



Innovation at the Heart: Unveiling the Strategic Mastery of Family Firms in Resource Management

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Abstract In the current business landscape, innovation is essential for companies to ensure their survival and competitiveness. However, innovation often requires substantial investments that may exceed a company's internal resources, leading businesses to seek alternative mechanisms such as technological collaboration with external entities and R&D investment. Research has shown that both strategies positively influence firms' innovation performance. However, the factors affecting organizational behaviour and outcomes are often overlooked. Family businesses, characterized by their unique ownership structure and intertwined financial and non-financial goals, are ideal for studying how these objectives impact innovation decisions. This study aims to determine whether technological collaboration and internal R&D expenditure have a greater effect on the innovation processes of family firms compared to non-family firms. Using data from 2,415 Spanish companies over ten years, this research contributes to the literature by integrating the socioemotional wealth perspective and demonstrating that family firms are better equipped to implement and benefit from these strategies to enhance innovation outcomes.

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Innovación en el corazón: revelando el dominio estratégico de las empresas familiares en la gestión de recursos

Resumen En el panorama empresarial actual, la innovación es esencial para que las empresas aseguren su supervivencia y competitividad. Sin embargo, la innovación a menudo requiere inversiones sustanciales que pueden exceder los recursos internos de una empresa, lo que lleva a las empresas a buscar mecanismos alternativos, como la colaboración tecnológica con entidades externas y la inversión en I+D. La investigación ha demostrado que ambas estrategias influyen positivamente en el desempeño innovador de las empresas. Sin embargo, los factores que afectan el comportamiento organizacional y los resultados a menudo se pasan por alto. Las empresas familiares, caracterizadas por su estructura de propiedad única y sus objetivos financieros y no financieros entrelazados, son ideales para estudiar cómo estos objetivos afectan las decisiones de innovación. Este estudio tiene como objetivo determinar si la colaboración tecnológica y el gasto en I+D interno tienen un mayor efecto en los procesos de innovación de las empresas familiares en comparación con las empresas no familiares. Utilizando datos de 2,415 empresas españolas durante diez años, esta investigación contribuye a la literatura integrando la perspectiva de la riqueza socioemocional y demostrando que las empresas familiares están mejor equipadas para implementar y beneficiarse de estas estrategias para mejorar los resultados de la innovación.

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1. Introduction

In today's business landscape, innovation has become paramount for companies to ensure their survival and competitiveness (Fontana & Nesta, 2009). However, innovation often requires substantial investments that may surpass a company's internal resources. Consequently, businesses often seek alternative mechanisms, such as technological collaboration with external entities and R&D investment, to bolster their innovation efforts (Cassia et al., 2012; Classen et al., 2012). Research has shown that technological collaboration positively influences firms' innovation performance, as measured by patents or joint inventions (Faems et al., 2005; Kang & Park, 2012; Kim & Song, 2007; Miotti & Sachwald, 2003). Additionally, internal R&D expenditure also has a positive effect on firms' innovation performance (Mate-Lordén & Molero, 2020; Nieto & Santamaría, 2010). However, these analyses often overlook the factors that affect organizational behaviour and outcomes (Aguilera et al., 2024). Given the importance of goal setting for predicting these organizational behaviours and outcomes, it is key to a detailed understanding of what factors affect organizations' decision to pursue a specific set of goals (Aguilera et al., 2024). One of the key factors that explain organizational behaviour is related to the corporate governance and ownership of the firms. Family firms are the most common type of company (Faccio & Lang, 2002). They are characterized by a unique ownership structure, and their organizational goals intertwine both purely financial objectives and non-financial ones. Thus, given their prevalence in society and their distinctive characteristics in setting objectives, we believe that this type of organization is ideal for studying how their goals can impact the decisions they make to enhance innovation (Cassia et al., 2012; Classen et al., 2012).

According to Gómez-Mejía et al. (2007), family firms are organizations that pursue both financial and non-financial goals. The socioemotional wealth (SEW) perspective (Gómez-Mejía et al., 2007; King et al., 2022) refers to these non-financial goals, which address the family's emotional needs, such as retaining family control and maintaining a strong family-firm identity. Thus, the preservation of SEW influences goal setting being these organizational goals closely tied to the organizational mission or purpose (Aguilera et al., 2024), but also to more operational issues related to their implementation. Therefore, on the one hand, we observe a blend of financial and non-financial goals within their overall utility function, as family managers are faced with balancing rational and emotional considerations

when setting goals and making decisions (Kotlar et al., 2020; Zellweger et al., 2013), and on the other, they possess greater capabilities to implement and achieve these goals because family firms exercises greater control over the constant monitoring of managers and the influence of processes within the organisation (Carney, 2005; Gedajlovic & Carney, 2010), due to the close relationship between the family and the business. Consequently, we believe that family firms are better equipped to integrate both technological collaboration and internal R&D expenditure into their objectives and implement them more effectively to achieve greater innovation outcomes.

Therefore, the main objective of this study is to find out whether these two factors - technological collaboration and internal R&D expenditure - would have a higher effect on the innovation processes of family firms in comparison with non-family firms. While various factors impact innovation performance, such as market conditions and regulatory environments, external technological collaboration and internal R&D expenditure were chosen due to their direct relevance to family firms' strategic decision-making and their potential for measurable innovation outcomes. They represent tangible and actionable strategies that family businesses can implement to drive innovation: external technological collaboration facilitates access to external knowledge, expertise, and resources crucial for innovation; similarly, internal R&D investment signifies a commitment to innovation within the organization, fostering the development of new products, processes, or services to enhance long-term competitiveness and sustainability. The database used to test our hypothesis was the "Survey on Corporate Strategies", where information on 2415 Spanish companies over 10 years (2006-2015) are available.

This article makes a significant contribution to the literature. Calabrò et al. (2019) and Röd (2016) emphasize the ongoing efforts to identify and comprehend the factors that influence innovation within family-owned businesses. This persistent call underscores the crucial role of innovation in sustaining the competitive advantage and long-term viability of family firms. These reviews underscore the necessity for a more comprehensive examination of how family dynamics affect the innovation outcomes within these enterprises. We contribute to the family firms literature by integrating the SEW (Aguilera et al., 2024; Davila et al., 2023; Kotlar et al., 2018) with the role of two factors—external technological collaboration and internal R&D expenditure—that impact innovation in family firms. The primary contribution lies in analysing how SEW, tied to the family's affective needs such as identity, family influence, and the perpetuation of the

family dynasty, influences family firms' responses to investments in innovation and technological collaboration compared to non-family firms, and how they apply and take advantage of these factors to enhance their innovation outcomes. Furthermore, the study also contributes to the innovation literature by demonstrating that family firms, due to their unique organizational goals aligned with their purpose and their capability for rapid implementation, are the entities best positioned to capitalize on these investments and collaborations with other stakeholders in terms of innovation.

The paper is organized as follows. The next section contains the theoretical reasoning that justifies our hypotheses. Section 3 describes the sample, the variables, and the estimation procedure. Section 4 summarizes the results of our empirical tests. The final section discusses the findings and conclusions.

2. Theoretical Framework and Hypothesis Development

According to Cilleruelo Carrasco et al. (2008), innovation is a systematic, multifactorial process originating from an idea, knowledge, or need. It encompasses both product and process changes, recognizing improvements, possessing practical applications, market and societal acceptance, and serving as a means to an end (OECD, 2005). Within innovations, a distinction can be made between product innovations (new knowledge is applied to design and develop new or improved products or existing products, Gopalakrishnan & Damanpour, 1997) and process innovations (new knowledge is used to implement new or improved production processes that reduce cost (Fagerberg et al., 2004)). For instance, for market entry, product innovations are usually more appropriate than process innovations, as they allow responding quickly to customer needs, increasing product quality and variety, and gaining market share ahead of competitors (Nieto & Santamaría, 2010). In turn, process innovations lead to improvements in production efficiency and cost reductions, thanks to investments in machinery or new technology to the search for greater flexibility (Cohen & Klepper, 1996). Therefore, product innovation is usually more critical than process innovation in achieving a competitive advantage. While process innovation reduces production costs, product innovation creates enhanced versions of existing products that customers perceive as having greater value. In addition, they often tend to be more striking, objective, and palpable to external stakeholders, such as customers, investors, and competitors, in contrast to process innovations. For this reason, in this re-

search we will focus only on product innovation. The innovation processes within family firms have been extensively studied by numerous researchers, leading to several systematic literature reviews aimed at unravelling the complexities of these processes. For instance, Calabrò et al. (2019) and Röd (2016) have conducted comprehensive reviews to identify the unique factors influencing innovation in family-owned firms. The persistent call to identify and understand these factors underscores the significance of innovation in maintaining the competitive edge and long-term sustainability of family firms. These reviews highlight the need for a deeper exploration of how family dynamics impact the innovation outcomes in these enterprises.

Among the important factors that can affect the innovation process in family firms, we will examine one external factor and one internal factor, both of which we consider to have significant influence on innovation. Regarding the external factor, we are going to study collaboration with other external agents aimed at innovation. This factor has been studied by authors such as Kim and Song (2007), Hoang and Rothaermel (2005) or Huang et al. (2011), who found a positive effect on product innovations. Also, many authors consider it to be one of the most efficient instruments for coordinating the innovation activity of companies (Hoang & Rothaermel, 2005; Schoenmakers & Duysters, 2006; Tripsas et al., 1995; Ulset, 1996; Von Hippel, 1988). Regarding the internal factor, we are going to study the internal R&D expenditure made by the company itself. It is particularly interesting for us to study this factor as many authors have concluded that internal R&D expenditure is positive for innovation (Nieto & Santamaría, 2010; Villagómez-Sánchez et al., 2019), and authors such as Villagómez-Sánchez et al. (2019) conclude that R&D generates higher revenues than any other innovation expenditure.

2.1. The effect of external technological collaboration on product innovation

Scientific-technological collaboration has been revealed as a hybrid mechanism for the coordination of resources for the promotion of research activities that lead to the formation of technological capacities and skills in organisations, a necessary condition for a better innovative performance (Galván, 2017; Teece et al., 1997; Veugelers, 1998). In our analysis we have categorized technological collaboration as an external factor due to its involvement with agents external to the company. Nevertheless, it's essential to note that such collaborations entail the utilization of resources not only from the external agent but also from the company itself, resulting in a hybrid combination of both. Hence, we con-

clude that technological collaboration represents a hybridization of external and internal factors. Companies decide to collaborate with each other to get the resources and capabilities that they cannot generate within themselves through the different types of learning or that they cannot obtain efficiently in the market (Das & Teng, 2000). To this end, they often help strengthen technology networks by entering into agreements with other technologically advanced companies, with research organizations, and by engaging with customers, suppliers and even competitors (Cuervo-Cazurra & Un, 2007; Nieto & Santamaría, 2007).

Researchers have found that firms use different types of R&D partners for different purposes (Teece, 1980). Firms that collaborate with customers are primarily looking for new ideas or ways to reduce the uncertainty associated with bringing innovations to market (Von Hippel, 1988). In contrast, partnerships with suppliers are often aimed at improving the quality of inputs or reducing costs through process innovations (Hagedoorn, 1993). Collaboration with competitors, on the other hand, is often motivated by potential synergy effects (Das & Teng, 2000) or by sharing R&D costs (Miotti & Sachwald, 2003). Finally, cooperation with universities and research institutes often pursues radical product innovations that may open up completely new markets or market segments (Monjon & Waelbroeck, 2003; Tether, 2002).

Regarding the literature on the effect of technological collaboration on firm innovation, we note that several authors find a positive relationship between technological collaboration and innovative performance (Faems et al., 2005; Miotti & Sachwald, 2003; Nieto & Santamaría, 2007). According to them, this effect is due to the fact that technological alliances boost the innovative capacity of the firm through the effective combination of the partners' resources and the exploitation of complementarities.

Similarly, other authors find that the importance of collaborative innovation stems from its positive effect on innovation performance, both at the collaboration level (Hoang & Rothaermel, 2005; Kim & Song, 2007), and at the firm level (Huang et al., 2011; Kang & Park, 2012; Keil et al., 2008; Lahiri & Narayanan, 2013; Mention, 2011; Sampson, 2005; Soh & Subramanian, 2014; Tomlinson, 2010; Vasudeva et al., 2013; Xie et al., 2016).

Therefore, we note that most of the literature supports a positive relationship between collaboration with external actors and innovation.

2.2. The effect of internal R&D expenditure on product innovation

The second factor to be studied is the company's own internal R&D expenditure. This is an internal factor, as it forms part of the internal structure of the company and can positively or negatively influence the results of innovation projects (Buesa et al., 2002; Campoverde et al., 2021).

In accordance with the definition provided by the Basque Statistical Institute (2012), internal R&D expenditure is expenditure on Scientific Research and Technological Development activities carried out within the company's Research Unit or Centre, regardless of the origin of the funds, during the reference year. Expenditure carried out outside the centre, but in support of internal R&D tasks, is also included.

Depending on the nature of the expenditure, a distinction is made between current and capital expenditure. Among current expenses, we distinguish between personnel expenses and other current expenses. About the former, they comprise the total remuneration of all types of personnel, including social security contributions paid by the company, with the exception of travel expenses, which are included in other current expenses. The latter correspond to small equipment and miscellaneous supplies; energy; maintenance and minor repairs; rental and cleaning of premises; purchase of services; remuneration proportional to the R&D activity of indirect personnel; and travel allowances. Excluded are actual or imputed depreciation and amortisation expenses. On the other hand, capital expenditure refers to gross capital investment in land, buildings, major capital works, inventories, plant and equipment, carried out during the reference period by the company for R&D activities, irrespective of the form of financing.

Attending to the effect of internal R&D expenditure on innovation in firms, it is interesting to mention the work of Nieto and Santamaría (2010), which analyses technological collaboration and innovation in technology-based companies. This study finds that the effect of innovation expenditure on innovation performance is positive. They find that internal development expenditures have a positive impact on the propensity to innovate in product innovation.

In the same vein, the work of Mate-Lordén and Molero (2020) obtains results that show that the investment of private resources in internal R&D has a positive effect on the technological performance (patents) of Spanish firms. In turn, the work of Villagómez-Sánchez et al. (2019) shows that innovation expenditures generate a positive effect on innovative performance, and the separation of these expenditures allows us to determine that R&D generates higher revenues than

any other innovation expenditure. Finally, [Love and Roper \(1999\)](#) find that the effect of R&D intensity on the number of new or improved products is highly significant and positive.

Thus, we observe that most of the literature shows a positive relationship between investment in internal R&D expenditure and innovation.

2.3. The moderating role of family ownership on the external technological collaboration and product innovation relationship

The Willingness Paradox in family firms describes a phenomenon where these firms, despite their ability to manage promising collaborative projects, are generally reluctant to open the product innovation process to the outside world. This paradox can be analyzed through the lens of the Resource-Based View (RBV), which argues that collaborations are valuable resources for overcoming barriers to innovation, exploiting synergies of resource complementarities between partners, and serving as an important source of competitive advantage for family firms' innovation ([Das & Teng, 2000](#); [Feranita et al., 2017](#)).

According to the RBV, collaborations enable family firms to overcome resource constraints that may be shaped by their governance structures. These collaborations are seen as a means to combine complementary resources between partners, resulting in synergies that can drive innovation. Therefore, from this perspective, collaborations should be viewed as a key competitive advantage for family firms, helping them innovate more effectively.

Nevertheless, the paradox arises when we observe that, despite recognizing the value of collaborations and having the capability to manage them, many family firms exhibit a marked reluctance to open their innovation processes to external actors ([De Massis et al., 2015](#)). This behavior can be influenced by several SEW factors specific to family firms, such as the desire for maintaining the family control. Family firms often have a strong desire to maintain control over their operations and key processes. Opening up the innovation process could be perceived as a threat to this control. Another example is the perceived risk associated with opening the innovation process, especially in terms of intellectual property and trade secrets. These characteristics can explain why, despite the potential benefits highlighted by RBV studies, family firms may be inclined to avoid opening their innovation processes. Allowing external actors, such as suppliers, to gain influence and control over the technological trajectory of products ([Almirall & Casadesus-Masanell, 2010](#); [De Massis et al., 2015](#)) could jeopardize their accumulated SEW. In fact, [Gómez-Mejía et al. \(2007\)](#) showed that, in order

to protect non-financial profits, family firms are willing to accept higher 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 sense, the preservation of SEW has been shown to be the fundamental reference point that drives strategic decision-making in family firms ([Zellweger et al., 2013](#)). Therefore, when making strategic decisions, family managers often face a balancing act between rational and emotional considerations, which overlap and sometimes compete with each other ([Kotlar et al., 2020](#)). This interplay of goals setting it has been found to condition family managers' behaviour with respect to seeking technology partnerships ([Classen et al., 2012](#)). Therefore, it can be observed how due to SEW, family firms develop a strong concern about possible losses of control ([Gómez-Mejía et al., 2007](#)), and these concerns can complicate collaborative relationships with external partners when open innovation implies a restriction of the firm's control over the technological path of the product ([Almirall & Casadesus-Masanell, 2010](#)).

Nonetheless, despite the aforementioned reasons that a priori lead family entrepreneurs to be more reluctant to collaborate technologically with other organizations, the existence of a significant body of research (e.g., [Arregle et al., 2007](#); [Eddleston et al., 2008](#); [Le Breton-Miller & Miller, 2015](#)) suggests that, drawing on attributes such as "long-term orientation" and "high level of social capital", largely stemming from stewardship theory, family firms might demonstrate a greater propensity to participate in collaborative innovation efforts aimed at enhancing SEW when compared to non-family firms. As a result, one could contend that this distinctive conduct might serve to mitigate to some extent the behavioural agency concerns related to risk aversion and the preservation of SEW in relation to the choice of participating in collaborative innovation initiatives.

Despite the contradictions found in the literature regarding the greater or lesser propensity of family firms to collaborate with other agents for research, what is clearer is that the family firm has a greater capacity to implement that new knowledge. Researchers determine that due to family members' unwillingness to lose control (e.g., [Gómez-Mejía et al., 2007](#)), resource constraints stemming from their governance structures and size (e.g., [Carney, 2005](#)), the distinctive aspects of their social capital (e.g., [Arregle et al., 2007](#); [De Massis et al., 2015](#); [Ireland et al., 2002](#)) and long-term orientation ([Miller & Le Breton-Miller, 2005](#)), collaborative innovation can be an effective means of overcoming barriers to innovation and an important source of competitive advan-

tage for innovation in family firms (De Mattos et al., 2013; Hitt et al., 2000; Sirmon et al., 2008). Thus, once the decision to collaborate is made, the implementation will be much more effective. The combination of a focus on long-term goals and a strong network of social connections contributes to the enhanced capacity to foster and cultivate successful, enduring relationships with stakeholders (De Massis et al., 2015; Miller & Le Breton-Miller, 2005) throughout innovation processes. This discovery is in line with earlier research suggesting that external social capital enhances the success of alliances and partnerships (Ireland et al., 2002). In addition, a notable competitive advantage of family firms is speed and agility in decision-making (Dodero, 2020). This is an advantage that is fundamentally provided by the vision and passion of the founder, who normally works very closely with customers adding value to the relationship through good products and excellent services. According to Poza (2007), this situation, i.e. the speed and agility of decision-making and the close relationship with customers, makes it easier for them to detect the needs of their customers before others, which allows them to take less time to bring new products to the market, and therefore to be more efficient in their innovation processes.

Therefore, considering that external collaboration is positive for the innovation of any company (Faems et al., 2005; Miotti & Sachwald, 2003; Nieto & Santamaría, 2007), and that family firms have a superior capacity to exploit their knowledge (Dodero, 2020; Poza, 2007), we believe that the use of external collaborations by family firms in their product innovation processes is greater, and we formulate the following hypothesis to test this:

Hypothesis 1 (H1). *The family firm positively moderates the effect of technological collaboration on the achievement of product innovations.*

2.4. The moderating role of family ownership on the internal R&D expenditure and product innovation relationship

According to Cirillo, Ossorio, and Pennacchio (2019), family involvement in ownership diminishes firms' allocation of resources towards research and development (R&D), posing a potential threat to both the established order and the familial well-being. Similarly, Choi and Choi (2015) observed a negative association between family ownership and R&D investment (Briano-Turrent et al., 2023). This observation is also corroborated by the findings of Chen and Hsu (2009), who, in their examination of a sample of Taiwanese firms, identified a negative correlation

between family ownership and R&D expenditure. Despite numerous studies indicating that family-owned firms tend to invest less in R&D, there is a body of research suggesting that they are proficient in managing resources efficiently, resulting in enhanced innovation outcomes. For instance, Chen and Hsu (2009) note that while reduced R&D investment in such enterprises may indicate a reluctance to undertake risky ventures over the long term, it could also signify that firms with substantial family ownership are adept at leveraging R&D resources effectively, thus requiring less R&D expenditure compared to those with minimal family involvement. Garcés-Galdeano et al. (2024) also show that family firms have faster decision making, which allows increasing the speed and intensity of efforts to identify and collect new knowledge. Therefore, the rapid recognition of an important project and the agile decision-making process enhance the return on investment in terms of innovation. Similarly, Durán et al. (2016) observe that family-owned enterprises allocate fewer resources to innovation projects compared to non-family firms. However, this observation does not imply inferior innovation capabilities among family-owned firms. Their meta-analysis of 108 primary studies from 42 countries indicates that family firms excel in resource utilization, effectively translating innovation inputs into tangible outputs.

It is worth mentioning that the results of the report "Family firms facing the challenge of innovation", prepared by Ernst & Young (EY) and the Institute of Enterprise (IE) Center for Families in Business in the year 2022, also support these results. According to this study, family firms manage innovation more efficiently. The report shows how efficiency in innovation management drops dramatically when the company is no longer controlled by a family group. On average, the efficiency ratio falls by 19 patents per million euros invested in R&D. In contrast, when the company becomes part of a family group, it is estimated to increase by eight patents per million euros invested in R&D expenditure.

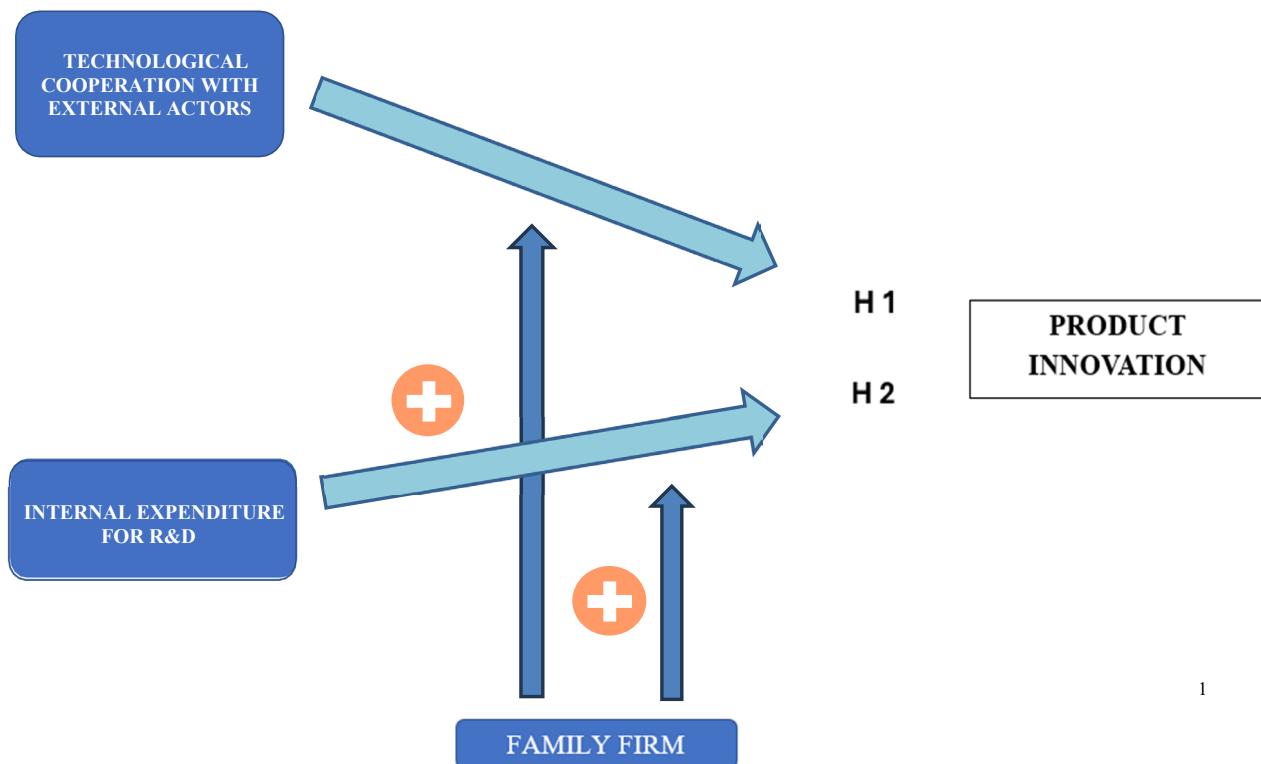
These findings collectively emphasize the intricate dynamics inherent in the innovation strategies of family firms and their skilful resource utilization. The concept of SEW plays a pivotal role in understanding the relationship between resource utilization and innovation within family firms (Fuetsch, 2022). Given that SEW encompasses the emotional needs of the family, such as identity, family influence, and the perpetuation of the family legacy (Miller et al., 2015) it becomes evident that family firms, driven by SEW considerations, excel in leveraging resources allocation efficiently for innovation initiatives. SEW provides family firms with a unique set of

motivations and values that guide their strategic decision-making processes. This emotional endowment encourages family firms to focus on sustainable, long-term goals, potentially influencing their approach to innovation (Gómez-Mejía et al., 2014; Le Breton-Miller & Miller, 2006). The adept resource utilization observed in family firms may be attributed to their ability to align innovation initiatives with the preservation of socio-emotional wealth, thus fostering a more balanced and strategic deployment of resources (Schmid et al., 2014). In essence, SEW acts as a guiding force, shaping the relationship between family firms, resource utilization, and their distinctive approach to innovation.

In view of these results, the second hypothesis aims to test whether the moderating effect of the family firm on the effect of internal R&D expenditure on the production of product innovations is positive. It seems that family firms invest less in R&D expenditure (Durán et al., 2016), but we want to verify that despite spending less, they make better use of this expenditure, in the sense that they are more efficient and obtain more products. To this end, the following hypothesis is formulated:

Hypothesis 2 (H2). *The family firm positively moderates the effect of internal R&D expenditures on the achievement of product innovations.*

Figure 1. Theoretical model



3. Methodology

3.1. Sample and data collection

In order to carry out this study we have used the information obtained from a database called Survey on Corporate Strategies (ESEE). This is a database that collects data obtained from a combined work of a governmental entity, the Spanish Ministry of Industry, and the State Industrial Holding Company (SEPI) Foundation. The latter is a Spanish foundation that aims to promote and

carry out economic and business studies. It also manages and promotes the university and management training process. So, it can be said that the data used in our analysis are objective in nature.

In order to be included in the sample, companies were required to show indicators of innovative performance and to be in the sample for the entire fiscal year in which the data were collected. Companies were also categorised as family or non-family, and were required to indicate a measure of company size. Accordingly, a final

sample has been obtained containing information on 2415 enterprises, ranging from micro enterprises (less than 20 employees) to large enterprises (more than 500 employees), over a time period of 10 years from 2006 to 2015.

From this database, information has been collected related to the innovative performance of the company, the funding they receive from different governmental entities and individual company characteristics such as company size, employment level and investment in R&D expenditure. The definition of a family firm within this dataset is based on self-assertion, i.e. a family firm is defined according to its own perception based on the founder, values and objectives. It can be said that the variables found in the ESEE are of valid use as they have been used in works such as the one carried out by [Máñez et al. \(2004\)](#) and [Pérez et al. \(2004\)](#).

3.2. Description of variables

To carry out the study, an econometric model has been created, which is composed of one dependent variable, two independent variables, one moderating variable and control variables. In the following, we will describe all of them, explaining the role they play in the model.

In order to measure the impact that the factors under study have on the product innovation processes of family firms, the dependent variable used is a dummy variable that takes the value (1) if the firm obtains product innovations, and the value (0) if it does not. In this way, it has been possible to study to what extent the aforementioned factors affect the probability of obtaining product innovations. This variable has been used in several studies such as the ones of [Campoverde et al. \(2021\)](#) or [Minguela-Rata et al. \(2014\)](#).

Regarding the independent variables, firstly, a qualitative variable has been introduced, which is composed of the sum of four dummy variables that collect information on different types of technological collaboration between companies. Therefore, it collects information about four types of collaborations, collaboration with customers, collaboration with suppliers, collaboration with competitors and collaboration with universities and/or technology centres. This variable can adopt a total of 5 values. If it adopts the value (0) means that the company does not engage in any kind of collaboration, if it adopts the value (1) makes one type of collaboration, if it adopts value (2) it makes two types of collaborations, if it adopts value (3) it makes three types of collaborations and, finally, if it adopts value (4) means that it carries out all types of collaboration. This variable has been included in the model with the intention of analysing whether the impact of technological collaboration on the

achievement of product innovations is significant, and whether this impact is positive or negative. This variable has been used by authors such as [Feranita et al. \(2017\)](#), [Nieto et al. \(2015\)](#) and [Campoverde et al. \(2021\)](#).

Secondly, a quantitative independent variable has been included in the model that captures the amount of internal R&D expenditure made by the companies, divided by the total number of employees of the company. This variable has been used also in works such as [Buesa et al. \(2002\)](#) or [Campoverde et al. \(2021\)](#). The unit of measurement used is thousands of euros. This variable has been included in the model with the intention of analysing whether the impact of internal R&D expenditure on obtaining product innovations is significant, and to see whether this impact is positive or negative.

In order to test the moderating effect, a dummy variable has been introduced which takes the value (1) in the case of being a family firm and the value (0) in the case of not being a family firm. This is a self-reported value that has been used in other works such as [Máñez et al. \(2004\)](#) and [Pérez et al. \(2004\)](#). It has been included in the model as a moderating variable with the intention of analysing the moderating impact of the family firm on the effect of technological collaboration and internal R&D expenditures in obtaining product innovations.

In addition, in order to test the hypotheses, it has been necessary to control for a number of individual company indicators that we believe may have an impact on their innovative performance. First, dummy variables have been included to determine to which type of industry the firms belong, distinguishing a total of 20 different industries. These control variables have been used similarly in works such as the one of [Huergo \(2006\)](#) or [Nieto and Santamaría \(2010\)](#). We consider it important to include these variables to avoid potential problems related to the industry to which these companies belong, as, for example, some industries tend to receive larger amounts of financial support than others ([Boter & Lundström, 2005](#)).

In turn, a variable measuring the total number of employees in R&D departments has been added with the intention of capturing the relative size of these departments and their impact on the firm's overall innovative performance ([Buesa et al., 2002](#)). Subsequently, to control for the factors in the environment in which a firm may operate, the variables Market Dynamism and the Number of Competitors in the Market, which control for dynamism and competition in the market of the sector to which the firms belong ([Schumpeter, 1942](#)), have been added. These variables have been also used by [Nieto and Santamaría](#)

(2010).

The last control variables used in the model are firm size, measured through the natural logarithm of the total number of employees (Cam-poverde et al., 2021), and the age of the enterprise, measured in years (Briano-Turrent et al., 2023). These variables allow an adequate control of the specific characteristics of the company.

3.3. Method of estimation

In this context, two indices, White (1980) and Breusch and Pagan (1979), have been employed to detect the presence of heteroscedasticity in the sample. Heteroscedasticity refers to the presence of non-constant variability in the errors of a regression model, violating one of the fundamental assumptions of Ordinary Least Squares (OLS). In classical linear regression, it is assumed that the variance of errors is constant across all levels of predictor variables. When this assumption is compromised, it can affect the efficiency and statistical validity of the estimates.

In our case, the results of these tests indicate the presence of heteroscedasticity, thus it is necessary to address this issue to obtain more efficient and valid parameter estimates.

The Weighted Least Squares (WLS) method is a technique that tackles the heteroscedasticity problem by adjusting the weights assigned to

each observation based on the variance of errors. The idea is to give more weight to observations with lower error variance and less weight to those with higher variance. This way, the disproportionate influence of observations with high variability on the estimation of model parameters is corrected.

In our case, the choice to use Weighted Least Squares is justified because this approach allows for more efficient and reliable estimates in the presence of heteroscedasticity, improving the validity of statistical inferences (Stanley & Doucouliagos, 2015; White, 1980). The weighting of observations is done according to the magnitude of error variances, so observations with greater precision contribute more to the estimation process.

4. Results

Descriptive statistics are shown in Table 1. It shows that the probability of having carried out some kind of collaboration during the 10 periods is almost 60% and the average investment per employee made by the companies in internal R&D expenditure was a total of 852,000€. In terms of obtaining product innovations, 17% of the companies studied obtained this type of innovation.

Table 1: Descriptive analyses and correlations

Variable	Mean	S. D.	1	2	3	4	
1. Product innovation	0.170	0.380	1				
2. Technological collaboration	0.593	1.030	0.420***	1			
3. Relativised internal R&D expenditures	852.420	2726.100	0.288***	0.407***	1		
4. Family business	0.417	0.493	0.015*	-0.037***	-0.020**	1	
5. Age of the company	29.100	19.900	0.097***	0.191***	0.120***	0.038***	
6. Ln (No. of employees in the company)	4.090	1.410	0.271***	0.499**	0.234***	-0.099***	
7. Relative total R&D employment	19.400	54.100	0.259***	0.368***	0.580***	0.005	
8. Market dynamism	0.177	0.707	-0.062***	-0.099***	0.070***	0.008	
9. Number of competitors in the market	0.112	1.280	-0.128***	-0.181***	0.088***	0.045***	
Variable			5	6	7	8	9
5. Age of the company			1				
6. Ln (No. of employees in the company)			0.303***	1			
7. Relative total R&D employment			0.060***	0.117***	1		
8. Market dynamism			0.012	-0.142***	-0.065***	1	
9. Number of competitors in the market			-0.107***	-0.281***	-0.081***	0.025***	1

(*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%.

Referring to the characteristics of the companies under study, it is noteworthy that 41.7% of them are family firms and their average age is around 30 years. It is also worth noting that the family firm shows a negative correlation with technological collaboration and internal R&D expenditure. That is, family firms are expected to collaborate less technologically and to invest less in internal R&D expenditure than non-family firms. These descriptive results are in line with studies such as [De Massis et al. \(2015\)](#), [Chen and Hsu \(2009\)](#), and [Durán et al. \(2016\)](#).

There is also a negative correlation between firm size, as measured by the natural logarithm of the total number of employees in the firm, and the family firm. This means that the family firm is generally smaller in size than the non-family firm. Finally, it is noteworthy that technological collaboration, internal R&D expenditures and family firm show a positive correlation with the variable “Product innovations”, so their effect on this variable is expected to be positive. Based on the results shown in Table 2, we will analyse whether the models presented support the two hypotheses (H1 and H2).

Table 2: Regression analyses

Variable	Model 1	Model 2	Model 3	Model 4
Technological collaboration	0.113 ***	0.010***	0.110 ***	0.101 ***
Internal expenditures	2.187e-05 ***	2.163e-05 ***	2.204e-05 ***	2.073e-05 ***
Family firm	0.001	0.018 ***	0.006 ***	0.019 ***
Seniority of the company	-4.577e-06	-1.885e-05	-4.134e-06	-1.869e-05
Ln (No. of employees in the company)	0.002 ***	0.002 ***	0.002 ***	0.002 ***
Relative total R&D employment	2.680e-04 ***	2.692e-04 ***	0.001***	2.639e-04 ***
Market dynamism	-1.043e-05	5.529e-05	-1.307e-06	5.644e-05
No. of competitors in the market	-0.001 ***	-0.001 ***	-0.001 ***	-0.001 ***
Technological collaboration *Family firm		0.029***		0.025 ***
Internal expenditure *Family firm			6.607e-06 ***	4.346e-06 *
Constant	-0.002	-0.001	-0.002	-0.001
R-squared	0.368	0.332	0.345	0.333
No. observations	11634	11634	11634	11634

(*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%.

Industry variables have been included in the regression but are not shown in the table.

Firstly, in model 1, we find it particularly interesting to note that the family firm individually does not show a significant positive effect on the achievement of product innovations. That is, we do not find significant evidence to determine that family firms, per se, obtain more product innovations than the rest of the firms.

Second, we observe that the effect of technological collaboration with external agents on the achievement of product innovations is positive and significant in all the models ([Faems et al., 2005](#); [Miotti & Sachwald, 2003](#); [Nieto & Santamaría, 2007](#)). Likewise, in model 2, the variable that captures the interaction between technological collaboration and the family firm also shows a positive and significant effect in all the models, so we conclude that the models presented support and confirm our first hypothesis (H1) where

the family firm moderates positively the effect of technological collaboration in obtaining product innovations. In other words, it is confirmed that family firms are able to take better advantage of technological collaborations than non-family firms, so that the impact of these collaborations on the increase of their product innovations is greater. This advantage can be attributed to the unique characteristics of family firms, such as the long-term orientation and high level of social capital. Both help to explain the superior ability to nurture and develop prosperous, long-standing relationships with the stakeholders ([De Massis et al., 2015](#); [Miller & Le Breton-Miller, 2005](#)). These traits enable them to quickly identify and respond to customer needs, thus accelerating the introduction of new products to the market. In essence, family firms manage knowledge more

effectively and can leverage technological collaborations with external partners more efficiently. Secondly, in model 1, we observe that the effect of internal R&D expenditure on product innovation is also positive and significant, as pointed out by authors such as [Love and Roper \(1999\)](#). In the same way, in model 3 the variable that captures the interaction between relativised internal R&D expenditures and the family firm also shows a positive and significant effect in all the models, allowing us to conclude that the models presented support and confirm our second hypothesis (H2) where the family firm moderates positively the effect of internal R&D expenditures on the achievement of product innovations. The confirmation of this hypothesis means that the family firm is more efficient in taking advantage of internal R&D expenditures than in non-family firms. For each unit invested, family firms achieve a greater increase in product innovations than non-family firms. This efficiency could be due to their particular characteristics, such as the agile strategic decision-making process ([Doderò, 2020](#); [Poza, 2007](#)), makes it easier for them to detect the needs of their customers before others, which allows them to take less time to bring new products to the market, and therefore to be more efficient in their innovation processes. In model 4, all interactions are shown, all of them maintaining the level of significance. In summary, the study highlights that family firms not only capitalize on technological collaborations better but also manage their internal R&D expenditures more efficiently, resulting in superior product innovation outcomes compared to non-family firms.

5. Conclusion

This study aims to determine whether technological collaboration and internal R&D expenditure have a greater effect on the innovation processes of family firms compared to non-family firms. Our results indicate that family firms benefit more from technological collaborations, achieving greater increases in product innovation compared to non-family firms. Additionally, our findings suggest that family firms are more efficient in managing internal R&D investments. This could be due to their particular characteristics, which give them competitive advantages that other firms do not have. Family firms have greater speed and agility in their decision-making, and they also have a close relationship with their customers ([De Massis et al., 2015](#); [Miller & Le Breton-Miller, 2005](#)). Both long-term orientation and high level of social capital help to explain the superior ability to nurture and develop prosperous, long-standing relationships with the

stakeholders. They can detect the needs of their customers before others, thus being able to be quicker in bringing new products to the market. In other words, they are able to manage knowledge better, and can therefore take better advantage of technological collaborations with external agents and R&D investment in terms of innovative performance.

Our results align with prior research indicating that family-owned enterprises may invest less in R&D compared to non-family firms, but this doesn't imply inferior innovation capabilities. Instead, family firms excel in optimizing resource utilization, effectively translating innovation inputs into tangible outputs ([Chen & Hsu, 2009](#); [Durán et al., 2016](#)) demonstrating that family firms manage innovation more efficiently.

5.1. Contributions

This article makes a significant contribution to the literature by addressing the ongoing efforts to understand the factors that influence innovation within family-owned firms, as highlighted by [Calabrò et al. \(2019\)](#) and [Röd \(2016\)](#). These studies emphasize the critical role of innovation in maintaining the competitive edge and long-term sustainability of family firms, thereby underscoring the need for a deeper examination of the unique dynamics affecting innovation in these enterprises.

Our research enhances the family business literature by integrating the concept of SEW ([Aguilera et al., 2024](#); [Davila et al., 2023](#); [Kotlar et al., 2018](#)) with the examination of two key factors—external technological collaboration and internal R&D expenditure—that drive innovation in family firms. The primary contribution of this study lies in analyzing how SEW, which encompasses the family's emotional needs such as identity, influence, and the preservation of the family legacy, shapes family firms' approaches to innovation and technological collaboration compared to non-family firms. Specifically, we explore how family firms leverage these investments to enhance their innovation outcomes.

Additionally, this study contributes to the broader innovation literature by demonstrating that family firms, due to their distinctive organizational goals and swift decision-making capabilities, are particularly well-equipped to maximize the benefits of investments in innovation and technological collaborations with external partners. This unique alignment of family firms' strategic objectives with their innovation activities positions them advantageously to exploit these factors for superior innovation performance.

5.2. Practical implications

Given that the results demonstrate family firms' superior ability to leverage collaborations and R&D investments, we recommend family firms to increase their technological collaborations with customers, suppliers, competitors, universities, and technology centres, and enhance their internal investments in R&D. These actions are supported by evidence showing that the unique characteristics and competitive advantages of family firms make them more efficient at managing financial and knowledge resources, translating these into new and improved products.

Furthermore, given the importance family firms place on preserving SEW to ensure the company's longevity for future generations, it is essential for them to adopt these practices to innovate and stay competitive in the market. Engaging in technological partnerships is particularly beneficial, as it provides a valuable means of acquiring funding and knowledge without the high risks and costs associated with private financing. By leveraging such collaborations, family firms can not only bolster their innovation capabilities but also fortify their position in the market, thereby ensuring long-term sustainability and succession planning.

5.3. Limitations and future research

Finally, we refer to the limitations we encountered in carrying out the study. In this regard, we must mention the limitations found with respect to the database used for the study. Firstly, it only collects information from 2006 to 2015, and unfortunately, we currently do not have access to the data for the update, so it would be interesting to study the same hypothesis in recent years. Furthermore, the database used only collects information about Spanish companies, so, if we wanted to check whether these conclusions also apply to family firms at the European and global level, it would be necessary to study companies from all over the world.

It is also worth noting that the database used does not contain information about the family generation in which the firm is located, whether the CEO is family member or not, or how the top management team of the family firm is composed. It would be interesting to study how these factors can influence innovation processes in these firms.

Finally, we have observed that family firms exhibit a commendable ability to optimize their connections with other enterprises and stakeholders, effectively utilizing their internal resources devoted to R&D. It becomes intriguing to delve deeper into the inquiry of whether these businesses are able to leverage additional forms

of public or external resources in a similar manner. Understanding their aptitude for harnessing such resources beyond their immediate network could shed light on the broader strategies employed by family firms in maximizing their overall competitiveness and innovation capabilities. This exploration may provide valuable insights into the holistic resource management practices adopted by family enterprises, contributing to a comprehensive understanding of their dynamic role within the business ecosystem.

Conflict of interest statement

Declaration of interest: none.

Ethical statement

The authors confirm that data collection for the research was conducted anonymously and there was not possibility of identifying the participants.

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Data availability statement

The data that support the findings of this study are available from the corresponding author, [L.G.G], upon reasonable request.

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