Ganter, 2015). The richness of these alternative methods would favour a better comprehension of the mediating effect of TI efficiency on the family management-firm performance relationship. Third, limitations in our database have made it impossible to control for other key variables, such as the level of family ownership, the generation in charge or the existence of family governance practices. For example, since the top management team of a family firm typically includes family members from multiple generations with contrasting goals and views (Pittino et al., 2019), it would be particularly interesting to examine whether and how such generational diversity in family firms' management affects TI efficiency in achieving performance outcomes. Furthermore, given that innovation is a complex multidimensional process and that family influence may create disadvantages in some areas of innovation and advantages in others (Bammens et al., 2015), it would also be of great value to analyse the extent to which TI efficiency, assessed in terms of different innovation inputs (e.g. R&D personnel or external networks), and innovation outputs (e.g. process or services innovations), might affect firm performance. Likewise, future work may explore the indirect incidence of TI efficiency on multifaceted measures of firm performance embracing not only financial but also non-financial indicators (Yeniaras et al., 2017*)*. Finally, understanding how and why some environmental factors, such as industry volatility, munificence, complexity or technology level, may influence TI efficiency, and thus impact on firms' performance outcomes, can be a fruitful research topic.

In conclusion, our paper advances the research stream concerned with the family effect on organizational outcomes. Utilizing insights from the RBV, this study refines our knowledge regarding the influence of family involvement in management on firm

performance by integrating this relationship into a novel mediation model that includes an intervening mechanism, TI efficiency, which up to now remains almost unexplored. The results reveal that TI efficiency is of crucial importance to achieve richer performance outcomes in those family firms with an active participation of family members in the firm management. With solid theoretical foundations supporting that TI efficiency is able to explain why some family firms perform better than their competitors and with specific managerial implications of the processes that family firms can undertake to improve their performance outcomes through TI efficiency, the model shown in this study enhances our understanding of the singular but critical topic of performance in family firms.

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FAMILY MANAGEMENT AND FIRM PERFORMANCE – THE INTERACTION EFFECT OF TECHNOLOGICAL INNOVATION EFFICIENCY

Abstract

Understanding the relationship between family management and firm performance has emerged as one of the most prominent issues for both scholars and professionals in the family firm research field. This chapter aims to shed light on this theme by analysing how family members in top management teams (TMT) impact on firm performance. Moreover, this chapter adds the effect of an interaction factor that has become essential for the improvement of firms' competitiveness: technological innovation efficiency. By conducting a panel data analysis on 1154 observations of private manufacturing firms over the period 2010–2015, the findings reveal a negative impact of family members in TMT on firm performance. The empirical analysis also reveals that technological innovation efficiency weakens the negative effect of family presence in TMT on firm performance.

Keywords: family management, firm performance, technological innovation efficiency, upper echelon, socioemotional wealth.

1. Introduction

Firm performance is essential to guarantee firm success and survival (Diéguez-Soto, López-Delgado, & Rojo-Ramírez, 2015; Martínez-Romero, 2018). However, and notwithstanding the importance of family firms worldwide (Family Firm Institute, 2018; La Porta, Lopez-De-Silanes, & Shleifer, 1999; Zellweger, 2017), the existing research regarding the influence of family firms' characteristics on firm performance is far from offering conclusive results (Basco, 2013; De Massis, Kotlar, Campopiano, & Cassia, 2015; López-Delgado & Diéguez-Soto, 2015).

Recent studies have focused on how family involvement in management impacts on firm performance (Diéguez-Soto, Manzaneque, González-García, & Galache-Laza, 2018; Sciascia, Mazzola, & Kellermanns, 2014). Family managers, and specifically family members in top management teams (hereafter TMT), as the dominant coalition in family firms (Chrisman, Chua, Pearson, & Barnett, 2012; Chua, Chrisman, & Sharma, 1999), are in charge of strategic decision-making, having a determining influence on performance outcomes.

The impact of family TMT members on performance outcomes could be justified in the light of both the upper echelon (Hambrick & Mason, 1984) and the socioemotional wealth (Gómez-Mejia, Haynes, Núñez Nickel, Jacobson, & Moyano Fuentes, 2007) theories. On the one hand, the upper echelon theory states that TMT members' behaviour and characteristics are important influential factors of performance outcomes (Certo, Lester, Dalton, & Dalton, 2006; Kor, 2006). On the other hand, it is widely accepted that family TMT members take strategic decisions considering not only financial objectives but also noneconomic goals (Astrachan & Jaskiewicz, 2008; Martínez-Romero & Rojo-Ramírez, 2017; Zellweger & Astrachan, 2008), influencing their firms' performance.

Despite the existing studies analysing the direct impact of family management on performance outcomes (Sciascia & Mazzola, 2008; Sciascia et al., 2014), there is scarce previous literature using the number of family TMT members to measure family management. Moreover, there is also a lack of prior research analyzing specific factors that moderate the relationship between family TMT members and firm performance in private firms. Therefore, in an attempt to deepen in such relationships, this chapter

introduces a continuous variable to measure family management and a moderating factor which may well be helpful to explain the current findings. Specifically, the effect of technological innovation efficiency (hereafter TI efficiency) was included as an additional element that may influence the impact of family TMT members on firm performance. Our contention is that family firm research should essentially consider another factor, namely TI efficiency, that may encourage family managers to motivates them to start changes in the way the strategic innovation process is developed, with the final goal of enhancing performance outcomes.

Thereby, this chapter addresses a twofold research question. First, how family TMT members influence performance in the context of private firms? Second, does TI efficiency moderate the expected relationship between family TMT members and firm performance? To answer these questions, an empirical analysis is developed utilizing a longitudinal dataset comprising 1154 observations of Spanish manufacturing firms over the period 2010-2015. Spain is a really interesting context for analysing the effect of family TMT members on firm performance, because the family presence in the TMT of Spanish firms is around 70%, meanwhile in 51.6% of Spanish family firms, all TMT members belong to the family (IEF & Red de Cátedras de Empresa Familiar, 2015, 2018).

This chapter offers relevant contributions to the literature. First, we answer the call for further research on the family management-performance relationship in the context of private firms (Sciascia et al., 2014; Zattoni, Gnan, & Huse, 2015). Specifically, we investigate the influence of family TMT members on performance outcomes (Ling & Kellermanns, 2010). At this respect, we go beyond previous research which has mainly used a binary measure of family involvement in management (e.g. Diéguez-Soto, Garrido-Moreno, & Manzaneque, 2018; Rojo-Ramírez & Martínez-Romero, 2018), and employ a continuous variable to report the family presence in TMT, counting the number of family members in top management positions. This is of utmost interest because allows to disclose heterogeneity among family firms. Second, we surpass the conceptual frame that analyses the direct effect of family involvement in management on firm performance and we introduce TI efficiency as a moderator of the abovementioned relationship. In such a way, we investigate how family presence in TMT interacts with TI efficiency in influencing firm performance. Notwithstanding prior research has examined different factors (Diéguez-Soto et al., 2018b; Kellermanns et al., 2012) that may influence the

family presence in TMT on firm performance, to the best of the authors' knowledge, no research has analysed when and under what conditions TI efficiency influences such relationship.

The chapter is structured as follows. The second section introduces the theoretical foundations and hypotheses development. Data and methodology are depicted in section three, meanwhile section four exhibits empirical results. Finally, the discussion of our findings, the limitations and future research and the conclusions are exposed.

2. Theoretical foundations

2.1. Family presence in top management team and firm performance

There is no doubt that family firms present peculiar features conditioning their performance outcomes (Arosa, Iturralde, & Maseda, 2010; Arrondo-García, Fernández-Méndez, & Menéndez-Requejo, 2016), due to the intermeshing of the family and the business (Berrone, Cruz, & Gómez-Mejia, 2012; Berrone, Cruz, Gómez-Mejia, & Larraza-Kintana, 2010; Zellweger, 2017). As family involvement in the firm increases, so does the overlap between the family and the business (Le Breton-Miller, Miller, & Lester, 2011).

Specifically, family presence in management is an important conditioning of firm performance (Diéguez-Soto et al., 2018b), inasmuch as it is an expression of the family ability to influence the firm's outcomes (De Massis, Kotlar, Chua, & Chrisman, 2014).

Nevertheless, despite the great deal of attention that the relationship between family involvement (in management) and firm performance has received, results are far for being conclusive (Basco, 2013; De Massis et al., 2015; Sciascia et al., 2014). Most of the existing research has focused on large (e.g. Dyer Jr, 2006; Kammerlander et al., 2015) and public (e.g. Diéguez-Soto et al., 2018b) companies. However, prior studies do not assure that results found for public firms could hold for private businesses (Martínez-Romero, Martínez-Alonso, & Casado-Belmonte, 2018; Miller, Le Breton-Miller, Lester, & Cannella, 2007). Among those studies analyzing the family management-firm performance relationship in private firms, the existing results reveal both a positive

influence (e.g. Gallucci, Santulli, & Calabrò, 2015) and a negative influence (e.g. Sciascia & Mazzola, 2008) of family managers on firms' outcomes.

In any case, what is clear is that family members present in the firm management, and namely in the TMT, belong to the dominant coalition of the firm and thus exert significant influence on organizational outcomes (Hambrick & Mason, 1984). Family managers have been demonstrated to be the most important decision-makers within the context of family firms (Vandekerkhof, Steijvers, Hendriks, & Voordeckers, 2015). In this vein, the upper echelon theory states that TMT members' experiences, attitudes and beliefs drive strategic decision-making (Cyert & March, 1963; Hambrick & Mason, 1984). Namely, the beliefs, values and goals of TMT members will influence the implementation of strategies and consequently, the firms' outcomes.

Moreover, in a family firm context, family's presence in the TMT lead to peculiar performance outcomes due to the overlapping of economic and noneconomic goals, which rises as a primary driver in guiding family firms' strategic choices (Gómez-Mejia et al., 2007). Specifically, family managers normally overweigh emotional considerations over purely financial objectives (Vandekerkhof et al., 2015; Zellweger, Kellermanns, Chrisman, & Chua, 2011). Thus, decision-making within family managed firms is highly influenced by noneconomic objectives, captured by SEW, which may conduct family managers toward the fulfilment of affective needs, rather than acting under effectiveness principles (Martínez-Romero & Rojo-Ramírez, 2017).

Accordingly, gains or losses in SEW become the pivotal frame of reference that family firms use to make strategic decisions (Berrone et al., 2012; Gómez-Mejia et al., 2007; Martínez-Romero & Rojo-Ramírez, 2016), and family managers would avoid strategic choices that are perceived as threats to their SEW. For example, family managers are reluctant to allow new members from outside the family to take control over strategic decisions as this involves losing control of their firms (Gómez-Mejia et al., 2007; Gómez-Mejia, Makri, & Kintana, 2010). Therefore, even though collaboration networks and relationships with external stakeholders might well be associated with improved performance (De Massis, Kotlar, Campopiano, & Cassia, 2013; Sorenson, 1999), family managers perceive these strategies as a loss of control over their firms and as a cession of discretionary power over outsiders. These concerns may hinder collaborative

relationships with external partners (De Massis, Frattini, & Lichtenthaler, 2013; Manzaneque, Rojo-Ramírez, Diéguez-Soto, & Martínez-Romero, 2018), limiting the possibilities of obtaining performance outcomes.

Moreover, family managers' desire to maintain their SEW might lead to a lack of professionalism in the firm, inasmuch as firm managers may be selected based on nepotism or altruism rather than on meritocracy principles (Llach & Nordqvist, 2010; Poutziouris, 2001). Problems related to self-control and altruism result in higher agency costs (Schulze, Lubatkin, Dino, & Buchholtz, 2001) while also increase the difficulty of monitoring the firm performance (Dyer Jr, 2006). That is, whether nepotism is the accepted norm, incompetent family members might be placed in key management positions, thus jeopardizing firm performance (Manzaneque, Diéguez-Soto, & Garrido-Moreno, 2018a).

Therefore, family managers in order to maintain the control of their firms and namely, to preserve their SEW, may act under nonpurely financial ideals (Martínez-Romero et al., 2018; Martínez-Romero & Rojo-Ramírez, 2017), prioritazing family over economic goals (Chrisman et al., 2012; Martínez-Romero et al., 2018; Rojo-Ramírez & Martínez-Romero, 2018). Furthermore, as the number of family members in management increases, noneconomic goals acquire greater relevance over economic objectives. Thus, our first hypothesis is:

Hypothesis 1: A higher presence of family members in the firm TMT exerts a negative influence on firm performance.

2.2. The moderating influence of technological innovation efficiency

We have previously hypothesized that firms with higher family presence in TMT are likely to diminish their performance outcomes. Herein, we argue that this relationship might be moderated by TI efficiency.

Prior research reveals that TI efficiency is a fundamental factor in the obtaining of superior incomes (Wang, 2007) and in the improvement of firms' competitiveness (Gao & Chou, 2015). TI efficiency is defined as the relative capability of a firm to achieve TI outputs given a certain quantity of TI inputs (Cruz-Cázares, Bayona-Sáez, & García-

Marco, 2013; Manzaneque et al., 2018b). Furthermore, Cruz-Cázares et al. (2013) showed that in a complex and long-term innovation process, the efficiency with which innovation inputs are converted into innovation outputs is the key to increase firm performance.

Family management is often related with a long-term perspective due to the overlap between the family and the business. In this vein, authors agree that innovation is a necessary condition for family firms' continuity (Kellermanns et al., 2012; Martínez-Alonso, Martínez-Romero, & Rojo-Ramírez, 2018). Accordingly, by refining the management of innovation resources and capabilities, family managed firms may be able to increase the probability of sustainability and survival in the long-term (Revilla, Perez-Luno, & Nieto, 2016; Yu, Lumpkin, Sorenson, & Brigham, 2011). Moreover, although family involvement in TMT is seen as a specific governance structure (Diéguez-Soto et al., 2018a) that enables the possesion of unique characteristics such as long-standing relationships (Patel & Fiet, 2011), social capital (Arregle, Hitt, Sirmon, & Very, 2007) or tacit knowledge (Llach & Nordqvist, 2010), it does not appear to be a sufficient condition for the achievement of competitive advantages and the enhacement of firm performance (Dyer Jr, 2006; Wagner, Block, Miller, Schwens, & Xi, 2015). At this respect, a higher efficiency in the conversion of innovation inputs into innovation outputs (Duran et al., 2016), may help family managed firms to reinforce their unique systemic conditions, contributing to the development of idiosyncratic resources and dynamic capabilities (Sirmon, Hitt, & Ireland, 2007; Teece, Pisano, & Shuen, 1997). Specifically, these characteristics may be fully developed by being the best at orchestrating resources (Chirico, Sirmon, Sciascia, & Mazzola, 2011), because the simple possesion of innovation resources is not enough to achieve superior firm performance (Sirmon & Hitt, 2003).

Hence, a more efficient management of innovation resources would enable family managers to attract external stakeholders, including other family managed firms (Miller & Le Breton-Miller, 2005). Greater TI efficiency derived from the consolidation of these relationships (Diéguez-Soto et al., 2018a), allows family managers to further develop their social capital (Schulze & Gedajlovic, 2010). These external groups are usually aware of the innovative potential of family managed firms and therefore, they are eager to establish long-standing and prosperous relationships with them (Miller & Le Breton-

Miller, 2005). Accordingly, the establishment of these relationships could lead to the development of open innovation projects (Feranita, Kotlar, & De Massis, 2017) and more precisely R&D collaborations (Grimpe & Kaiser, 2010), which might increase TI efficiency, and thus, can help family managed firms to improve their firm performance (Carney, 2005).

Moreover, these external partners are aware of the family firms' desire to preserve their SEW in the long-term (Martínez-Romero et al., 2018), as well as their concern to protect and maintain the family firm reputation and identity (Deephouse & Jaskiewicz, 2013), given the closeness these firms show to the environment in which they operate (Berrone et al., 2010). As a consequence, whether family managers do not perceive a threat over their SEW and over their firm control, and, more importantly, whether their noneconomic goals are not surpassed by economic ones, they would be willing to accept the establishment of such collaborative innovation ties (Feranita et al., 2017). These innovation networks, will increase the R&D critical mass augmenting the possibilities of obtaining innovation outcomes, and thus, TI efficiency (Galende Del Canto & Suárez González, 1999; Kancs & Siliverstovs, 2016). Therefore, increased TI efficiency will enable family managers to take full advantage of this privileged knowledge derived of the relationships with selected stakeholders and then, enhance firm performance (Matzler, Veider, Hautz, & Stadler, 2015).

It is known that better communication, decision-making processes or tacit knowledgede may increase TI efficiency in family managed firms. Yet, some family managed firms could be able to create a virtuous circle in such a way that TI efficiency may enhance the business-oriented, friendly, sincere and close relationships inside the firm (Gómez-Mejia et al., 2007). In this vein, TI efficiency may permit a more fluid communication among family managed firms' members (Diéguez-Soto et al., 2018a), an improved decision-making quality (Vandekerkhof, Steijvers, Hendriks, & Voordeckers, 2018) and also the transmission of valuable ideas across different departments (Bammens, Notelaers, & Van Gils, 2015). This strong feeling of mutual trust between family managers, due to the increased TI efficiency, positively contributes to a wider dissemination of tacit knowledge throughout the firm (Nieto, Santamaría, & Fernández, 2015). The possesion of this unique and non-transferable knowledge (Duran et al., 2016), will enable family managers to reinforce the commitment and identification with their

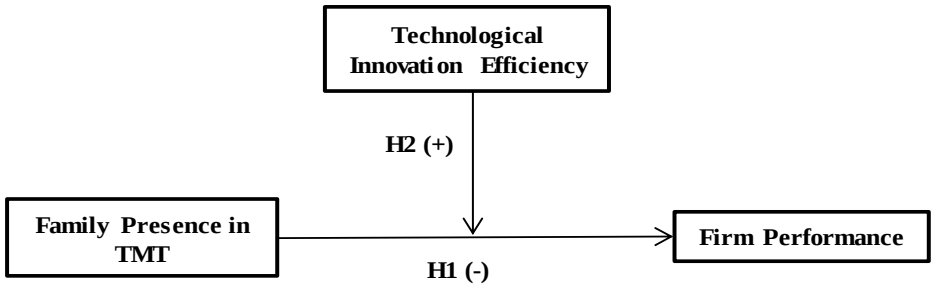
firms (Chrisman et al., 2012; Pazzaglia, Mengoli, & Sapienza, 2013) and consequently, improve their performance outcomes. That is, TI efficiency will reinforce the abovementioned family managed firms' distinctive characteristics, unlocking their performance potential.

Based on the foregoing discussion, we state that TI efficiency may weaken the negative influence of family TMT members on firm performance, inasmuch as it contributes to align economic and noneconomic goals improving firms' outcomes. Therefore, our second hypothesis is:

Hypothesis 2: Technological innovation efficiency weakens the negative influence of family presence in TMT on firm performance.

The theoretical model and the proposed hypotheses are presented in Figure 1.

Figure 1. Theoretical model and hypotheses



3. Research method

3.1. Sample and data sources

In order to check our hypotheses, we employed the Survey on Business Strategies (ESEE). Specifically, we analysed the 2010-2015 period. The ESEE is administrated by the State Partnership of Manufacturing Equity (SEPI) foundation on behalf of the Spanish Ministry of Industry and consists of manufacturing firms. The survey is designed following both exhaustive and random sampling criteria, guaranteeing the representativeness of the population and the validity of the contents. Particularly, the data include the whole population of Spanish manufacturing businesses with 200 or more

employees, and a stratified random sample of 5% of the population of firms with at least 10, but fewer than 200 employees. The survey, which has been conducted year by year since 1990, encompasses unbalanced data covering 1,800 firms on average per year. After removing businesses with incomplete data for the analysed variables, we adopted a matched-pair research design (see among others Allouche, Amann, Jaussaud, & Kurashina, 2008) through which each firm that achieves TI efficiency was matched with another one without TI efficiency. This approach is based on two potential factors, firm size (ln of total assets) and industry (three-digit SIC code). The matching was conducted for each year (see Table 1 for the distribution of pairs by year). The final sample comprises 1154 observations of private manufacturing firms (577 with TI efficiency and 577 without TI efficiency). Table 1 provides a more detailed view of the sample.

Table 1. Sample characteristics

Number of firms per year		
Year	Firms in the population	Matched sample
2010	5040	200
2011	5040	190
2012	5304	198
2013	5304	202
2014	5566	192
2015	5566	172
Sample composition by size	N	%
Large-size firms	601	0.521
Medium-size firms	374	0.324
Small-size firms	179	0.155
Total	1154	100
Sample composition by industry		
Industry	N	%
Meat industry	40	0.035
Foodstuffs and snuff	174	0.151
Drinks	16	0.014
Textiles and clothing	64	0.055
Leather and footwear	12	0.010
Timber industry	12	0.010
Paper Industry	4	0.003
Chemical and pharmaceutical products	228	0.198
Rubber and plastic	42	0.036
Non-metallic mineral products	48	0.042
Ferrous and non-ferrous metals	18	0.016
Metal products	34	0.029
Agricultural and industrial machinery	172	0.149

Computer, electronic and optical products	48	0.042
Electrical machinery and material	88	0.076
Motor vehicles	84	0.073
Other transport equipment	34	0.029
Furniture industry	36	0.031
Total	1154	100

3.2. Variables

Dependent Variable. In this chapter, firm performance is measured by the return on assets ratio (earnings before interest and tax to total assets), which is commonly used in the family business field (e.g. Anderson & Reeb, 2003) and particularly when studying innovation in family businesses (e.g. Diéguez-Soto et al., 2018b).

Independent Variable. Family presence in management is the independent variable. In line with the study of Kotlar et al. (2014), we contemplate both family ownership and family involvement in TMT as factors that affect decision-making in family businesses. Accordingly, we define family presence in management as a continuous variable counting the number of family members in the firm's TMT (Kotlar, De Massis, Frattini, Bianchi, & Fang, 2013; Manzaneque et al., 2018b).

Moderating variable. We employ TI efficiency as a moderating variable. Following Cruz-Cázares et al. (2013), who consider that an optimal measure of TI efficiency should include both, innovation input and innovation output, we use R&D expenses as innovation input (Qiao & Fung, 2016) and the number of product innovations as innovation output (Cruz-Cázares et al., 2013). Therefore, TI efficiency is measured by the ratio of number of product innovations over R&D expenses.

Control Variables. In order to rule out possible alternative explanations to that formally hypothesized, we include several control variables that might affect firm performance. Due to firm capabilities are formed through experience acquired over time (Cruz-Cázares et al., 2013), we control by firm age, measured as the number of years between the firm's foundation and the observation year (Martínez-Romero & Rojo-Ramírez, 2017). Since large firms have advantages in comparison with small firms in terms of financial and economic resources or internal knowledge (Cohen & Klepper, 1996), which are expected to increase both TI efficiency and firm performance, we controlled for firm size measured as the log annual of total assets (Kotlar et al., 2013).

Moreover, due to firms with greater financial resources are able to achieve greater firm performance, leverage is measured as debt to total assets ratio (Block, 2012). We also measure the geographical localization by adding a group of dummy variables to control for the territorial specificities or context conditions (Camagni & Capello, 2013). These control variables also allow us to capture the effect of geographical opportunities to improve firm performance and to develop innovation (Diéguez-Soto et al., 2018b). Specifically, we include dummy variables representative of seven Spanish territorial subdivisions (NUTS1, Nomenclature des Unités Territoriales Statistiques)2. Finally, eighteen dummy variables referring to specific sub-industries were included in all models.

3.3. Methods

Given that our main goal is to analyse both, the influence of family TMT members on firm performance and the moderating effect of TI efficiency in the abovementioned relationship, we estimate different models based on the following equation:

$$\begin{aligned} Firm\ Performance \\ &= \beta_0 + \beta_1 Family\ management + \beta_2 Technological\ innovation\ efficiency \\ &+ \beta_3 Family\ management * Technological\ innovation\ efficiency \\ &+ \beta_4 Firm\ age + \beta_5 Firm\ size + \beta_6 Leverage + \beta_7 Territorial\ subdivisions \\ &+ \beta_8 Sub - industries + \varepsilon \end{aligned}$$

We use a panel data methodology, which allows us to control for individual heterogeneity or unobservable individual effects. Commonly, it is required to distinguish fixed effect from random effect in panel data, normally using Hausman test. However, in our case fixed effect estimation is not appropriate given the time invariant nature of the industry affiliation and territorial subdivisions dummies (Diéguez-Soto & Lopez-Delgado, 2018; González, Guzmán, Pombo, & Trujillo, 2013). Consequently, to test our hypotheses we use robust and two-stage least squares regression with random effects controlling by heteroscedasticity.

[2] Regions in the European Union-NUTS 2013/EU-28. Eurostat: http://ec.europa.eu/eurostat/web/nuts/overview [Accessed 10th of October of 2018]. The subdivisions are (1) Northwest, (2) Northeastern, (3) Madrid (4) Center, (5) East, (6) South, and (7) Canarias.

4. Results

Means, other descriptive statistics for continuous variables and frequencies for categorical variables are reported in Panel A, Table 2.

The correlation matrix is presented in Panel B, Table 2. Multicollinearity should not be a concern in our study as we found only moderate levels of correlation between our variables. Besides, we analysed the variance inflation factors (VIF) and observed that all values were lower than 1.13, being below the suggested warning level proposed in prior research (Hair, Anderson, Tatham, & Black, 1999). Thus, there is enough evidence to rule out multicollinearity in the data.

Table 2. Descriptive statistics and correlation matrix

Panel A. Descriptive statistics					
Continuous variables					
	Mean	Median	25%	75%	Std. Dev.
ROA	0.094	0.078	0.034	0.137	0.112
Firm Age	3.485	3.583	3.135	3.891	0.633
Firm Size	17.689	17.615	16.612	18.660	1.638
Leverage	0.497	0.492	0.339	0.664	0.214
Family Management	0.605	0.000	0.000	1.000	1.026
Technological innovation efficiency	3.22e-05	1.97e-08	0.000	4.80e-06	3.95e-04
Categorical variables					
Geographical localization	N	%			
Northwest	136	11.80%			
Northeastern	188	16.29%			
Madrid	71	6.18%			
Center	175	15.17%			
East	480	41.57%			
South	91	7.87%			
Canarias	13	1.12%			
Panel B. Correlation matrix					
	1	2	3	4	5
1. ROA					
2. Firm Age	-0.042				
3. Firm Size	-0.035	0.102***			
4. Leverage	-0.108***	-0.076***	0.209***		
5. Family management	-0.043*	-0.076***	-0.241***	-0.055**	
6. Technological innovation efficiency	-0.060*	0.003	-0.079**	-0.018	-0.012

N (observations) = 1154; *** Significant at 1%, **Significant at 5%, *Significant at 10%.

Table 3 shows the regressions results. Model 1 is the baseline model and includes only control variables. Model 2 is a variant of model 1 in which we add the variable

family presence in TMT. The coefficient of family presence in management is negative and significant in explaining the firm performance (β = -0.004; p<0.1), supporting our first hypothesis.

The variable TI efficiency is then introduced in Model 3. The results show that the coefficient of TI efficiency is non-significant. However, the direct effect of the moderator is not substantial for testing the moderating hypothesis (Baron & Kenny, 1986); on the contrary, whether the moderator is uncorrelated with the dependent variable, the interpretation of the interaction term is easier (Michiels, Voordeckers, Lybaert, & Steijvers, 2014). Further, what we want to examine is, when and to what extent TI efficiency through long-standing relationships, tacit knowledge and social capital lead family managed firms to the improvement of their performance outcomes. TI efficiency is thus expected to indirectly affect the relationship between family presence in TMT and firm performance.

Hence, to capture this potential moderating impact of TI efficiency on the family presence in TMT-firm performance relationship, Model 4 includes the interaction effect Family management*TI efficiency, which is positive and statistically significant (β = 84.989; p<0.1). Therefore, our results provide support for our second hypothesis.

Table 3. Random effects regressions

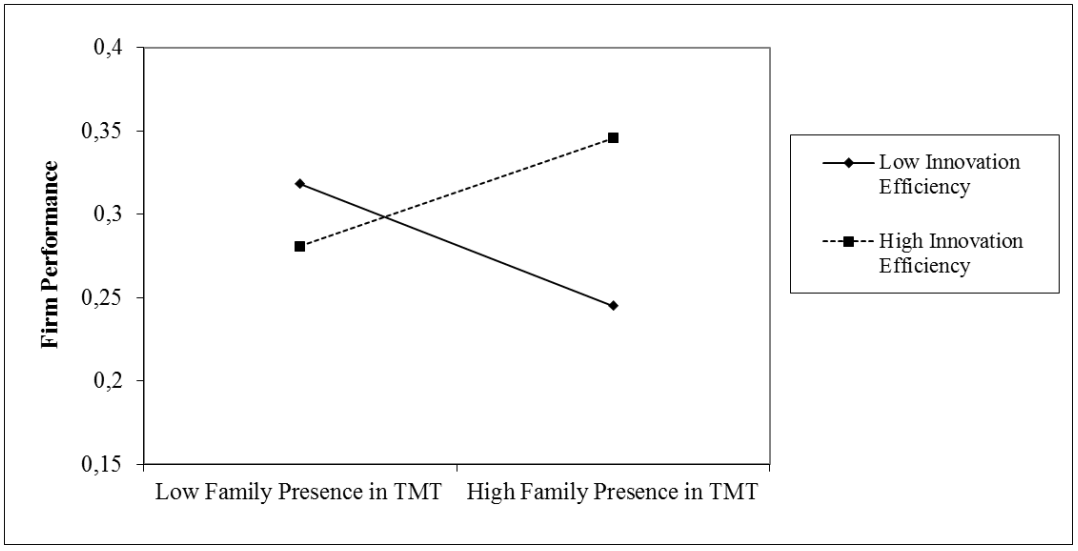
Dependent Variable	Firm performance (ROA)			
	Model 1	Model 2	Model 3	Model 4
Main effect				
Family Management (β1)		**-0.004* (0.003)**	-0.004 (0.004)	-0.005 (0.004)
Moderator				
Technological innovation efficiency (β2)			-8.888 (2.227)	-11.543 (1.494)
Interaction effect				
Family management *x* Technological innovation efficiency (β3)				**84.989* (47.310)**
Controls				
Firm Age (β4)	-0.007 (0.010)	-0.007 (0.010)	-0.006 (0.010)	-0.013 (0.011)
Firm Size (β5)	**-0.007* (0.004)**	**-0.008* (0.004)**	-0.007 (0.004)	-0.004 (0.004)
Leverage (β6)	**-0.096*** (0.029)**	**-0.096*** (0.029)**	**-0.070*** (0.025)**	**-0.074*** (0.025)**
Territorial subdivisions	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Constant	**0.323*** (0.104)**	**0.336*** (0.106)**	**0.321*** (0.105)**	**0.299*** (0.099)**
Number of observations	1154	1154	1154	1154

Hausman Test				
Wald's X^2	69.99***(29)	71.64***(30)	67.78***(29)	196.88***(34)
R^2				
Within	0.0269	0.0263	0.0066	0.0306
Between	0.1412	0.1459	0.1472	0.1528
Overall	0.0762	0.0787	0.1000	0.1071

Note.
(1) Standard deviations are in parentheses; significant coefficients are in bold.
***Significant at 1%, **Significant at 5%, *Significant at 10%.

Figure 2 shows a plot of this interaction effect with a positive slope for family presence in TMT and firm performance when TI efficiency is high, and a negative slope for family presence in TMT and firm performance when TI efficiency is low. These results further confirm H2.

Figure 2. Interaction effect of TI efficiency on the relationship between family presence in TMT and firm performance



4.1. Robustness test

To strengthen the obtained findings, we developed an additional robustness control on the interaction effect of TI efficiency, using an alternative measure of this moderating variable. Thus, in this case, TI efficiency is calculated by the ratio of number of product innovations, over R&D intensity. R&D intensity has been commonly utilized in prior literature (e.g. Manzaneque et al., 2018a) as an innovation input in the measurement of TI efficiency.

Table 4 shows that the robustness test results are very similar to those obtained in previous analyses (Table 3), thus reinforcing our empirical findings. Model 6 reveals that the interaction effect of Family management*TI efficiency exerts a positive and significant impact (β=7.68e-06; p<0.1) on firm performance.

In short, this check enables us to guarantee the consistency of our results.

5. Discussion

Investigating how family presence in TMT influences firm performance has become an important topic in management research (e.g. Block, Jaskiewicz, & Miller, 2011; Manzaneque et al., 2018b). Prior literature has shown that family managed firms often prioritize noneconomic goals over economic ones (Gómez-Mejia et al., 2007; 2010), creating a unique context that affects decision making and strategy implementation and ultimately, the achieved performance (Martínez-Romero et al., 2018; Rojo-Ramírez & Martínez-Romero, 2018). However, as previously stated, the existing results regarding the effect of family presence in TMT on firm performance are far for being conclusive (Vandekerkhof et al., 2018). At this respect, it is important to highlight that we found a lack of prior studies investigating firms' factors that may have an indirect impact on the family involvement-performance relationship. This is why we introduce a moderating factor, i.e. TI efficiency, which might well be helpful to explain the controversial results.

Table 4. Robustness test

Dependent Variable	Firm performance (ROA)	
	Model 5	Model 6
Main effect		
Family Management (β1)	-0.004 (0.004)	-0.006 (0.004)
Moderator		
Technological innovation efficiency (β2)	-4.18e-07 (2.59e-07)	-5.42e-07 (1.94e-07)
Interaction effect		
Family management *x* Technological innovation efficiency (β3)		**7.68e-06* (4.32e-06)**
Controls		
Firm Age (β4)	-0.006 (0.010)	-0.011 (0.011)
Firm Size (β5)	-0.006 (0.004)	**-0.007* (0.004)**
Leverage (β6)	**-0.070*** (0.025)**	**-0.070*** (0.024)**
Territorial subdivisions	Yes	Yes
Industry dummies	Yes	Yes
Constant	**0.319*** (0.105)**	**0.340*** (0.107)**
Number of observations	1154	1154

Hausman Test		
Wald's X^2	58.36*** (29)	88.35*** (34)
R^2		
Within	0.0064	0.0323
Between	0.1449	0.1519
Overall	0.0981	0.1106

Note.
(1) Standard deviations are in parentheses; significant coefficients are in bold.
***Significant at 1%, **Significant at 5%, *Significant at 10%.

In line with recent studies (Martínez-Romero et al., 2018; Sciascia & Mazzola, 2008), our empirical findings show that family involvement in management, and specifically family presence in the TMT, exerts a negative influence on firm performance. These results can be explained in the light of both the upper echelon and the SEW theories, inasmuch as family managers would avoid taking strategic decisions that imply a loss of control over their firms (Gómez-Mejia et al., 2007; 2010), knowing that these decisions might involve improved performance outcomes. Furthermore, our findings reveal a positive moderating effect of TI efficiency on the family management-performance relationship. That is, firms with higher family presence in TMT and with enhanced TI efficiency, by promoting long-standing and prosperous relationships with selected stakeholers (Patel & Fiet, 2011), social capital (Arregle et al., 2007) and tacit knowledge (Llach & Nordqvist, 2010), weakens the negative relationship between family presence in TMT and firm performance.

This chapter contributes to previous literature in several manners. First, we analysed the family presence in TMT-firm performance relationship in the context of private firms, which up to now has not received enough attention (Martínez-Romero et al., 2018; Sharma & Carney, 2012), despite the mixing findings (Sciascia et al., 2014). In line with recent studies (Diéguez-Soto et al., 2018b), our findings reveal that family managers, as the dominant coalition in family firms (Hambrick & Mason, 1984; Vandekerkhof et al., 2015), negatively influence performance outcomes. Furthermore, we go a step further than previous research that used a binary measure of family management (e.g. Diéguez-Soto et al., 2018a; Rojo-Ramírez & Martínez-Romero, 2018), by using a continuous variable of family presence in TMT, disclosing heterogeneity across family firms with respect to firm performance.

Second, with the purpose of shedding some light on the family management-performance relationship, this chapter introduces the moderating effect of TI efficiency. Thus, our study provides relevant insights regarding the interactive effect of TI efficiency and family presence in TMT with regards to performance outcomes. In such a way, our findings highlight that when TI efficiency is high, firms with major family presence in TMT are able to obtain higher performance outcomes, whereas when TI efficiency is low, firms with major family presence in TMT decrease their performance results. That is, Figure 2 evinces that the moderating effect of TI efficiency on the family management-performance relationship is contingent upon the number of family managers on the TMT. Thus, our results seem to suggest that when there is a higher presence of family members in the TMT and a greater TI efficiency, family managers do not perceive any threat to their emotional endowment, because they dominate the strategic decision-making. In these situations, family managers enter in a virtuous circle and will be willing to establish collaborative innovation ties that increase TI efficiency (Feranita et al., 2017) and thus, firm performance, inasmuch as these innovative collaborations are not contemplated as a loss of their firm control.

Our findings also have important practical implications, particularly for those family managed firms that are disposed to enhance their firm's outcomes. In this sense, family managers should be aware about the importance of attaining higher TI efficiency in order to reach a proper balance between their economic and noneconomic goals. In this vein, family managed firms may hire key external managers to learn from them the necessary skills and knowledge to improve efficiency in the resource management and implement an innovative culture that persist in the long-term (Diéguez-Soto, Duréndez, García-Pérez-de-Lema, & Ruiz-Palomo, 2016). Furthermore, external managers can avoid certain common practices in family firms such as overcompensation (Anderson & Reeb, 2004), or preventing an unqualified family member from becoming CEO (Shleifer & Vishny, 1986), which could be detrimental to the implementation and development of innovative projects, and thus, to TI efficiency and firm performance.

Notwithstanding the relevance of the obtained results, this chapter presents certain limitations that in turn, open new lines for future research. Although we have focused in the family members' presence in the TMT, we haven't contemplated the heterogeneity between these members. At this respect, future studies should analyse whether the

interaction effect of TI efficiency on firm performance is the same when in a family firm TMT, members of various generations with different goals and values coexist (Chrisman et al., 2012). What is more, we measured TI efficiency using number of products as innovation output instead of using process innovation, which has been considered essential to decrease costs and to improve production efficiency by reducing the required level of input (Chang, Bai, & Li, 2015; Ramos, Acedo, & Gonzalez, 2011). Thus, further research should take into account the use of both product and process innovations as outputs to calculate TI efficiency in order to see its possible consequences on firm performance.

6. Conclusion

Overall, our chapter examines fundamental relationships in the family firm field, relating family presence in TMT to firm performance and highlighting the key role of TI efficiency. Thus, this manuscript reveals that TI efficiency weakens the negative relationship between the family presence in TMT and firm performance. Notwithstanding our study extend the theoretical and empirical contributions of prior literature (Diéguez-Soto et al., 2018b; Sciascia & Mazzola, 2008; Sciascia et al., 2014), more research is required to better understand the management implications in family firms performance and, more importantly, to identify what new factors may indirectly contribute to enhance the family presence in TMT-firm performance relationship.

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CHAPTER III. THE IMPACT OF COLLABORATIONS ON FAMILY FIRMS' INNOVATION PERFORMANCE

UNLEASHING FAMILY FIRMS' POTENTIAL TO DO MORE WITH LESS: PRODUCT INNOVATION EFFICIENCY, FAMILY INVOLVEMENT IN TMTS AND TECHNOLOGICAL COLLABORATIONS

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UNLEASHING FAMILY FIRMS' POTENTIAL TO DO MORE WITH LESS: PRODUCT INNOVATION EFFICIENCY, FAMILY INVOLVEMENT IN TMTS AND TECHNOLOGICAL COLLABORATIONS

Abstract

Purpose – This paper aims to examine the influence of family involvement in TMTs on product innovation efficiency and the contingent role of technological collaborations, combining insights from the resource-based view and the behavioral agency model.

Design/methodology/approach – This study empirically develops and tests the hypotheses using a longitudinal sample of 3,852 firm-year observations from Spanish manufacturing firms over the period 2006-2016.

Findings – The results reveal that family involvement in TMTs positively influences product innovation efficiency. The results also show that such positive effect is weakened as technological collaborations increase, and varies according to the partner type with whom the cooperation agreement is established. Specifically, the findings indicate that collaboration with suppliers appear to be the least detrimental for product innovation efficiency in family firms, followed by collaborations with customers and research organizations.

Practical implications – Family firms should consider appointing family members to their TMT to improve product innovation efficiency. Moreover, to enhance the effect of family management on product innovation efficiency, family managers should carefully select their technological partners.

Originality/value – This study is one of the first to theoretically explain and empirically demonstrate that family involvement in TMTs is a critical antecedent of product innovation efficiency and that technological collaborations moderate such link. Moreover, this study goes further in revealing that distinct types of partners have a differential moderating influence on the family involvement in TMTs-product innovation efficiency relationship. The results can be used to help managers and practitioners to boost innovation performance as well as to assist policy makers to design firm-level innovation policies to improve family firms' competitiveness.

Keywords: product innovation efficiency, family involvement in TMTs, technological collaborations, resource-based view, behavioral agency model

1. Introduction

Product innovation efficiency, which can be defined as a firm's ability to carry out product3 innovations that exceed what would normally be expected from a given amount of R&D inputs (Cruz-Cázares et al., 2013), is crucial to cope with shortening product life cycles and intense market competition in today's uncertain and rapidly changing environments (Calabrò et al., 2019), and is considered essential to improve the performance and long-term survival of firms (Diéguez-Soto et al., 2016). Recently, scholars have started to devote considerable attention to the role of family firms in (product) innovation efficiency (e.g. Casado-Belmonte et al., 2021), given the prevalence of these businesses as the backbone of most industrialized and developed countries worldwide (Family Firm Institute, 2018). The central tenet of this research stream is that the idiosyncrasies of family firms render the transformation of innovation inputs into innovation outputs substantially more efficient, suggesting that family firms "do more with less" in their (product) innovation processes (Bendig et al., 2020; Duran et al., 2016; Matzler et al., 2015).

However, little is known to date about the antecedents that encourage or hinder the ability of family firms to innovate (its products) more efficiently (Duran et al., 2016; Manzaneque et al., 2020). Previous research states that family involvement (in ownership and in management), conceived as a product of family relationships built over time (Colbert, 2004; Shinnar et al., 2013), is a potential source of competitive advantage for innovation efficiency, as it brings high levels of family control over the firm (Gómez-Mejía et al., 2007), more flexible organization structures and adjustable decision-making (Craig and Dibrell, 2006), less formalized processes (De Massis et al., 2015), and the implementation of unique resource bundling processes (Carnes and Ireland, 2013). Specifically, family involvement in top management teams (TMTs) may be one of the

[3] Our emphasis on products rather than other types of innovation, such as patents or processes, is explained due to the following reasons. First, patents may underestimate firms' ability to innovate efficiently, not only because of many firms are unwilling to apply for patents for fear of their new ideas being appropriated (Deng *et al.*, 2013), or cannot afford the high cost of maintaining their validity or proving that the patent has been infringed (Encaoua *et al.*, 2006), but also because of patents may not be an effective means of appropriating R&D spending results (Levin *et al.*, 1987). Second, product innovation, compared to, for example, process innovation, presents particular challenges for family firms (De Massis *et al.*, 2015).

most critical antecedents of innovation efficiency, insofar as family managers ensure active family participation in strategic decision-making processes related to innovation, their monitoring and execution (Migliori et al., 2020). Nevertheless, family firms with family involvement in TMTs are heterogenous rather than homogenous group of entities, and thus, they are likely to differ in the way they conduct their product innovation processes (De Massis et al., 2015). Unfortunately, research has overlooked the question of whether different levels of family involvement in TMTs drive heterogeneity in product innovation efficiency. To the best of the authors' knowledge, only the study of Martínez-Alonso et al. (2020), in a very exploratory and succinct manner and as a part of a mediation analysis, in which the focus is firm performance, examines the relationship between family management and technological innovation efficiency. Accordingly, there has been recent calls for investigations into the factors that shape the turning of innovation inputs into innovation outputs within family firms (Calabrò et al., 2019; Duran et al., 2016).

Moreover, further research is needed on the contingent factors that might moderate the influence of family involvement in TMTs on product innovation efficiency and, therefore, the extent to which the subsequent potential gains or losses of product innovation efficiency are shaped by other external agents. One of these key factors concerns technological collaborations, defined as voluntary agreements among independent businesses, who exchange and share resources such as capital, information, knowledge and technology to fulfil a common innovation goal (Un et al., 2010). Despite being a decisive factor in supporting more efficient product innovations processes, research on technological collaborations in family firms is still in its infancy (Feranita et al., 2017). The scarce previous literature on the subject has mainly focused on analysing how certain family firms' characteristics, such as their resource endowments or risk aversion, affect the propensity of these firms to engage in collaboration agreements (Classen et al., 2012; Lazzarotti et al., 2017; Nieto et al., 2015). However, there is a lack of in-depth empirical and theoretical knowledge on when and to what extent such collaborations may affect family involvement in TMTs in achieving product innovation efficiency, which is a relevant research gap for both scholarship and practice.

The main goal of this study is thereby to expand on previous research by examining the following research questions: (1) Does family involvement in TMTs influence

product innovation efficiency? (2) Is the relationship between family involvement in TMTs and product innovation efficiency contingent upon technological collaborations? To examine these questions, we first rely on the resource-based view (RBV; Habbershon and Williams, 1999), as family firms need to focus on identifying, managing and deploying potential idiosyncratic resources resulting from family involvement in TMTs (Habbershon and Williams, 1999; Sirmon and Hitt, 2003), in order to achieve sustained competitive advantages that support more efficient product innovation processes, and thus, remain competitive over time. Second, based on the behavioral agency model (BAM; Wiseman and Gomez-Mejía, 1998), which establishes that the behaviour of the organization's dominant coalition (i.e. TMTs) affects corporate decision-making (Argote and Greve, 2007), we explore the extent to which technological collaborations influence family managers' strategic choices regarding the management of product innovation efficiency. From this perspective, we posit that the risks and costs inherent in collaboration agreements (e.g. opportunistic behaviours; Nieto and Santamaría, 2007) might condition family TMTs' behaviour to place more emphasis on socioemotional wealth (SEW) preservation as a means of ensuring their control and influence on products' technological trajectories. Thus, by bridging insights from the RBV and BAM theories, we provide a more nuanced picture on the manners in which family managers conduct their product innovation efficiency in a collaborative setting. These theoretical predictions are tested in a longitudinal sample of 3,852 firm-year observations from Spanish manufacturing firms over the period 2006-2016.

Our paper makes several contributions to the academic literature. First, it contributes to open up the "black box" of family firm innovation by providing a clearer understanding of the antecedents that fuels family firms' ability to "do more with less" in their product innovation processes (Duran et al., 2016). In this way, we shed new light on the significance of family involvement in TMTs to enhance internal functioning in product innovation processes and thus achieve more efficient transformations of innovation inputs into products innovations. Second, this study broadens the debate on heterogeneity in family firm innovation (Calabrò et al., 2019), taking into account differences in product innovation efficiency according to the level of family involvement in TMTs. This study also extends the embryonic knowledge on technological collaborations in family firms (Feranita et al., 2017), providing important insights into the role of collaborations as a

contingent factor affecting family TMT involvement in shaping the efficiency with which innovation inputs are transformed into product innovations. Finally, this study is also pioneering in empirically demonstrating that technological collaborations exert differential moderating impacts on the family management-product innovation efficiency link, depending on the type of partner.

2. Theoretical background and hypotheses development

2.1. Family involvement in TMTs and product innovation efficiency

The RBV provides a suitable theoretical lens on family firm innovation behaviour because it can help explain the complex nature of managing product innovation efficiency in a family firm context (Habbershon et al., 2003; De Massis et al., 2015). This RBV perspective implies that the confluence of family and business systems, gives rise to unique systemic conditions that generate an idiosyncratic set of intangible resources and capabilities (Habbershon and Williams, 1999), which affect the characteristics of technological innovation processes in family firms (De Massis et al., 2013). Under this view, family involvement in the firm, understood as the product of complex and long-lasting structures, i.e. family relations (Colbert, 2004; Shinnar et al., 2013), is among the most important family firms' resources that can lead to innovation-based competitive advantages, and ultimately, to attractive performance outcomes (Yeniaras et al., 2017), as it is unique, inseparable, synergistic, and difficult to duplicate (Nordqvist, 2005).

The uniqueness of family involvement is considered a major driver of the well-known heterogeneous character of family firms (Chua et al., 2012). Specifically, the varying forms and levels of family involvement can help to elucidate differences in family firms' behaviour regarding product innovation strategies (Calabrò et al., 2019). In this study, we argue that family involvement in TMTs, rather than in ownership, is what drives the product innovation efficiency, not only because of its major implication on strategic decision-making and therefore, on firm (innovative) outcomes (Finkelstein et al., 2009; Vandekerkhof et al., 2019), but also because of its proven ability to increase the probability of maximizing the value of different inputs factors when undertaking technological innovation processes (Martínez-Alonso et al., 2020). In this respect, differing levels of family involvement will shape the innovative strategic behaviour of family firms' TMTs (Klein et al., 2005; Ling and Kellermanns, 2010) and, thus, may

directly influence the efficiency with which the product innovation process is conducted (De Massis et al., 2015).

According to certain studies, family involvement in TMTs is viewed as a potential source of disadvantages for innovation, due, among other motives, to the family managers' common lack of professional competencies to innovate (Kotlar et al., 2014a). Nevertheless, a flourishing body of research (e.g. Muñoz-Bullón et al., 2020) strongly support that family firms' unique resources (e.g. tacit knowledge) lead to certain family-based competitive advantages that motivate family managers to ensure an efficient or parsimonious turning of innovation inputs into innovation outputs (Carney, 2005; Duran et al., 2016). These advantages are even more pronounced as the dynamic interaction between the family and firm subsystems becomes more significant, that is, as the level of family involvement in TMTs increases (Le Breton-Miller et al., 2011), given the crucial role of family managers in orchestrating firms' (innovation) resources (Sirmon et al., 2011).

Family managers, who in most cases are involved in the business from an early stage, are endowed with deep, largely tacit knowledge of their firm's resources, routines, stakeholders and technologies (Nieto et al., 2015). Due to its tacit component, this firm-specific knowledge is not codified and articulated without great effort and, thus cannot be easily replicated by others (Wong et al., 2008). Such tacit knowledge, which is accumulated in the form of actions and experiences over a long period of time, supports knowledge transfer and mutual learning (Muñoz-Bullón et al., 2020), and is found to enhance family managers' resource orchestration advantages for innovation (Duran et al., 2016). Hence, a higher presence of family members in the TMT will bring to the firm deeper levels of tacit knowledge, leading to a greater efficiency in transforming R&D input into product innovation.

Another core element embedded in family managers is social capital, which comprises the resources associated with the firm's relationships with internal and external stakeholders (Arregle et al., 2007). Within the firm, social capital enables family managers to maintain a cohesive and highly committed community of employees (Asaba and Wada, 2019), by developing trusting, sincere, and close relationships with those employees (Gómez-Mejía et al., 2007) and by using a distinctive family language (Tagiuri

and Davis, 1996). Outside the organization, social capital helps family managers to foster and nurture greater quality, long-standing relationships with potential partners and also to enhance the success of alliances and partnerships (Zahra, 2005). Thereby, a large number of family members involved in TMTs will allow for more effective communication and information exchange (Tagiuri and Davis, 1996), facilitating better quality decision-making and therefore, greater product innovation efficiency (Martínez-Alonso et al., 2020).

Moreover, there is an accumulated evidence advocating that family managers have less pressure for short-term payoffs (Rojo-Ramírez and Martínez-Romero, 2018), enabling them to expand their long-term view (Dunn, 1996). In this regard, having more family managers will imply a greater commitment to guarantee the continuity of the business in the long-term, which is beneficial to cover the time horizon required for innovation projects to be successful (Miller et al., 2015), as well as to acquire the accumulated expertise and knowledge necessary to be progressively more efficient in product innovation management over the years (Daspit et al., 2019). Likewise, as family participation in the TMT goes beyond decision-making to the execution of decisions, they may find it easier to adjust the course of unforeseen innovation outcomes, helping to reduce potential losses (Kellermanns et al., 2012). Therefore, a higher presence of family members in TMTs may favour family firms' innovative behaviour, as they are more likely to recognize and comprehend the problems and chances that firms face (Zahra, 2005).

Based on the foregoing arguments, we postulated the following hypothesis:

H1: Higher levels of family involvement in the TMT enhance product innovation efficiency

2.2. The moderating effect of technological collaborations

Technological collaborations with external partners are recognized as being beneficial for the firms' product innovation, since these partners provide the firm with the necessary resources (i.e. ideas, knowledge, experiences, and technology) to innovate its products (Nieto and Santamaría, 2007; Un et al., 2010; among several others). RBV scholars argue that collaborations are valuable resources to overcome innovation barriers (e.g. resource limitations shaped by governance structures), exploiting synergies from resource

complementarities between partners, and an important source of competitive advantage for family firm innovation (Das and Teng, 2000; Feranita et al., 2017).

Nevertheless, in contrast to this RBV viewpoint, a vast majority of studies (e.g. Bigliardi and Galati, 2018) have revealed that, while family firms are able to manage promising collaboration projects, they are generally unwilling to open the product innovation process to the external world (De Massis et al., 2015). The underlying reason for this unwillingness is that family managers may be firmly reluctant to let new actors (e.g. suppliers) from outside the business sphere gain the ability to exercise some influence and control over the technological trajectory of products (Almirall and Casadesus-Masanell, 2010; De Massis et al., 2015), as this would put their accumulated endowment of SEW at risk. The concept of SEW, which is a derivation of BAM, refers to a collective set of family's affective needs, such as sense of identity, ability to exercise family influence, and the perpetuation of the family dynasty (see Gómez-Mejía et al., 2007, for an overview). Through the BAM, Gómez-Mejía et al. (2007) proved that to protect non-financial benefits, family firms are willing to accept increased risks, because when the family's SEW is threatened, family managers are likely to make decisions that are not guided by economic rationality. In this light, BAM research has shown that SEW preservation constitutes the pivotal point of reference that drives strategic decision-making in family firms (Zellweger et al., 2013). Therefore, when making strategic decisions, family managers typically face a trade-off between the overlapping and sometimes competing rational and emotional considerations (Kotlar et al., 2020). This interplay of objectives has been identified as a key determinant of TMTs heterogeneity, which conditions family managers' behaviour regarding strategic choices (Kotlar et al., 2014b), including the searching for technological collaborations (Classen et al., 2012). More precisely, a higher number of family members in TMTs is expected to increase the emphasis on family goals and values in an attempt to protect SEW (Gómez-Mejía et al., 2007), making the decision to open up the product innovation process a very challenging issue.

Technological collaborations restrict the pool of available resources and may therefore directly threaten family managers' autonomy to allocate them to product innovations according to their personal criteria (Carney, 2005). While the family managers' freedom to allocate resources intuitively can be favourable in certain contexts

characterized by, for example, organizational innovation, collaborators may find this inadequate for conducting business (Nieto et al., 2015). In addition, collaborations can give rise to opportunistic behaviours (such as shirking, cheating, and appropriating resources and knowledge, etc) and appropriability hazards due to the existence of information asymmetries between partners (Wu, 2012), often unavoidable given the difficulty of bearing the higher costs associated with searching, contracting and monitoring these processes (Pisano, 1990). The inability to effectively supervise collaborators, together with the uncertain nature of these activities, can make it difficult for family managers to take advantage of their social capital and thus, to benefit from such cooperation agreements (Gjergji et al., 2019).

Moreover, collaborations require joint planning activities, which may oblige family managers to reveal strategically valuable information and give power to professional agents with the necessary technical background and expertise to manage these activities (Kotlar et al., 2014b). In this context, collaborations might provoke knowledge leakages as family managers would have to disclose firm-specific confidential information, like know-how and technologies, to outside actors (Cassia et al., 2012), damaging their intrinsic tacit knowledge and in turn, the efficiency with which they obtain product innovations. Likewise, collaborations might exacerbate the limited family managers' ability to assimilate and manage external knowledge, namely their absorptive capacity, hampering the possibility of extracting any value from innovations (Pellegrini and Lazzarotti, 2019).

On the other hand, collaborations may foster the risk-averse climate that often permeates family firms' decisions concerning product innovation given that, even when engaging in collaboration, family managers prioritize the firm continuity and survival in the long-term over short-term payoffs (Lambrechts et al., 2017). Similarly, collaborations could boost the not-invented-here syndrome (Katz and Allen, 1982). This is a cultural aspect that leads to a negative attitude toward the acquisition of new ideas or technologies (Antons and Piller, 2015), and which seems to be quite propitious in a family firm context (König et al., 2013), because of the psychological preconceptions of family managers towards external knowledge inputs. Finally, collaborations might compromise the identity aspect of SEW, inasmuch as less family managers' control over the entire

technical development path of products can seriously weaken the connection between the family name and the firm product (Kotlar et al., 2013).

Taken together, these arguments suggest that technological collaborations could undermine family managers' competitive advantages to innovate and therefore, their ability to efficiently conduct the product innovation process. Stated formally:

H2: Technological collaborations will moderate the relationship between family involvement in the TMT and product innovation efficiency, such that family involvement in the TMT will have a less intense influence on product innovation efficiency as collaborations increase.

2.3. The moderating effect of technological collaborations with different types of partners

That said, it must be recognised that collaborators are not all equal (O'Connor et al., 2021). Prior literature indicates that each partner type (e.g. customers) has its own priorities and goals, varies considerably in the nature and breadth of the transferred knowledge, and plays different roles through the product innovation process (Hsieh et al., 2018), which in turn may lead to varying levels of family losses in terms of SEW (De Massis et al., 2015). For example, customers and competitors may give firms a better understanding of the market whereas suppliers and research organizations may help solve troubles or identify new possibilities for the firm to explore (O'Connor et al., 2021). Therefore, one can expect that each partner type will exercise a distinctive impact on family managers' ability to achieve product innovation efficiency. For purposes of conciseness, our study focuses on four usual collaborators: suppliers, customers, competitors, and research organizations. Herein, based on the collaborators' divergent set of goals, knowledge and roles regarding the product innovation process, we go further and analyse the specific moderating effect of each collaborator on the family management-product innovation efficiency relationship.

Vertical collaborations (with suppliers and customers) are often the most established product innovation link for business to business relationships (Nieto and Santamaría, 2007). Collaboration with suppliers implies adjustments in firms' value chains, for example by having to outsource part of the product development process, generally that

related to the input side (Arranz and de Arroyabe, 2008). This entails a direct loss of family managers' autonomy in the conversion of raw materials and in the assignment of components parts or subsystems to product innovations, as some of the choices they previously made will now be taken by independent firms that are likely to maximize their payoffs (Almirall and Casadesus-Masanell, 2010). Moreover, collaboration with suppliers usually triggers personnel exchanges between the supplier and the customer as a mechanism to ensure knowledge sharing (Takeishi, 2002). Such staff exchanges could be a potential way for the supplier to gain insights into family managers' deeper firm-specific knowledge and efficiency targets, and how these are assessed internally (Un and Asakawa, 2015). Accordingly, as suppliers gain control in the early stages of the product's technological trajectory, family managers will have more difficulties in keeping their autonomy and tacit knowledge, and thus, their product innovation efficiency may be diminished.

Collaboration with customers involves the active participation of end-users in the product innovation process, for example by developing or modifying products based on the knowledge of their unmet preferences and needs (Chatterji and Fabrizio, 2014). These preferences and needs, which are deeply rooted in customers, may not be obvious even to them, but are acted upon when they buy the products (Un et al., 2010). In this setting, the limited family managers' absorptive capacity may hamper their ability to identify and therefore, assimilate and exploit latent customer needs (Tsai, 2009). This may increase family managers' reluctance to work with customers, inasmuch as such managers will be unable to know with certainty their customer needs and how to satisfy them, which in turn, could reduce the likelihood of successful product innovations (Kärkkäinen and Elfvengren, 2002). These arguments, coupled with the fact that collaboration with customers may influence product attributes (e.g. functional characteristics and properties) and personality (e.g. the message that the product explicitly communicates to the end-user), may cause a deterioration in family managers' bond and attachment to the product in question, and thus compromise the efficiency with which such product innovation is conducted.

Collaboration with competitors seems to be the least conducive to product innovation processes (Bayona-Sáez et al., 2003). This is because relations between competitors are unstable and dynamic by nature, provoking high levels of tension in firms (Gnyawali and

Park, 2011). Thus, such partner is expected to aggravate all problems associated with opportunistic behaviour and information leakages, and the risks of misappropriation and hold-up is greater with competitors (Nieto and Santamaría, 2007). Furthermore, competitors will actively block the transfer of new knowledge to direct rivals, due to it could reinforce the latter's advantages to better fulfil the needs of their similar customers (Un et al., 2010). Thereby, unless such collaboration is limited to solving shared problems outside the competitor's area of influence, such as regulatory changes or standard setting (Tether, 2002), it might undermine family managers' potential to achieve enhanced product innovation efficiency.

On the contrary, collaboration with research organizations is believed to focus on more (exploratory) basic and precompetitive research (Galati and Bigliardi, 2017). Indeed, as a driving force in basic research, it provides firms with a broader knowledge aimed at improving product innovation (Un et al., 2010). Consequently, collaboration with this partner urges family managers to enhance some core competencies, such as absorptive capacity, to acquire knowledge that although easily accessible, is certainly complex to assimilate and decode (Pellegrini and Lazzarotti, 2019). In addition, the incentives and foci of research organizations (e.g. investigation in multiple disciplines or dissemination of knowledge) are likely to differ considerably from those of family managers (Steinmo and Rasmussen, 2016). This modus operandi, in conjunction with the expected complexity of internalising such complex knowledge, may weaken the product innovation efficiency obtained by family managers.

All of the above leads us to hypothesize that:

H3: Technological collaborations with different types of partners, namely (a) suppliers, (b) customers, (c) competitors and (d) research organizations, will moderate the relationship between family involvement in TMTs and product innovation efficiency, and such interaction effects will vary according to the type of partner selected.

3. Methodology

3.1. Sample and measures

The sample used consists of a longitudinal panel dataset of 3,852 firm-year observations throughout a 11-year period (2006-2016) drawn from the Spanish Survey on Business Strategies (SSBS). The SSBS is an annual survey conducted by the SEPI Foundation in cooperation with the Spanish Ministry of Industry. The SSBS was developed with the aim of ensuring the representativeness of the Spanish manufacturing industry. The reference population are those firms with 10 or more employees dedicated to one of the activities pertaining to divisions 10 to 32 of the CNAE-2009 classification, excluding division 19 (activities related to oil refinery and fuel processing). Firms included in the SSBS are selected by combining random sampling (firms with 10 to 200 employees) and census systems (firms with more than 200 employees). Moreover, all information within the SSBS is subject to quality, consistency, and validation controls along time.

The SSBS focus on the manufacturing industry is regarded quite appropriate for our study, since the usual high level of obsolescence of manufacturing firms' products due to, among other factors, their progressively shorter life cycles (Kotlar et al., 2014b), suggests that product innovation efficiency is likely to be utilized in the pursuit of sustained competitive advantages. Furthermore, albeit families operate in a wide range of firms, family firms seem to be a very prevalent organizational form among manufacturing firms (Diéguez-Soto et al., 2016).

Table 1 provides definitions of the variables used in the empirical analysis. Dependent (product innovation efficiency) and independent (family involvement in TMTs) variables require further explanation.

Product innovation refers to the firm's introduction of completely new products or major changes that make them distinct from formerly manufactured products. Particularly, we assess product innovation in terms of the number of new products obtained, which is a reliable and critical indicator of a firm's product innovation activities (Sánchez-Marín et al., 2020; Un et al., 2010). In this study, we measure the product innovation efficiency as the ratio between the number of product innovations to the

number of firms' R&D employees with the aim of capturing the efficiency with which firms turn R&D input into product innovation output. This measurement implies the assumption that product innovation efficiency increases when (1) fewer R&D employees lead to the same number of product innovations or (2) the same number of R&D employees lead to a higher number of product innovations.

According to a large volume of research (e.g. Kotlar et al., 2014b), a family controls the firm when its members actively participate in ownership and management. The SSBS provides for all family firms the number of owners and their immediate relatives who hold positions in TMTs. Hence, we define the level of family involvement as a continuous variable counting the number of family members in the firm TMT. This is an objective measure of family involvement in TMTs, coherent with previous family firm studies (Kotlar et al., 2013; Manzaneque et al., 2020) and suitable for testing the proposed hypotheses.

3.2. Controlling for endogeneity

We use two sequential steps to control for possible endogeneity of family involvement in TMTs due to unobservable organizational or environmental characteristics not captured by the control variables, or reverse causality between independent and dependent variables. First, we employed longitudinal data and applied a 1-year lag between the dependent variable and the rest of variables to ensure the direction of causality and mitigate the likelihood of reverse causality. Second, we implemented Heckman's (1979) two-stage technique (e.g. Gómez-Mejía et al., 2007). Using Heckman's two-stage procedure, we first run a probit model in which the endogenous variable is the family firm (= 1) versus non-family firm (= 0) and estimate the inverse Mills ratio. We then run the regression models of product innovation efficiency using the inverse Mills ratio from the first-stage model as an additional control.

We used three instrumental variables in the first-stage model that may affect the likelihood of family control, but are not correlated with product innovation efficiency. The first instrumental variable is the number of family members working as employees in the business, as having family members as employees raises the gains that a family may obtain from controlling a firm (Kotlar, Fang, et al., 2014a). Furthermore, in line

Table 1. Definition of variables

Variable	Definition	References
Panel A. Dependent variable		
Product innovation efficiency	It is measured as the division between the number of product innovations and the number of firms' R&D employees.	Martínez-Alonso et al. (2020)
Panel B. Independent and moderating variables		
Family involvement in TMTs	It is measured as the number of family members who occupy positions in the TMT.	Kotlar et al. (2013)
Technological collaborations	It is measured as the number of technological collaborations that a firm develops with different types of partners (suppliers, customers, competitors, research organizations). This variable ranges from 0 (a firm does not collaborate with any partner) to 4 (a firm collaborates with all partners).	Classen et al. (2012)
Collaboration with suppliers	A dummy variable indicating whether the firm develops technological collaboration with suppliers (1 = Yes; 0 = No).	Bodas-Freitas and Fontana (2018)
Collaboration with customers	A dummy variable indicating whether the firm develops technological collaboration with customers (1 = Yes; 0 = No).	Un et al. (2010)
Collaboration with competitors	A dummy variable indicating whether the firm develops technological collaboration with competitors (1 = Yes; 0 = No).	Hsieh et al. (2018)
Collaboration with research organizations	A dummy variable indicating whether the firm develops collaboration with universities and/or technological centers (1 = Yes; 0 = No).	Tsai (2009)
Panel C. Control variables		
Firm size	It is measured as the natural logarithm of the number of employees.	Alberti et al. (2014)
Generational stage	A dummy variable indicating whether the firm is less than 25 years old (first generation business) (1 = Yes; 0 = No).	Arrondo-García et al. (2016)
Past firm performance	It is measured as the difference between sales and the cost of goods sold scaled by sales in t-1.	De Massis et al. (2018)
Financial aid for innovation	A dummy variable indicating whether the firm has received financial aid for innovation (1 = Yes; 0 = No).	Raymond et al. (2010)
Firm leverage	It is measured as the ratio of total debt to total assets.	Matzler et al. (2015)
Process innovation	A dummy variable indicating whether the firm introduces new or significantly improved production processes (1 = Yes; 0 = No).	Un and Asakawa (2015)
Territorial subdivisions (NUTS1)[a] dummies	1. Northwest; 2. Northeastern; 3. Madrid; 4. Center; 5. East; 6. South; and 7. Canarias.	Manzaneque et al. (2020)
Industry dummies	1. Meat industry; 2. Foodstuffs and snuff; 3. Drinks; 4. Textiles and clothing; 5. Leather and footwear; 6. Timber industry; 7. Paper Industry; 8. Graphics; 9. Chemical and pharmaceutical products; 10. Rubber and plastic; 11. Non-metallic mineral products; 12. Ferrous and nonferrous metals; 13. Metal products; 14. Agricultural and industrial machinery; 15. Computer, electronic and optical products; 16. Electrical machinery and material; 17. Motor vehicles; 18. Other transport equipment; 19. Furniture industry; and 20. Other manufacturing.	Diéguez-Soto et al. (2018)

Note(s): [a]NUTS1: Nomenclature des Unités Territoriales Statistiques. Eurostat: http://ec.europa.eu/eurostat/web/nuts/overview (Accessed 5 of July of 2021)

with previous family and innovation studies (Fang et al., 2021; Muñoz-Bullón et al., 2020), the share of both industry sales and regional sales from family firms were also included as instrumental variables. These variables should be related to the probability that a firm in the industry is a family firm, but should be independent of product innovation efficiency as the latter is industry-adjusted.

3.3. Analytical method

Given that our dependent variable (product innovation efficiency) is left-censored, i.e. it only presents positive values and contains several observations with values equal to 0, a Tobit panel data approach is most appropriate to check our hypotheses (Grimpe and Kaiser, 2010). Tobit models rightly address this particular aspect of our data by treating firms with no product innovation efficiency distinctly different from firms with product innovation efficiency. Specifically, we employ random-effects Tobit models. The alternative fixed-effects approach is not feasible in this case due to some key control variables in our model, such as industry dummies, are invariant over time for each firm in the sample (Ashwin et al., 2015; Kennedy, 1998). Since our dataset is longitudinal in nature, this model, in addition to allow measuring the incidence of observable variables on product innovation efficiency, also measures the impact of non-observable ones. Our model has the following analytical specification:

$$y_{it} = \begin{cases} \beta' x_{it-1} + u_{it,} \quad i = 1, 2, \dots, N; \quad t = 1, 2, \dots, T \quad \text{if } y_{it}^{*} > 0 \\ 0 \quad \text{Otherwise,} \end{cases} \quad (1)$$

where yit is a latent variable reflecting firm i's product innovation efficiency level at time t, y*it is the unobserved (latent) variable that measures each firm's real product innovation efficiency, xit–1 is a vector of relevant firm factors to explain the extent of product innovation efficiency, β is a vector representing the parameters to be estimated, and uit is the error term. This error term is defined as follows: uit = vi + eit, being the former element (vi) a firm-specific unobservable effect that captures all unobserved, time-constant characteristics affecting product innovation efficiency. The latter element (eit), frequently named as the idiosyncratic or time-varying error, accounts for the unobserved aspects that vary over time and impact on product innovation efficiency. This model will

thus estimate β to more accurately capture the effect of regressors on product innovation efficiency.

Moreover, since correcting for self-selection of family control is of great theoretical importance (Chrisman and Patel, 2012), we incorporate the inverse Mills ratio from the first-stage model into the product innovation efficiency models. The non-significance of the inverse Mills ratio in the second stage denotes that the potential endogeneity of family control did not negatively influence the estimated results on product innovation efficiency. The hypothesized results are similar with and without the presence of the inverse Mills ratio.

4. Results

4.1. Descriptive statistics and correlations

Table 2 shows the means, standard deviations, and correlations for the variables used in this study. Modest correlation values among our variables are revealed. The highest correlation coefficient is below the problematic level of 0.80 (Gujarati and Porter, 2008), thus suggesting low multicollinearity hazards. Furthermore, to check for moderation and reduce the potential problem of multicollinearity, the independent variable was mean-centered before generating the interaction terms (Aiken and West, 1991).

4.2. Results from regression analyses

Table 3 presents the regression results for the influence of family involvement in TMTs on product innovation efficiency and the moderating effect of technological collaborations. Model 1 includes the control variables and the estimation of the main effect. Family involvement in TMTs is positively and significantly associated with product innovation efficiency ($\beta = 0.398$; $p < 0.05$), demonstrating that growing levels of family involvement in TMTs are related to greater product innovation efficiency, thereby supporting H1.

In Model 2, we add the variable technological collaborations. The results show a positive and significant direct effect of such collaborations on the dependent variable ($\beta = 0.416$; $p < 0.05$). Nevertheless, since our main objective is to analyse when and to what extent technological collaborations affects the family management-product innovation

efficiency relationship, Model 3 introduces the interaction term between technological collaborations and family involvement in TMTs. The coefficient of the interaction term is negative and significant for the dependent variable ($\beta = -0.407$; $p < 0.01$). We thus find support to H2. To better interpret our significant moderating effect (Dawson, 2014), in Figure 1, we illustrate the interaction by estimating the predicted product innovation efficiency of firms under different conditions (low and high values of family involvement in TMTs and low and high values of technological collaborations). Figure 1 displays that as family involvement in TMTs increases, product innovation efficiency is higher, and that the intensity of such effect (slope) is higher as technological collaborations decrease.

Table 4 presents the regression results for the moderating effects of collaborations with suppliers, customers, competitors, and research organizations. Model 4 adds the direct effects of collaborations with these partners and shows that collaboration with suppliers has a significant positive impact on product innovation efficiency ($\beta = 1.322$; $p < 0.01$), while collaborations with customers, competitors, and research organizations does not exert significant influence on the dependent variable. Then, Models 5, 6, 7, and 8 introduce the interaction terms between collaborations with suppliers, customers, competitors, and research organizations and family involvement in TMTs, with the coefficients of these terms being significant in the case of suppliers, customers and research organizations, and non-significant for competitors. Hence, we find support for H3a, H3b y H3d, but reject H3c. Additionally, suppliers are found to be the partners with the least negative and significant moderating effect (Model 5, $\beta = -0.535$; $p < 0.10$), followed by customers (Model 6, $\beta = -0.798$; $p < 0.05$) and research organizations (Model 8, $\beta = -0.859$; $p < 0.01$), respectively. Figure 2 provides a graphical representation of the resulting significant interaction terms.

Table 2. Descriptive statistics and correlation matrix

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Product innovation efficiency	0.54	2.83												
2. Family involvement in TMTs	0.73	1.08	.05***											
3. Technological collaborations	1.66	1.20	.01*	-.13***										
4. Collaboration with suppliers	0.56	0.49	.03**	-.08***	.77***									
5. Collaboration with customers	0.46	0.50	.03*	-.10***	.76***	.48***								
6. Collaboration with competitors	0.07	0.25	-.03**	-.06***	.44***	.19***	.22***							
7. Collaboration with research organizations	0.58	0.50	-.01	-.11***	.65***	.27***	.23***	.16***						
8. Firm size	5.12	1.31	-.09***	-.29***	.34***	.24***	.14***	.24***	.31***					
9. Generational stage	0.33	0.47	.04**	-.08***	-.01	-.02	.02	.03	-.02	-.07***				
10. Past firm performance	0.25	0.12	-.03**	.10***	-.03**	-.04**	.02	-.04**	-.05***	-.16***	-.04**			
11. Financial aid for innovation	0.28	0.44	.01	-.01	.34***	.22***	.17***	.19***	.34***	.23***	-.02	.02		
12. Firm leverage	0.51	0.22	.01	-.07***	.05***	.02	.01	.08***	.06***	.17***	.07***	-.24***	.05***	
13. Process innovation	0.68	0.56	.01*	-.01	.20***	.18***	.11***	.08***	.14**coll*	.13***	-.05***	-.01	.10***	-.01

Note(s): N (observations) = 3,852; SD = Standard deviation; *p < 0.10. **p < 0.05. ***p < 0.01

Table 3. Direct influence of family involvement in TMTs on product innovation efficiency and moderating effect of technological collaborations

DV: product innovation efficiency	Model 1	Model 2	Model 3
Main effect			
Family involvement in TMTs	0.398** (0.192)	0.409** (0.192)	1.068*** (0.294)
Moderator			
Technological collaborations		0.416** (0.166)	0.352** (0.168)
Interaction effect			
Technological collaborations * family involvement in TMTs			-0.407*** (0.137)
Controls			
Firm size	0.189 (0.257)	0.071 (0.261)	0.081 (0.260)
Generational stage	1.079** (0.490)	1.086** (0.488)	1.103** (0.488)
Past firm performance	-1.500 (1.618)	-1.571 (1.615)	-1.742 (1.615)
Financial aid for innovation	1.158*** (0.412)	1.056*** (0.413)	1.139*** (0.412)
Firm leverage	0.617 (1.019)	0.582 (1.018)	0.499 (1.017)
Process innovation	1.791*** (0.354)	1.715*** (0.355)	1.725*** (0.354)
Territorial subdivisions and industry dummies	yes	yes	yes
Inverse Mills ratio	-0.059 (0.374)	-0.044 (0.373)	-0.079 (0.373)
Intercept	-7.520*** (1.514)	-7.542*** (1.510)	-7.460*** (1.508)
Number of observations	3,020	3,020	3,020
Wald chi-square	59.61***	65.86***	74.28***
Log likelihood	-4536.295	-4533.152	-4528.739
Likelihood ratio test	472.46***	466.25***	462.43***

Note(s): DV: Dependent variable; Standard errors in parentheses; *p < 0.10. **p < 0.05. ***p < 0.01

Figure 1. Interaction: technological collaborations x family involvement in TMTs

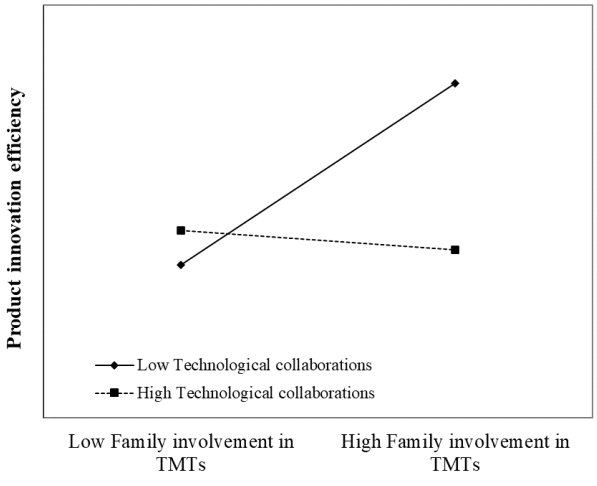
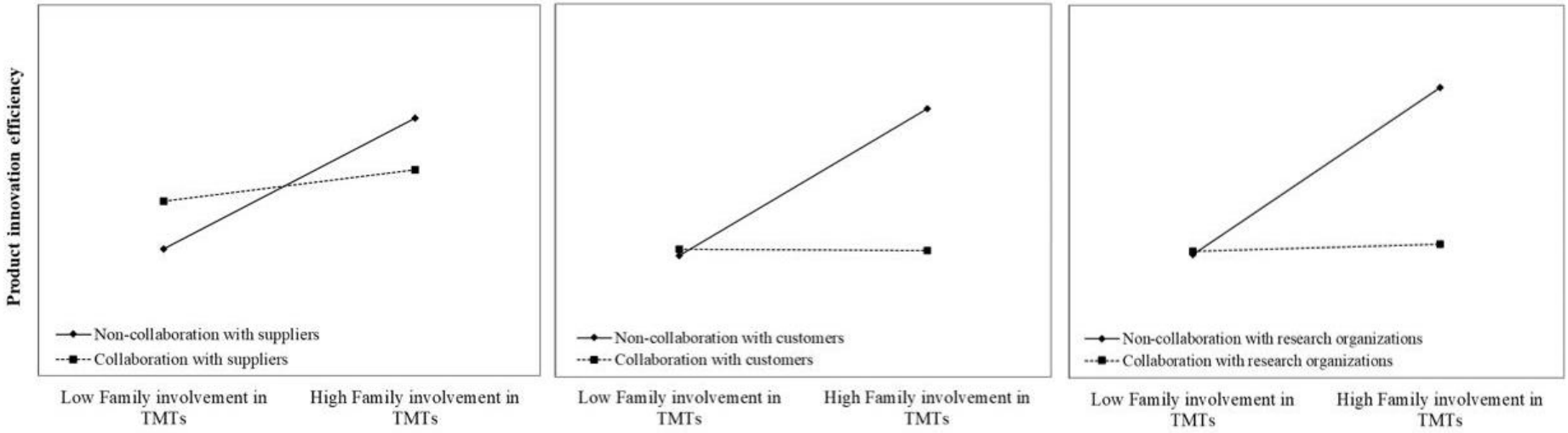


Table 4. Moderating effects of collaborations with different types of partners on the family involvement in TMTs-product innovation efficiency relationship

DV: product innovation efficiency	Model 4	Model 5	Model 6	Model 7	Model 8
Main effect					
Family involvement in TMTs	0.414** (0.192)	0.705*** (0.251)	0.790*** (0.242)	0.450** (0.194)	0.897*** (0.268)
Moderators					
Collaboration with suppliers	1.322*** (0.419)	1.293*** (0.419)	1.347*** (0.419)	1.306*** (0.419)	1.293*** (0.418)
Collaboration with customers	0.022 (0.422)	0.027 (0.422)	0.173 (0.427)	0.025 (0.422)	0.013 (0.422)
Collaboration with competitors	-0.629 (0.665)	-0.696 (0.666)	-0.740 (0.666)	-0.983 (0.733)	-0.655 (0.664)
Collaboration with research organizations	0.168 (0.429)	0.169 (0.429)	0.185 (0.429)	0.180 (0.429)	0.087 (0.431)
Interaction effects					
Collaboration with suppliers * family involvement in TMTs		-0.535* (0.301)			
Collaboration with customers * family involvement in TMTs			-0.798** (0.317)		
Collaboration with competitors * family involvement in TMTs				-0.898 (0.718)	
Collaboration with research organizations * family involvement in TMTs					-0.859*** (0.335)
Controls					
Firm size	0.061 (0.261)	0.047 (0.261)	0.063 (0.261)	0.076 (0.262)	0.081 (0.261)
Generational stage	1.115** (0.488)	1.078** (0.488)	1.147** (0.488)	1.144** (0.489)	1.153** (0.488)
Past firm performance	-1.531 (1.611)	-1.673 (1.613)	-1.573 (1.611)	-1.565 (1.612)	-1.559 (1.612)
Financial aid for innovation	1.091*** (0.413)	1.115*** (0.413)	1.153*** (0.414)	1.095*** (0.413)	1.086*** (0.413)
Firm leverage	0.656 (1.017)	0.671 (1.016)	0.588 (1.017)	0.616 (1.017)	0.594 (1.017)
Process innovation	1.673*** (0.355)	1.666*** (0.355)	1.702*** (0.355)	1.679*** (0.355)	1.659*** (0.354)
Territorial subdivisions	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	yes
Inverse Mills ratio	-0.018 (0.373)	-0.020 (0.373)	-0.003 (0.373)	-0.054 (0.375)	-0.051 (0.374)
Intercept	-7.682*** (1.511)	-7.589*** (1.510)	-7.749*** (1.511)	-7.666*** (1.511)	-7.687*** (1.511)
Number of observations	3,020	3,020	3,020	3,020	3,020
Wald chi-square	72.67***	75.66***	78.69***	74.01***	79.02***
Log likelihood	-4529.591	-4528.007	-4526.408	-4528.883	-4526.299
Likelihood ratio test	461.42	457.48	457.60	459.59	463.34

Note(s): DV: Dependent variable; Standard errors in parentheses; *p < 0.10. **p < 0.05. ***p < 0.01

Figure 2. Interactions: collaboration with suppliers, customers and research organizations x family involvement in TMTs



5. Discussion and conclusions

5.1. Discussion of results

Academics have embarked on a vigorous debate about the antecedents of innovation efficiency, with particular emphasis on unleashing family firms' innovative potential (Duran et al., 2016; Manzaneque et al., 2020). Contributing to this debate, we aimed to explain the manners in which the level of family involvement in TMTs influences product innovation efficiency. In view of the important role that technological collaborations play throughout the product innovation process (Nieto and Santamaría, 2007), we investigated whether and to what extent collaborations (1) with external partners, and more specifically, (2) with suppliers, customers, competitors and research organizations, moderate the relationship between family involvement in TMTs and product innovation efficiency. This article deals with these issues and offers new insights using a sample of 3,852 firm-year observations from Spanish manufacturing firms.

Our first result confirms that increased levels of family involvement in TMTs are positively associated with product innovation efficiency. This result is in line with the literature arguing that family involvement in the TMT is beneficial for innovation efficiency, as family managers may leverage their tacit knowledge, social capital and sense of long-term commitment to strongly support more efficient technological innovation processes (Muñoz-Bullón et al., 2020).

Our second result verifies our theorizing that technological collaborations weaken the positive link between family involvement in TMTs and product innovation efficiency. This result suggests that the underlying risks and costs of collaboration agreements (e.g. loss of managerial autonomy over products' technological path) could be greatly magnified by family managers when achieving product innovation efficiency, due to the greater families' concern for preserving SEW (Gómez-Mejía et al., 2007). In this light, collaborations might diminish the effectiveness of family managers' unique resources (e.g. social capital) that fuel firms' ability to innovate their products efficiently.

Our third result refers to the moderating effect of collaborations with different partner types, namely suppliers, customers, competitors, and research organizations, individually

considered. On the one hand, our results show that collaborations with suppliers, customers and research organizations weaken the family management-product innovation efficiency link. Moreover, research organizations emerge as the partner type that exert the most detrimental moderating effect, followed by customers and suppliers in order of importance. These findings are coherent with prior literature indicating that family firms appear to be more favourable to opening up their innovation processes to customers and suppliers as opposed to other collaboration forms (Pellegrini and Lazzarotti, 2019), since suppliers and customers are the collaborators who less damage SEW preservation (De Massis et al., 2015). On the other hand, our results show that collaboration with competitors does not moderate the family management-product innovation efficiency relationship. One potential explanation for this non-finding could be that firms have established formal knowledge protection mechanisms to protect themselves from competitors' threats (O'Connor et al., 2021).

5.2. Theoretical implications

This study makes several important contributions to the literature. It complements and extends the ongoing debate on family firm innovation by offering evidence on the potential of business families to "do more with less" in their technological innovation processes (Bendig et al., 2020; Duran et al., 2016). Building on RBV, we substantiate this assumption by examining the influence of family involvement in TMTs on product innovation efficiency. Notably, we argue that family involvement in TMTs represents the governance mechanism that allows for major family participation on strategic decision-making concerning innovation, thus exerting the most significant influence on product innovation processes. Specifically, we theorize that growing levels of family involvement in TMTs enhance the endowment and leverage of the unique resources (i.e. tacit knowledge, social capital, sense of long-term commitment) of family managers, and thus potentially help family firms to achieve greater product innovation efficiency. This is an important contribution to research on family firm innovation, as it underlines that successful product innovation processes require the implication and participation of all family TMT members, thus revealing new theoretical insights into the role of families in shaping the future technological trajectories of their firms' products.

Our study also enriches the lively discussion on heterogeneity among family firms (Chua et al., 2012) by identifying family involvement in TMTs as a powerful source of variability in family firms' innovation behaviour (e.g. Calabrò et al., 2019). Family involvement in TMTs differs within family firms and may change over time (Nordqvist et al., 2014), which means that the most suitable resources for achieving greater efficiency in the conversion of innovation inputs into product innovations are likely to vary across family firms at any one time and within a business through time. We thus provide a more complete picture of the heterogeneous innovation behaviour of family firms in terms of management (Nieto et al., 2015), contributing to the recent and scarce research on family involvement in TMT as an antecedent of innovation (Kammerlander et al., 2020).

This study also contributes to broaden the emerging research stream on technological collaborations in family firms (Feranita et al., 2017). Prior literature has shown that technological collaborations can be a double-edged sword with both positive and negative effects for family firm innovation (Bigliardi and Galati, 2018). While RBV theorists often find in collaborations critical resources to provide competitive advantage for innovation in these firms (Feranita et al., 2017), recent applications of BAM through the SEW lens suggest that collaborations can act as a detrimental factor in the link between family firm and innovation (Pellegrini and Lazzarotti, 2019). The establishment of collaboration agreements may be seen a priori as a means of rapidly improving the efficiency with which product innovations are conducted, but the reluctance to cede control over new product's technological trajectory to external partners prompts family managers' aversion to this practice (Almirall and Casadesus-Masanell, 2010; De Massis et al., 2015). This study, by introducing technological collaborations as a contingent factor into the relationship between family involvement in TMTs and product innovation efficiency, enhances our understanding regarding when and to what extent such collaborations shape product innovation processes in family firms. In doing so, we reveal that technological collaborations greatly influence family managers' SEW considerations, to the extent that such collaborations contribute to diminish firms' ability to efficiently turning innovation inputs into product innovations.

Finally, this study is also one of the first to explain and demonstrate that different collaborators lead to varying levels of family losses concerning SEW, which, in turn, result in distinctive influences on the family management-product innovation efficiency

link. This is explained by the diversity of goals, knowledge and roles that characterise each collaborator when participating in product innovation processes. It builds on and extend previous family firm studies focusing on the drivers of collaborations (Classen et al., 2012; Nieto et al., 2015) and the manners in which collaborations influence innovation outputs (Aiello et al., 2020; Ardito et al., 2018). Although researchers have suggested that disparate collaborators may entail dissimilar levels of loss of SEW endowment by family firms (De Massis et al., 2015), this issue has not been empirically addressed until now.

5.3. Managerial Implications

This study also provides some important practical insights. Given the compelling need to be continuously efficient in product innovation processes to survive in today's competitive world (Duran et al., 2016), family firms should address the question of how to configure their TMT as a key aspect to unleash their firms' innovation potential (Matzler et al., 2015). Our findings suggest that the appointment of family members in the TMT would enable effective and rapid dissemination of the intangible resources (e.g., tacit knowledge) deeply embedded in family managers and thus help family firms to innovate more efficiently.

Moreover, our study can help family managers identify and address the distinctive constraints and opportunities that emerge when operating in a collaboration context. Family firms with increased family involvement in their decision-making processes and seeking to enhance their product innovation must carefully and constantly monitor the context of the collaboration, that is, the partner type with whom the cooperation is formed, to better assess the costs and gains resulting from product innovation efficiency. Likewise, family managers must strive to overcome the shortcomings (e.g. limited absorptive capacity) that become apparent in the specific relations with collaborators. For example, whether the collaboration is with research organizations or customers, family managers would need to invest in human capital development to enhance their learning capabilities (Wu, 2012), to better recognize the value of new ideas arising from interactions with such collaborators. On the other hand, whether the collaboration is with suppliers, family firms would have to establish some kind of legal and contractual mechanisms (Lazzarotti et al., 2017), such as for example, confidentiality agreements, to avoid possible knowledge leakages and opportunistic behaviours.

Additionally, this study may also offer some important suggestions to policymakers for the design of new policies and incentives aimed at boosting product innovation efficiency in family firms. For instance, they should foster the development of collaboration relationships between family firms and different partner types by offering incentives for the SEW protection and should facilitate the access of family firms to new knowledge on this subject by strengthening family business' professional associations and networks (Aiello et al., 2020).

5.4. Limitations and future research

This study is not without its limitations; nevertheless, these offer new opportunities for future research. First, it relies on data from Spanish manufacturing firms. It could be argued that the political, economic, and cultural context of Spain may bring about possible biases regarding the effects of family involvement in TMTs and technological collaborations on product innovation efficiency, which affect the results. Future investigations could therefore replicate our study using sampling frames other than Spanish firms to extend the validity of the results.

Second, this study is quantitative in nature and relies on survey data. Although this enables us to check the study's hypotheses on a broad and representative sample, it further constrains the scope and kind of knowledge we can gather from the results. For example, we do not have specific insights about the ways in which technological collaborations interact with family involvement in TMTs to influence firms' product innovation efficiency. This precludes us from recognising the specific mechanisms that might explain why collaborations moderate the effect of family involvement in TMTs on product innovation efficiency. Since identifying these mechanisms could help to shed new light on the topic, future researchers should rely on qualitative research methods, such as direct interviews with TMT members (De Massis et al., 2015), to gain a better understanding of these mechanisms.

Finally, limitations with our database have made it impossible to capture key aspects such as family ownership, family CEO or gender diversity, which may shape TMTs in achieving innovation. For instance, since gender diversity contributes to enhancing social relations and developing an open working climate (Ruiz-Jiménez and Fuentes-Fuentes, 2016), it would be particularly interesting to examine how such diversity in family's TMT

may affect product innovation efficiency in a collaborative environment. Future investigations could also extend the study of gender diversity beyond TMT to all firm employees to determine how family firms' teams should be composed to boost product innovation efficiency.

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CHAPTER IV. THE IMPACT OF WOMEN ON FAMILY FIRMS' INNOVATION OUTCOMES

THE PRESENCE OF WOMEN IN PRIVATE FAMILY FIRMS' CORPORATE GOVERNANCE AND INNOVATION OUTCOMES

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THE PRESENCE OF WOMEN IN PRIVATE FAMILY FIRMS' CORPORATE GOVERNANCE AND INNOVATION OUTCOMES

Abstract

Despite the increase in the number of studies analysing innovation in family firms over the last decade, there are still a number of critical issues that are far from being resolved. One of these issues is related to the influence of women's presence in corporate governance structures on firms' innovation outcomes. In this light, the aim of the present chapter is to investigate whether the inclusion of women in private family firms' corporate governance structures, namely in the general shareholders' meeting, the top management team, and board of directors, influences firms' innovation. By applying regression analyses to a sample of 214 Spanish private family firms, the findings reveal that the presence of women in general shareholders' meetings and in top management teams has a negative and significant effect on innovation.

Keywords: women, corporate governance, innovation, family firms

1. Introduction

Innovation is the engine that drives businesses (Casado-Belmonte et al. 2021; Diéguez-Soto et al. 2016a). Innovation is widely recognised as the mechanism through which firms are able to make continuous breakthroughs that help them survive, grow faster, be more efficient and ultimately more profitable than non-innovators (Atalay et al. 2013; Martínez-Alonso et al. 2020b). Due to today's increasingly changing and competitive environment, shorter product cycles, and the potential for imitation, firms must innovate constantly to gain more sustainable competitive advantages (Gomes et al. 2011; Kotlar et al. 2014).

Family firms, defined as businesses "governed and/or managed with the intention to shape and pursue the vision of the business held by a dominant coalition controlled by members of the same family or a small number of families in a manner that is potentially sustainable across generations of the family or families" (Chua et al. 1999, p. 25), constitute the backbone of most of the world's economies (De Massis et al. 2018; Family Firm Institute 2018). In addition to their global economic attractiveness, there is also growing interest in recognising that family firms possess certain peculiarities that make them rather unusual compared to the rest of firms when it comes to innovation (Calabrò et al. 2019; Casado-Belmonte et al. 2021). One of these peculiarities concerns the complex but unique alignment of ownership, management and control that occurs in the governance systems of family firms (Goel et al. 2014). Accordingly, and because of the multiplicity of pursued goals and the evolving role of the family in the business, family firms need specific governance structures (Nordqvist et al. 2014). Notably, the various forms in which the family participates in the governing bodies of such firms has made them an advantageous environment for gaining competitive advantages that favour innovation (De Massis et al. 2016; Li and Daspit 2016; Matzler et al. 2015).

Among the most common and influential corporate governance bodies within family firms are the general shareholders' meeting, the top management team and the board of directors (Nordqvist et al. 2014; Suess-Reyes 2014). The general shareholders' meeting is a governance body that deals with legal issues, such as the designation of the CEO and directors, and is usually held once a year (Nordqvist et al. 2014). The top management team is a key body composed of the CEO and other executives and is primarily responsible for

adopting the firm's general decisions, establishing the goals to be achieved, and designing the means to achieve them (Ruiz-Jiménez and Fuentes-Fuentes 2016). Finally, the board of directors is a governance body whose main functions are exercising control, reviewing and evaluating the ideas of the top management team, assessing the CEO's performance or safeguarding the interests of the shareholders (Suess-Reyes 2014).

On the other hand, the incorporation of women into the labour market, and in particular into positions of certain responsibility, is becoming more and more prominent in today's business world (Informa 2021). All firms around the world are increasingly trying to be equitable when hiring employees (Schwab et al. 2020). Indeed, gender diversity, at all corporate levels, has been introduced as a major priority in the strategic agenda of most firms worldwide (Mariño-Garrido and Martínez-Romero 2020). Accordingly, academic and professional interest in exploring the incorporation of women into corporate governance structures is rising on a large scale (Deloitte 2017; Hernández-Ortiz et al. 2020), with particular emphasis on examining how women's presence in general shareholders' meetings, top management teams and/or board of directors influence firm outcomes (Amin et al. 2021; Fenoy-Castaño et al. 2021; Wu et al. 2021).

Despite the importance attached to the incorporation of women to corporate governance structures (Nájera-Vázquez and Martínez-Romero 2020), its effects on private family firms' innovation outcomes are almost non-existent to date (Casado-Belmonte et al. 2021; Scholes et al. 2021). Consequently, understanding how gender diversity influences innovation within family firms has become a crucial issue, as women's presence in corporate governance bodies brings certain advantages, such as greater creativity or problem-solving skills, which are key to successful innovation. With this in mind, this chapter aims to analyse the potential effects of women's presence in three corporate family firms' governance bodies (general shareholders' meeting, top management team and board of directors) on innovation. To analyse the relationships between women's presence in the different family firms' corporate governance structures and innovation, qualitative data from a survey provided by the Spanish Institute of Family Firms and the Spanish network of family business chairs, as well as economic-financial data from the Iberian Balance Sheet Analysis System, were used. Based on this information, a final sample of 214 Spanish private family firms was constituted. The obtained results reveal that the presence of women in general shareholders' meetings and in top management teams has a negative effect on private family firms' innovation outcomes.

The present study offers several contributions. To the best of the authors' knowledge, this is the first study analysing the influence of women's presence in three different corporate governance structures, i.e. general shareholders' meetings, top management teams and board of directors, on firms' innovation outcomes. Moreover, this is one of the few studies investigating gender diversity and innovation issues, by focusing exclusively on private family firms. Finally, this study contributes to the research avenue on the consequences of integrating women in the workforce and specifically, at the highest firm levels.

The chapter is organised as follows. First, a literature review is carried out, and three hypotheses are established. This is followed by the methodology section and a discussion of the obtained results. Finally, the conclusions section includes contributions, practical implications, as well as some limitations and future research directions.

2. Literature review and hypotheses

2.1. Presence of women in family firms' corporate governance structures

Family firms have become the lifeblood of the Spanish economy (IEF and Red de Cátedras de Empresa Familiar 2015; López-Delgado and Diéguez-Soto 2020). Family firms suffer from several limitations, such as the lack of division of power among the owners, or the lack of objective criteria when choosing the successors of the firm. According to a study conducted by the Spanish Institute of Family Firms and the Spanish Network of Family Business Chairs, the continuity of the family CEO is consensual in only 32.5% of the surveyed firms (IEF and Red de Cátedras de Empresa Familiar 2018). The data show that no objective criteria are applied in the election of management positions in 54.2% of the respondents, resulting in a high concentration of family members in the firm management (Gómez-Mejía et al. 2007; IEF and Red de Cátedras de Empresa Familiar 2018). In most cases, the governance and management structures of family firms are not sufficiently professionalised, as family succession makes the division of decision-making powers almost non-existent.

With regard to women's presence in governance bodies, it can be stated that in Spanish family firms, 28.8% of the managers are women (IEF and Red de Cátedras de Empresa Familiar 2018). Moreover, 21% of the CEOs are women. On average, 31.9% of family firms' boards of directors include, at least, a woman. In this vein, there is an overlap between

women's presence in top management positions and in boards, as recent studies reveal that the majority of firms with more than 40% female managers have women in their boards (Informa 2021). Finally, with respect to general shareholders' meetings, the body par excellence for the representation of ownership, the presence of women is similar to that of management bodies. Special mention requires the fact that the highest proportion of women is found in family-related bodies, i.e. in family governance mechanisms (Miller et al. 2013; Suess-Reyes 2014), such as the family council and family assembly. In general terms, the Spanish data are in line with the worldwide trend (Corporate Women Directors International 2019).

Nowadays, including women in the firms' workforce, and specifically in management and governance positions, is becoming an issue of utmost importance. Gender diversity, at all business levels, is a priority on the strategic agenda of most listed and unlisted firms (Mariño-Garrido and Martínez-Romero 2020). Moreover, United Nations has established gender equality as a sustainable development goal to achieve gender parity and empower all women and girls (United Nations 2021). Therefore, firms all around the world are trying to be equitable when recruiting employees (Schwab et al. 2020).

Women's presence in firms is associated with numerous advantages, such as a wider variety of perspectives (Hillman et al. 2002), more flexibility and motivation for team building (Bianchi-Martini et al. 2012), greater creativity and more new ideas and insights (Miller and Triana 2009), effective problem solving and enhanced capability (Galia and Zenou 2012).

More specifically, concerning the women participation in corporate governance structures, it can be stated that women lead to a better business environment, from an organizational, management and financial perspective (Fenoy-Castaño et al. 2021). Women in governance structures promote more effective global relationships, positively affecting firms and improving their reputation (Robinson and Dechant 1997; Zyglidopoulos 2003). Moreover, women tend to be more risk-averse, being more cautious about new strategies and demonstrating more restrained decision-making behaviour (Byrnes et al. 1999; Eckel and Grossman 2008; Mínguez-Vera and Martin 2011). In contrast, men tend to be more self-confident and more reckless (Huang and Kisgen 2013; Loukil and Yousfi 2016). The latter aspect has a direct influence on the lower presence of women in corporate governance

structures. However, there is general consensus that women's involvement in corporate governance offers new perspectives, experiences, knowledge, and activities that positively affect business development (Hillman et al. 2002).

With regard to women owners, and their presence in general shareholders' meetings, female shareholders have been found to exert a different role than men, as they are influenced by different individual, organizational, and resource-related aspects (Harveston et al. 1997). However, other authors failed to find significant differences between firms owned by women and firms owned by men regarding strategic processes (Cadieux et al. 2002). Special mention requires the study of Dumas (1998), who revealed that although women did not generally have substantial ownership, they have a strong presence in the firms.

Concerning women participation in TMTs, it is argued that they bring a different kind of social and human capital to the firm (Adler and Kwon 2002; Bass 2019; Miller and Triana 2009). Women usually exhibit leadership styles characterized by knowledge sharing, common values, good communications and high levels of inclusion (Eagly and Carli 2003; Powell et al. 2008; Scott and Brown 2006). Moreover, women in management promote the "out-of-the-box thinking" that leads to increase entrepreneurial activities (Hunter et al. 2012; Lyngsie and Foss 2017).

Finally, about women's presence in boards of directors, it can be stated that female directors present higher levels of sensitivity and take care of other people's welfare (Nielsen and Huse 2010), improve monitoring (Ben Rejeb et al. 2020), reconcile the interests of managers and shareholders (Lakhal et al. 2015), and enhance board deliberations of complex issues (Huse and Solberg 2006).

2.2. Presence of women in family firms' corporate governance structures and innovation

Up to now, extant literature on the effects of the presence of women in corporate governance structures is not conclusive (Maseda et al. 2021). Some studies indicate a positive relationship between gender diversity and firm outcomes, while others indicate a negative or even nonsignificant relationship (Miller and Triana 2009; Roberson et al. 2017).

When focusing specifically on firms' innovation outcomes, gender diversity literature has not yet found a consensus on how women's presence in corporate governance structures influences innovation-related activities. In the following paragraphs, we review the main existing contributions in this field (see Table 1 for a summary of these studies).

Table 1. Literature review on the influence of women's presence in corporate governance structures on innovation

Authors	Year	Sample	Type of firm	Innovation variable	Key findings
Miller, T.; Triana, M.C.	2009	432 US firms (2002-2005)	Listed	R&D intensity	Board gender diversity has a positive effect on innovation
Torchia, M.; Calabrò, A.; Huse, M.	2011	317 Norwegian firms (2005-2006)	Both Listed and Private	Organizational innovation	When there are at least three women on the board, their effects on innovation are positive
Bianchi-Martini, S.; Corvino, A.; Rigolini, A.	2012	69 Italian firms (2006-2010)	Listed	Investments in innovation	No relationship was found between the presence of women in the board of directors and innovation
Galia, F.; Zenou, E.	2012	176 French firms (2008)	Both Listed and Private	Product, process, marketing, and organizational innovations	Board gender diversity has a positive effect on marketing innovation, a negative impact on product innovation, and no influence on process and organizational innovations
Ruiz-Jiménez, J.M.; Fuentes-Fuentes, M.M.	2016	205 Spanish SMEs (2010)	Private	Product and process innovations	Gender diversity in the top management team enhances the effect of management capabilities on the implementation of product and process innovations
Chen, J.; Leung, W.S.; Evans, K.P.	2018	1,224 firms (1998-2006)	Listed	R&D and patents	Female board representation is associated with greater investment in innovation and a higher number of patents and citations for a given R&D expenditure
Nadeem, M.; Bahadar, S.; Gull, A.A.; Iqbal, U.	2020	10,334 observations from U.S. firms (2002-2018)	Listed	Product and process innovations	Board gender diversity is positively associated with environmental innovation
Hernández-Lara, A.B; Gonzales-Bustos, J.P.	2020	86 Spanish firms (2003-2017)	Listed	R&D and patents	The proportion of women on boards has a positive influence on innovation, and such influence becomes negative if the female directors belong to the family that controls the firm
Bannò, M.; Coller, G.; D'Allura, G.M.	2021	755 Italian firms (2018)	Both Listed and Private	Patents	The presence of female family members directors has a negative impact on innovation, and such impact is mitigated when there are at least three women on the board and/or they are president or vice president

Ain, Q.U.; Yuan, X.; Javaid, H.M.	2021	12,948 observations from Chinese firms (2008-2017)	Listed	Patent applications, invention patent applications, utility model patent applications and design patent applications	Board gender diversity has a positive effect on corporate innovation
Hernández-Lara, A.B.; Gonzales-Bustos, J.P.; Alarcón-Alarcón, A.	2021	67 Spanish firms (2003-2019)	Listed	R&D ratio	Gender diversity on corporate boards has a positive impact on R&D, and this positive impact is smaller if female directors have family ties to male directors
Wu, J.; Richard, O.C.; Triana, M.C.; Zhang, X.	2021	328 chinese firms (2008-2013); 245 UK firms (2008-2015)	Listed	R&D intensity	A high gender diversity in both the top management team and the board of directors (TMT–BOD gender diversity) has a positive impact on organizational innovation

Miller and Triana (2009) studied the mediating role of innovation in the relationship between board diversity and firm performance and found a positive relationship between board gender diversity and innovation. Similarly, Torchia et al. (2011) examined the link between gender diversity and organizational innovation and discovered that only when women constitutes a 'critical mass' within the board, i.e. if there are at least three females directors, their effects on innovation are positive. Bianchi-Martini et al. (2012) investigated the relationship between board diversity and investments in innovation and found that presence of women on boards did not influence such investments. Galia and Zenou (2012) studied the effect of board gender diversity on four types of innovations: product, process, marketing, and organizational. Results showed that female presence in the board has a positive effect on marketing innovation and a negative impact on product innovation. Moreover, no association of board gender diversity with process and organizational innovations was found. Ruiz-Jiménez and Fuentes-Fuentes (2016) showed that managerial capabilities are more influential in both product and process innovation when the top management team is more balanced in number of men and women. Chen et al. (2018) revealed that female board representation is related to higher innovation success, elucidating that firms with female board representation are likely to make more investments in innovation and obtain more patents and citations for a given amount of R&D expenditures. Nadeem et al. (2020) found that board gender diversity positively affects environmental

innovation and that this effect is more pronounced in less profitable firms and in environmentally sensitive sectors. Hernández-Lara and Gonzales-Bustos (2020) examined the influence of women on boards on innovation, comparing family and non-family firms. Results showed that the proportion of women on boards exert a positive influence on R&D and patents, but when these directors belong to the family that controls the firm, their influence is negative. Bannò et al. (2021) explored the impact of female directors on innovation in family firms and found that the female presence on the board has a negative effect on innovation. Furthermore, Bannò and colleagues also demonstrated that the above negative effect is mitigated when there are at least three women on the board and/or they are president or vice president. Ain et al. (2021) found that gender diversity on boards positively influences corporate innovation, proxied by innovation outputs such as patent applications, invention patent applications, utility model patent applications and design patent applications. Results also supported the notion that a 'critical mass' of female directors in the board is related to more innovation. In the same vein, Hernández-Lara et al. (2021) showed a positive relationship between board gender diversity and R&D. Nevertheless, these authors also found that such positive effect is lower if female directors have family ties to male board members. Wu et al. (2021) analysed the impact of women's presence in both the top management team and the board of directors on organizational innovation and found that innovation is greater when gender diversity is high in both governance bodies simultaneously. The prior studies reveal mixed and controversial findings concerning the impact of women's presence in corporate governance structures on firms' innovation (Nadeem et al. 2020; Torchia et al. 2011). Accordingly, and due to the importance of this research trend, more investigation is required, as reflected in recent calls for researching on the topic (Bannò et al. 2021; Hernández-Lara and Gonzales-Bustos 2020).

The review of the above articles has also provided us with the opportunity to identify potential reasons that might help explain the similar and different results that have arisen around the relationship between gender diversity in corporate governance structures and innovation. First, as shown in Table 1, studies on this topic tend to use primarily samples of listed firms. Given that information on board membership is available in listed firms, most of these studies have focused on analysing gender diversity in boards on innovation in quoted companies, revealing an overall positive trend. In contrast, little is known about how women's presence in top management teams and general shareholders' meetings influence

innovation. With regard to private firms, much less is known concerning how female participation in corporate governance bodies affects innovation. Second, innovation is a complex and multidimensional phenomenon (Martínez-Alonso et al. 2020a). As can be seen in Table 1, the impact of gender diversity in governance bodies has been analysed under a variety of innovation forms, which explains the wide diversity of results. Finally, the topic under study has been largely overlooked in the family firm field, with very few studies analysing the gender diversity-innovation relationship. This aspect is of great importance, as previous literature indicates that family firms have a special linkage between their management, ownership and governance structures (Berent-Braun et al. 2018; Chrisman et al. 2005), due to the family involvement within the firm, which makes them completely different from non-family firms when it comes to innovation (Calabrò et al. 2019; Casado-Belmonte et al. 2021). Hence, although there are arguments for and against the effect of women's presence in corporate governance on firms' innovation (Bannò et al. 2021; Hernández-Lara et al. 2021), little is known about how female presence in upper levels influences innovation within family firms.

Based on the literature review and above argumentation, we propose the following hypotheses:

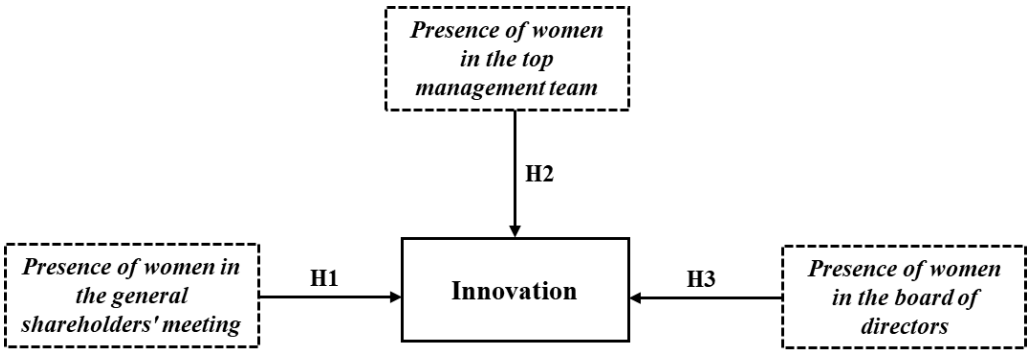
H1. The presence of women in general shareholders' meetings exerts an effect on innovation in private family firms.

H2. The presence of women in top management teams exerts an effect on innovation in private family firms.

H3. The presence of women in boards of directors exerts an effect on innovation in private family firms.

The conceptual model with the suggested hypotheses is shown in Figure 1.

Figure 1. Conceptual model and hypotheses



3. Data and methods

3.1. Sampling and data collection

The primary source of data for this chapter comes from a wider cross-sectional survey conducted during 2016 by the Spanish Institute of Family Firms and the Spanish Network of Family Business Chairs. This survey explores general business characteristics, as well as corporate governance, innovation, internationalization, and training issues in Spanish private firms. The information was collected by NEXO through telephone interviews and/or e-mails. The final response rate was 11.93%, with a sampling error of ±3.08, and p = q = 50%. The survey was answered by CEOs, executives, and managers, because their positions guarantee in-depth firm knowledge (Meroño-Cerdán et al. 2017). In addition, firm level information is drawn from the database Iberian Balance Sheet Analysis System (SABI) managed by Bureau Van Dijk, a secondary data source containing accounting and financial data of the analysed firms. By combining the two mentioned sources of information, an initial sample of 925 Spanish private firms was obtained. A restriction was applied to such sample to select only family firms. The criterion imposed on the data was that the percentage of family ownership was higher than 50% and that at least one family member was a regular member of the firm's corporate governance bodies (Chua et al. 1999; Graves and Thomas 2004). Moreover, the sample firms were required to have at least one of the following corporate governance bodies: general shareholders' meeting, top management team and/or board of directors. Hence, after applying these criteria and eliminating cases with missing values for the main variables, our analyses are based on a final sample of 339 Spanish private family firms. Additionally, by utilising two different sources of data, i.e. the SABI database and the survey, common method bias concerns is reduced (Podsakoff et al. 2003).

3.2. Measurement

3.2.1. Dependent variable

The dependent variable of this study, namely innovation, is measured in terms of product innovation. Product innovation occurs when a firm introduces completely new products or products with significant modifications, new functions, or variations in their design, presentation, materials or composition (Martínez-Alonso et al. 2019; Nieto and Santamaría 2010). Therefore, in line with previous literature (e.g. Ayllón and Radicic 2019; Un et al. 2010), product innovation is measured as a dichotomous variable that takes the value 1 when the firm obtains product innovation and 0, otherwise. The reasons why we focus on product and not on other types of innovation, such as patents or processes, are as follows. First, patents may potentially underestimate firms' innovativeness (Martínez-Alonso et al. 2020b), not only because of many firms are generally reluctant to apply for patents for fear that their new ideas will be appropriated (Deng et al. 2013), but also because they cannot afford the long time needed to go through the patenting process (Kalantaridis and Pheby 1999). Second, product innovation, compared to other types of innovation, such as marketing, organizational or process innovation, poses unique challenges for family firms (De Massis et al. 2015).

3.2.2. Independent variables

We have three independent variables that capture the share of women's participation in the family firm's governing bodies (Nájera-Vázquez and Martínez-Romero 2020): (1) the *presence of women in the general shareholders' meeting*, measured as the ratio of the number of women shareholders to the total number of shareholders; (2) the *presence of women in the top management team*, calculated as the division of the number of women managers by the number of total managers; and (3) the *presence of women in the board of directors*, measured as the ratio of the number of women board members to the total number of board members.

3.2.3. Control variables

In addition to the dependent and independent variables, we include several control variables to ensure adequate model specification and to consider possible alternative explanations. First, we control for *firm age*, calculated as the natural log of the number of

years since the firm's foundation, as younger firms are expected to be more involved in developing and implementing product innovations than more mature firms (Steeger and Hoffmann 2016; Tsao and Lien 2013). Second, we control by *firm size*, measured as the natural log of total assets, since larger firms tend to have greater potential to exploit economies of scale in production, finance and R&D than smaller firms (Deng et al. 2013; Sánchez-Famoso et al. 2017). Third, we control by *firm performance*, calculated as the ratio of earnings before interest, taxes, depreciation and amortisation to invested capital (Rojo-Ramírez 2019), given that it potentially influences the attitude of corporate governance bodies towards innovation (Ashwin et al. 2015; Bendig et al. 2020). We also control for two types of innovation, namely *process innovation* and *marketing innovation* (Estrada and Dong 2020). On the one hand, process innovation is a dummy variable that takes the value 1 if the firm has implemented any significant change in production or delivery procedures, and 0 otherwise. On the other hand, marketing innovation is a dummy variable that is operationalised as 1 if the firm has introduced new marketing methods, like changes in product design, packaging, placement, promotion, or price, and 0 otherwise. Moreover, since family CEOs appear to be more reluctant to innovate than their non-family counterparts (Kraiczy et al. 2015), we control for the presence of *family CEO* by using a dummy variable that takes the value 1 when the CEO is a family member, and 0 otherwise (Sánchez-Famoso et al. 2019). Finally, given that business sectors may have distinct levels of propensity to innovate, we also control for potential industry effects by including two dummy variables (*manu and cons)* that allow three important business lines to be distinguished: manufacturing, construction, and other sectors of the economy.

3.3. Modelling

To estimate the models and check our hypotheses with product innovation as the dependent variable, we utilize binary logistic regression analysis (Kleiner-Schäfer and Liefner 2021). Since product innovation has a dichotomous nature, ordinary least-squares regressions are not appropriate as they would give rise to unbiased estimators (Greene 2000). Therefore, this statistical technique will make it possible to comply with the proposed goal of analysing the influence of women's presence in corporate governance bodies on the likelihood of achieving product innovation.

4. Data analysis and results

This section presents the results of the empirical study. Table 2 presents the descriptive statistics (mean, standard deviation, minimum and maximum) of the analysed variables. The sample firms are on average 39.31 years old, with a minimum age of 2 years and a maximum age of 1,017. Therefore, these firms have a fairly high average age, which is a common characteristic of family firms. The average size of the firms in the sample, in terms of total assets, is 5,615.49 thousand euros and ranges from 48.87 to 252,926.58 thousand euros. On the other hand, the general shareholders' meeting stands out as the governance structure with the highest presence of women, with an average value of almost 40.95%; followed by the board of directors, with a women representation of 35.23%; and by the top management team, with a 31.42% women's presence.

Table 2. Descriptive statistics of the variables

Variables	Mean	SD	Minimum	Maximum
Product innovation	0.64	0.48	0.00	1.00
Firm age	39.31	77.33	2.00	1,017.00
Firm size	5,615.49	18,193.43	48.87	252,926.58
Firm performance	11.00	16.00	-153.00	105.00
Process innovation	0.51	0.50	0.00	1.00
Marketing innovation	0.57	0.50	0.00	1.00
Family CEO	0.91	0.29	0.00	1.00
Manufacturing	0.22	0.42	0.00	1.00
Construction	0.13	0.33	0.00	1.00
Presence of women in the general shareholder's meeting	40.95	93.56	0.00	100.00
Presence of women in the top management team	31.42	58.67	0.00	100.00
Presence of women in the board of directors	35.23	59.77	0.00	100.00

Notes: n = 339. SD = standard deviation

Table 3 reports the Pearson pairwise correlation matrix, which shows the significant (univariate) effects of the characteristics that are considered to influence product innovation. Firm size, firm performance, process innovation, and marketing innovation are positively correlated with product innovation. Construction is negatively correlated with the dependent variable. On the other hand, while the presence of women in the general shareholders' meeting is negatively correlated with product innovation, the presence of women in the top management team and in the board of directors shows no correlation with the dependent variable. Furthermore, the correlations between explanatory variables included in the same

model were not higher than 0.34, which is below the 0.80 threshold above which multicollinearity problems may arise (Gujarati and Porter 2008).

Table 4 presents the results for the effects of the presence of women in the general shareholder's meeting (Model 1), in the top management team (Model 2), and in the board of directors (Model 3) on product innovation within family firms. Model 0 only includes the control variables. This model provides a baseline against which to compare the rest of the models that also include the corporate governance variables. Model 0 shows that firm performance has a positive and significant influence on product innovation (β = 1.690; p < 0.01), implying that firms with higher performance levels can afford to take the risks associated with product innovation activities. Both process innovation (β = 1.221; p < 0.01) and marketing innovation (β = 1.134; p < 0.01) are positively and significantly related to product innovation. Moreover, the Cox and Snell R^2 is 16 %, the Nagelkerke R^2 is 23% and the model is significant (p < 0.01).

In Models 1 to 3, which are also significant (p < 0.01), both the Cox and Snell R^2 and the Nagelkerke R^2 increase with the inclusion of those variables capturing the presence of women in corporate governance bodies. Model 1 reveals that family CEO (β = 1.598; p < 0.05) exerts a positive and significant impact on the dependent variable, suggesting that family firms are more likely to develop product innovations when they have a family CEO. Model 1 also shows that the presence of women in the general shareholders' meeting (β = -0.004; p < 0.10) has a negative and significant effect on the dependent variable. Hence, hypothesis 1 is strongly supported.

In line with Model 1, Models 2 and 3 show that firm performance (β = 2.466; p < 0.01); (β = 2.187; p < 0.05) -respectively-, positively affect product innovation, although in Model 3 the effect is less significant in comparison to previous models. Thus, the relationship between firm performance and product innovation is very remarkable within the analysed models. Models 2 (β = 1.293; p < 0.01) and 3 (β = 1.252; p < 0.01) also reveal a positive and significant effect of process innovation with respect to product innovation, so it could be argued that these types of innovations are closely related. Similarly, Model 2 (β = 0.935; p < 0.01) and Model 3 (β = 1.448; p < 0.01) show that marketing innovation is positively and significantly related to the dependent variable. On the other hand, the positive effect of family CEO is corroborated in Model 3 (β = 0.748; p < 0.010), so that the

presence of family CEO positively affects product innovation. Concerning the variables of major interest in our study, the presence of women in the top management team (β = -0.004; $p < 0.10$) is negatively and significantly related to product innovation, while the presence of women on the board of directors (β = -0.003; n.s.) shows no effect on the dependent variable. Hence, the results support hypothesis 2 and reject hypothesis 3.

5. Discussion and conclusions

Family firms have played a crucial role in the incorporation of women into the workplace, mainly because of family ties, relationships, and values (Hernández-Lara and Gonzales-Bustos 2020; Loukil and Yousfi 2016). Family firms are the most representative type of business both nationally and internationally, constituting the backbone of most of the world's economies (Martínez-Alonso et al. 2020b). In Spain, family firms represent more than 88.8% of the business community, generate 60% of gross added value and account for 70% of private employment (IEF and Red de Cátedras de Empresa Familiar 2015, 2018). In addition, family firms have demonstrated a strong commitment to the environment and employment during economic crises (IEF and Red de Cátedras de Empresa Familiar 2018). Therefore, given that most of the Spanish economy is sustained by family firms, it is extremely interesting to focus on their contribution to R&D activities, as there are still important shortcomings in their specific innovation capabilities (Calabrò et al. 2019; Casado-Belmonte et al. 2021).

Today, more and more women are entering the labour market (Mariño-Garrido and Martínez-Romero 2020). However, the incidence of women’s presence in businesses’ outcomes still remains inconclusive (Fenoy-Castaño et al. 2021; Maseda et al. 2021).

Table 3. Pearson pairwise correlation matrix.

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Product innovation	1.000											
2. Firm age	-.013	1.000										
3. Firm size	.103***	.186***	1.000									
4. Firm performance	.126***	-.096***	-.012	1.000								
5. Process innovation	.340***	.069**	.160***	.077**	1.000							
6. Marketing innovation	.322***	.023	.095***	.005	.290***	1.000						
7. Family CEO	-.034	.021	-.104***	.053	.039	-.002	1.000					
8. Manufacturing	.032	.133***	.128***	.051	.181***	.017	.035	1.000				
9. Construction	-.126***	-.071**	-.034	-.087**	.158***	.089***	.036	-.205***	1.000			
10. Presence of women in the general shareholder's meeting	-.121*	.073	.014	.021	-.033	-.019	.040	-.035	-.042	1.000		
11. Presence of women in the top management team	-.048	-.029	.002	.072	.040	.075	.037	-.018	-.053	.955***	1.000	
12. Presence of women in the board of directors	-.049	-.036	.005	.066	.029	.044	.064	-.026	-.053	.975***	.955***	1.000

Notes: n = 339. *p < 0.10; **p < 0.05; ***p < 0.01.

Table 4. Binary logistic **r**egression analysis results

Variables	Hypotheses	Model 0	Model 1	Model 2	Model 3
Intercept		0.821 (0.704)	-0.671 (1.498)	0.054 (1.154)	1.200 (1.210)
Firm age[a]		-0.137 (0.120)	0.007 (0.277)	-0.137 (0.183)	0.042 (0.212)
Firm size[a]		0.095 (0.069)	0.221* (0.135)	0.148 (0.105)	0.039 (0.104)
Firm performance		1.690*** (0.543)	3.703*** (1.371)	2.466*** (0.936)	2.187** (1.103)
Process innovation		1.221*** (0.168)	1.200*** (0.354)	1.293*** (0.274)	1.252*** (0.286)
Marketing innovation		1.134*** (0.160)	1.562*** (0.348)	0.935*** (0.264)	1.448*** (0.282)
Family CEO		0.363 (0.283)	1.598** (0.691)	0.229 (0.392)	0.748* (0.433)
Manufacturing		0.204 (0.203)	0.373 (0.409)	0.524* (0.311)	-0.234 (0.357)
Construction		0.423* (0.232)	0.505* (0.566)	0.578 (0.415)	0.371 (0.429)
Presence of women in the general shareholders' meeting	***H1***		-0.004* (0.002)		
Presence of women in the top management team	***H2***			-0.004* (0.002)	
Presence of women in board of directors	***H3***				-0.003 (0.001)
Model *LR* x^2		76.636***	67.413***	71.700***	60.346***
Cox and Snell R^2		0.163	0.255	0.202	0.183
Nagelkerke R^2		0.231	0.359	0.284	0.250

Note. N = 339. Dependent variable = product innovation. [a]Natural logarithm used in regression analysis. [b]Other sectors of the economy represent the suppressed category. *p < 0.10; **p < 0.05; ***p < 0.01

Several studies have shown that the inclusion of women in firms within corporate governance structures, , specifically within corporate of women in firms, specifically can bring important competitive advantages due to, among other reasons, the richness of different experiences and points of view (Daily and Dalton 2003; Hillman et al. 2002), more flexibility and creativity (Bianchi-Martini et al. 2012; Miller and Triana 2009), and a higher quality working environment (Bilimoria and Huse 1997). In contrast, other authors argue that gender diversity does not seem to influence firms' strategic decisions, and consequently their outcomes, or may even have a negative impact on their performance (Galia and Zenou 2012; Sabatier 2015). Indeed, despite the adoption of important initiatives and increased legislation promoting the inclusion of women in corporate governance structures, the numbers still fall short of what is needed (Hernández-Lara et al. 2021; Martín-Ugedo and Minguez-Vera 2014).

In light of this contextual reality, we analyse how the presence of women in different corporate governance structures (general shareholders' meeting, top management team and board of directors) affects innovation within family firms. To test the proposed hypotheses, we construct a database based on a survey provided by the Spanish Institute of Family Firms and the Spanish Network of Family Business Chairs, and economic-financial data from the SABI database. Finally, we tested the hypotheses using a final sample of 339 Spanish private family firms.

The results obtained from hypothesis 1 and 2 showed that the presence of women in the general shareholders' meeting and in the top management team has a negative and significant effect on product innovation. Thus, it becomes clear that women's attitude tends to be more risk-averse, so they are more likely to protect the firm from any change that could entail potential losses or adversity for the normal development of the business (Fenoy-Castaño et al. 2021; Kulik and Metz 2017). On the other hand, the impact of the presence of women in the board of directors (hypothesis 3) was also negative, although not significant. In this sense, it could be argued that there are benefits derived from gender diversity within corporate governance, but sometimes these different views can break the firm balance (Sheridan et al. 2011).

Moreover, it is worthy to highlight that the distinct types of innovations analysed (product, process, and marketing) show a high and significant correlation with firm performance, which is of great interest for business strategies, as prior research emphasizes (Cruz-Cázares et al. 2013; Martínez-Alonso et al. 2019). These findings are also corroborated with the positive effect of firm performance on product innovation showed in all regression models.

Furthermore, the presence of family CEO has been found to be associated with a higher likelihood of obtaining product innovation. According to Model 1 and Model 3, there is a positive impact of family CEO on product innovation when women are involved on the general shareholders' meeting and on the board of directors, respectively. Accordingly, it is interesting to know which factors of the family CEO favour the adoption of innovation strategies. It is also worth noting that in many cases, the choice of successors is not objective (IEF and Red de Cátedras de Empresa Familiar 2018). The configuration of corporate governance bodies remains one of the main challenges in family firms, as it can be directly

related to greater firm profitability (Gómez-Mejía et al. 2007). It is quite common to find businesses whose CEOs' levels of education increase directly in relation to firms' size, due to the new requirements and challenges they face. For example, the implementation of successful business strategies is more frequent when there is previous university education, which encourages business diversification and innovation (Diéguez-Soto et al. 2016b). The entry into new markets and businesses, as well as the definition of medium- and long-term firm goals is related to greater business innovation and an increase in the profitability of the family firm (IEF and Red de Cátedras de Empresa Familiar 2018). Therefore, CEO training is one of the variables that determines business development (Lyngsie and Foss 2017).

5.1. Contributions

This study makes important contributions to the literature. To the best of the authors knowledge, this is one of the first studies analysing how the presence of women in *different* corporate governance structures influences the level of innovations undertaken in family firms. Up to now, most studies have focused on women's presence in boards (e.g. Miller and Triana 2009), some studies have put their attention on the presence of women in top management teams (e.g. Ruiz-Jiménez and Fuentes-Fuentes 2016), and no article is centred on women's presence in shareholders' meeting with regards to firm innovation. Our study advances prior research by investigating the effect of women's presence in three corporate governance structures, i.e. board of directors, top management team and shareholders' meeting, on firms' innovation outcomes.

Second, our study deals with private firms, while prior research is mainly focused on large public firms due to the better accessibility to their data (e.g. Hernández-Lara et al. 2021; Wu et al. 2021), so the results obtained to date are far from clear and remain controversial. Indeed, it is quite difficult to access to reliable (governance) data of private firms (Carney et al. 2015; López-Delgado and Diéguez-Soto 2015). With this study, we contribute to advance the knowledge of gender diversity on private firms (Lyngsie and Foss 2017). Moreover, not only do we focus on private firms, but in family firms, which account for the vast majority of businesses around the world (La Porta et al. 1999). Therefore, we also answer the call for further research on women's presence in family businesses (Beltrán-Gomez et al. 2019; Maseda et al. 2021).

Third, our study contributes to expanded prior research by centring its attention on the Spanish context. Since the mid-2000s, there has been a strong legislative movement in Spain to integrate women in the workforce and at the highest firm levels (Hernández-Lara et al. 2021). With this legislation, the women's representation in Spanish firms is increasing and thus, analysing their impact on firms' outcomes has acquire special relevance (Palá-Laguna and Esteban-Salvador 2016).

5.2. Practical implications

This study also raises some practical and social implications. Although our results reveal a negative effect of the presence of women in general shareholders' meetings and in top management teams on innovation, other branches of research show that women have a positive influence on the firm due to their stable and low-variability decisions. Hence, the role that gender plays in relevant strategic decisions is highlighted. Our results promote the reorganisation of corporate governance structures, or even encourage the study of the benefits of gender diversity in other business strategies such as diversification or internationalization. We thus hope that these findings can inspire a new path for the visibility of women within (family) firms and increase the number of women with important roles in upper-level positions. Furthermore, this study also aims to contribute to the Sustainable Development Goal 5 set by the United Nations, which seeks to promote gender equality and empower both women and girls. In doing so, this study aims to underline the importance of building a more inclusive corporate world in which men and women have equal opportunities to access the highest levels of business and any other type of organisation. Finally, this study also offers some implications for policy makers to implement policies and laws that promote gender diversity in the different corporate governance bodies of a firm to better harness the potential benefits that gender-balanced governance bodies bring to business operations.

5.3. Limitations and future research directions

This study suffers from some limitations. First, we have only estimated the presence of women in three family firms' corporate governance structures, without taking into account female participation in the rest of family firms' governance bodies, such as family councils or family meetings. Therefore, future research is encouraged to analyse the effects of the

presence of women in other corporate governance bodies (Suess-Reyes 2014). Second, measuring the presence of women is sometimes difficult due to their low representation in businesses, so the results may be biased. In the particular case of this study, the sample has been limited to Spanish family firms, so that the obtained results may vary depending on the country, geographical area or type of business analysed. Therefore, it would be interesting to conduct similar research using different samples, such as family firms from other countries or even listed family firms.

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CONCLUSIONS

1. Conclusions

As outlined in the introductory section, the overall objective of this thesis is to study the antecedents and consequences of innovation in the context of family firms. In particular, this thesis investigates how different issues related to corporate governance structures influence family firms' innovation strategies and, ultimately, the obtained performance outcomes.

To accomplish this general goal, we have summarized five research publications covering four specific objectives. The first objective was to provide an overview of the research field on family firm innovation, by identifying and synthesizing the key topics and by highlighting future research opportunities. The second objective was to examine the indirect effect, both in the form of moderation and mediation analyses, of technological innovation efficiency in the relationship between family management and firm performance. The third objective consisted of investigating the moderating role of technological collaborations on the relationship between family management and product innovation efficiency. Finally, the fourth target was to analyse how the presence of women in different corporate governance structures affects innovation in family firms.

In this regard, the first objective corresponds to the first publication of this thesis (chapter I); the second objective is related to the second and third publications (chapter II); the third objective coincides with the fourth publication (chapter III); and the fourth objective matches the fifth publication (chapter IV). Moreover, we have included the introduction and conclusion sections.

The conclusions reached for each specific objective are presented below. In addition, a section is dedicated to the contributions of this thesis. We also dedicate a section to the practical implications. Finally, we conclude by indicating the limitations of this thesis and the future research avenues to be considered.

1.1. Conclusions regarding the first specific objective

To achieve our first specific objective, we employed bibliometric techniques, based on performance indicators and science mapping. Specifically, we applied three different bibliometric techniques, namely co-author, co-citation and co-word analyses, on a

database consisting of 975 documents published in 458 journals by 2507 authors and covering the period 1987-2019. Our results revealed that:

- Interest in the research field of innovation in family firms is growing worldwide, with a total of 72 countries publishing articles on family business innovation issues.

- Three sub-periods are identified, (1) initial phase (1987–2004), (2) take-off phase (2005–2014) and (3) splendour phase (2015–2019). In this regard, the last sub-period shows an exponential increase in the number of publications and the number of citations, suggesting that research on family firm innovation is in a developing stream.

- The three most productive authors are De Massis A., Kotlar J., and Kraus S. Furthermore, the most productive author is also the author of the most influential article in this field, i.e. Innovation with limited resources: management lessons from the German Mittelstand, published in Journal of Product Innovation Management.

- The three specific family business journals, namely Family Business Review, Journal of Family Business Strategy and Journal of Family Business Management are the most productive journals in terms of family firm innovation.

- The co-citation analysis recognises four clusters based primarily on (1) entrepreneurship, (2) behavioural agency theory, (3) resource-based view and (4) agency theory, which constitute the pillars of the theoretical foundations and intellectual structure in the research field of family firm innovation.

- The co-word analysis identifies five thematic clusters, led by the following keywords: (1) family firms, (2) innovation, (3) socio-emotional wealth, (4) firm performance and (5) internationalization. The identification of these thematic clusters, in turn, allows for the establishment of future research lines.

1.2. Conclusions regarding the second specific objective

To carry out our second specific objective, we developed two different publications. In the first publication, we studied whether family involvement in management influences firm performance indirectly through technological innovation efficiency, and in the second publication, we analysed the interaction effect of technological innovation

efficiency in the relationship between family management and firm performance. Our results reveal that:

- Concerning the first publication, family involvement in management shows a beneficial impact on firm performance, measured as gross margin. Moreover, technological innovation efficiency fully mediates the relationship between family involvement in management and firm performance. Namely, technological innovation efficiency is crucial to achieve richer performance outcomes in family firms with an active participation of family members in the firm management.

- Regarding the second publication, family management exert a negative effect on firm performance, measured as return on assets. Moreover, technological innovation efficiency negatively moderates the relationship between family management and firm performance. In other words, technological innovation efficiency allows enhancing the family management-firm performance relationship.

1.3. Conclusions regarding the third specific objective

To achieve our third specific objective, we analysed the manners in which family involvement in top management teams (hereafter, TMTs) influences product innovation efficiency. Moreover, we also examined whether and to what extent collaborations with external partners, and more specifically, with suppliers, customers, competitors and research organizations, moderate the relationship between family involvement in TMTs and product innovation efficiency. We reached the following conclusions:

- Increased levels of family involvement in TMTs are positively associated with product innovation efficiency.
- Technological collaborations weaken the positive link between family involvement in TMTs and product innovation efficiency. This suggests that the underlying risks and costs of collaboration agreements could be greatly magnified by family managers when achieving product innovation efficiency, due to the greater families' concern for preserving SEW.
- Technological collaborations with suppliers, customers and research organizations weaken the family management-product innovation efficiency link. Moreover, research organizations emerge as the partner type that exerts the most

detrimental moderating effect, followed by customers and suppliers in order of importance.

- Technological collaboration with competitors does not moderate the family management-product innovation efficiency relationship.

1.4. Conclusions regarding the fourth specific objective

Finally, to accomplish our fourth specific objective, we explored the potential effects of women's presence in three family firms' corporate governance bodies (general shareholders' meeting, top management team and board of directors) on innovation. We reached the following conclusions:

- Women's presence in general shareholders' meetings and in top management teams has a significant negative effect on product innovation. Therefore, it seems that women's attitude tends to be more risk-averse, so they are more likely to protect the firm from any changes that could entail potential losses or adversity for the normal development of the business.

- The impact of women's presence in boards of directors on product innovation was negative, although not significant. Hence, although certain benefits might arise from gender diversity within corporate governance, sometimes these different perspectives can break the balance of the firm.

2. Contributions

As expressed below, the obtained findings contribute to the research field on family firm innovation in several ways.

First, we enrich the ongoing debate on innovation in family firms through an extensive bibliometric analysis to better understand the antecedents and consequences of family firm innovation, as well as the drivers of family business heterogeneity in carrying out innovation processes. Moreover, we provide an integrative framework to open an agenda to guide future researchers in this promising field. We also demonstrate that family firm innovation is becoming an increasingly hot topic that will continue to grow in the near future.

Second, we expand current family firm research on organizational outcomes by formally investigating technological innovation efficiency as a moderating and mediating variable in the family management–firm performance relationship. In doing so, we go beyond the conceptual framework that is limited to analysing the direct effect of family involvement in management on firm performance. Moreover, we identify family involvement in management as a critical resource for unlocking the potential of family firms to innovate efficiently. We also extend the innovation–performance relationship by providing empirical evidence that if family firms want to be competitive and thus improve their performance, they should be highly efficient in turning innovation inputs into innovation outputs.

Third, we add to the embryonic knowledge on technological collaborations in family firms by providing important insights into the role of collaborations as a contingent factor affecting the relationship between family TMT involvement and product innovation efficiency. Furthermore, we reveal that technological collaborations strongly influence family managers' SEW considerations to the point that such collaborations contribute to lowering firms' ability to efficiently converting innovation inputs into product innovations. We also show that technological collaborations exert differential moderating impacts on the family management-product innovation efficiency link, depending on the type of partner.

Finally, we extend knowledge on the topic of gender diversity on family firm innovation by providing a pioneering study on the influence of women's presence in three different corporate governance structures, i.e. general shareholders' meetings, top management teams and board of directors, on private family firms' innovation outcomes.

3. Practical implications

Several practical implications derive from this thesis, the most important of which are the following.

First, in view of the results presented throughout the thesis, it seems clear that family firms have peculiar corporate governance structures that favour the development and implementation of unique innovation strategies. Therefore, the role of family managers and the women's presence in the different governance bodies should be considered in

order to enhance innovation outcomes and ultimately, to improve family firm performance.

In this regard, from the bibliometric analysis we were able to establish that family managers can learn how innovation and family firm scholars seek to support family businesses by analysing different phenomena related to innovation issues. For instance, family managers should learn how to balance emotional and financial considerations when making innovative strategic decisions. The bibliometric analysis can also help consultants and practitioners to recognize those factors that can influence strategic choices in order to properly implement innovative projects.

Our findings also reveal that to enhance firm performance from technological innovation efficiency, family managers should foster the development of an innovative culture and mentality within the business to fully promote the generation of new ideas and exploit innovation potential. Likewise, policymakers and public authorities can also contribute to enhancing family firm performance by promoting specific initiatives and innovation plans that boost technological innovation efficiency, as these policies entails positive externalities for society.

Moreover, our study can help family managers to identify and address the distinctive constraints and opportunities that arise when operating in a technological collaborative context. Family firms that have greater family influence in the decision-making and that seek to improve their product innovations should carefully and constantly monitor the collaboration context, that is, the partner type with whom the cooperation agreement is reached, to better assess the gains and costs of product innovation efficiency.

Finally, although our results reveal a negative effect of women's presence in corporate governance structures on innovation, other branches of research show that women have a positive influence on firms' outcomes due to their stable and low-variability decisions. Therefore, policymakers should implement policies and laws that promote gender diversity in corporate governance bodies to better exploit the potential benefits that gender-balanced governance bodies bring to business innovation in family firms.

4. Limitations and future research avenues

Despite the promising results of this thesis, our study has some limitations, which, in turn, may provide fruitful future research avenues.

First, this thesis only focuses on Spanish firms, which is particularly appropriate for the research objectives of the thesis, but may limit the generalizability of the findings. Therefore, future investigations should be carried out in countries other than Spain to extend the validity of the results.

Second, although we have focused on the family presence in the firm's management, we have not considered the heterogeneity among these members. In this sense, future studies should analyse whether the investigated issues in this thesis are the same when in family firms, management team members of various generations, different ages, different family ties, and with different goals and values, coexist.

Third, since innovation is a complex multidimensional phenomenon, and family influence may create advantages in some areas of innovation and disadvantages in others, it would also be valuable to examine to what extent technological innovation efficiency, assessed in terms of different innovation inputs (e.g., R&D personnel) and innovation outputs (e.g., service innovations), might affect firm performance.

Finally, we have only estimated women's presence in three family firms' corporate governance structures, not considering female participation in the other family governance bodies, such as family councils or family meetings. Thus, future studies are encouraged to examine the impact of women's presence in other family governance structures.

Summarizing, the results of this thesis show that research on innovation in the family firm context has become a hot topic among academics, practitioners and consultants and is expected to continue to grow exponentially in the coming years. Our findings also indicate that technological innovation efficiency contributes positively to the relationship between family management and firm performance. Furthermore, our results disclose that the positive relationship between family involvement in TMTs and product innovation efficiency weakens as technological collaborations increase, and varies according to the

partner type with whom the collaboration agreement is established. Moreover, our findings reveal that women's presence in the general shareholders' meeting and in the top management team negatively affects product innovation.

Therefore, the present thesis offers valuable contributions to the family firm innovation field, addressing some of the issues raised as hot topics, such as innovation efficiency, technological collaborations and gender, and their effect on performance. In addition, this thesis provides interesting practical knowledge for the design of management policies in family firms.