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FAMILY BUSINESS INNOVATIVENESS: A QUANTITATIVE ANALYSIS OF THE INDIVIDUAL AND COMBINED EFFECT OF SIZE, AGE/GENERATION AND FAMILY OWNERSHIP

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Abstract. No large-scale quantitative studies exist on how the complex characteristics of the firm affect the innovativeness of family businesses. Our study is the first to quantitatively examine how size, age/generation and family ownership individually and in combination affect the innovativeness of family businesses, using data from 56 countries. Firstly, we found that medium and large family businesses are perceived by potential successors as more innovative than small businesses; secondly, that the trend of family business innovativeness changes over time and generations according to the U-shape line; and thirdly, that the most effective family ownership in terms of innovativeness seems to be that with exactly 50%. These results were subsequently confirmed by testing the combined effect of the above mentioned three characteristics. In contrast, small family businesses in which the second or any subsequent generation is involved and which are minority or majority family-owned are perceived as the least innovative family businesses. Our findings can help public authorities in deciding how to allocate public funds, investors in deciding how to co-finance projects, and family businesses in defining development and innovation strategies for their growth.

Keywords: family business, family firm, innovativeness, business age/generation, business size, family ownership, one-way ANOVA, Kruskall–Wallis test.

JEL Classification: M21, O30, O32.

Introduction

Family businesses are an important form of enterprise in many economies worldwide (Cirillo et al., 2020). They play an important role, generating 50–90% of gross domestic product (Kenyon-Rouvinez & Ward, 2005) and employing about 60% of the world's population (Peráček et al., 2020). In general, it is estimated that nearly 85% of all private enterprises operating in the European market today are family-owned and family-run (Peráček et al., 2020). Family businesses (FBs) can be of any size, age, ownership structure and legal form. A typical

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characteristic of FBs is the long-term goal of passing the business with specific knowledge, experience and know-how on to descendants for the next generations (Nwuke et al., 2020). At the same time, they face a number of specific challenges, from strategic growth and succession planning to synchronising family and business goal (EFB, 2017; Zellweger, 2017). For such a business to survive as an economically active entity in the market, it must be able to sustain itself, be competitive and active and be attractive to the next younger generation. This means for them to be innovative (Ballal & Bapat, 2019; Lesáková et al., 2019).

According to various studies, innovation plays an important role in the survival of FBs. More innovative FBs have a higher chance of survival compared with those that are less innovative (Ballal & Bapat, 2019; Chan et al., 2019). *"Innovation is considered to be the vital cog in the wheel of family business and is the driving force behind long-term survival and sustainability of family firms"* (Ballal & Bapat, 2019, p. 317). They highlighted the importance of innovation in FB strategy, emphasising that FBs need to invest in innovation to ensure their long-term survival. This is especially true at a time when the millennial generation, characterised by their enthusiasm for innovation and technology, is becoming old enough to cooperate in the top management or overtake family businesses (Hidayati et al., 2020).

Although many studies have appeared in recent years dealing with the influence of specific firm characteristics on the success of established innovations, most of them have examined only one or two specific characteristics (Cucculelli & Peruzzi, 2020; Medase, 2020), had only a regional focus (Civelek et al., 2021; Wei & Chen, 2022) or focused on the comparison between FBs and non-FBs (e.g. Duong et al., 2022; Núñez-Cacho & Lorenzo, 2020). However, large-scale quantitative studies focusing on the influence of the complex characteristics of the firm on the innovativeness of FBs at cross-national level have received little attention in the literature (Pohjola & Koponen, 2012; Civelek et al., 2021).

This gap in literature still exists and represents an important area for future research. Our study focuses on investigating the influence of three business characteristics on FB innovativeness, both individually and in combination, using data from several countries. These characteristics are size, age/generation and family ownership. As our research sample, we used students with the potential to become successors of FBs. We did this because the millennial successors who are now at the age to take over the family business prefer to overtake the innovative companies. Therefore, the innovativeness of a FB could play an important role in their decision whether to continue with the FB (Holmberg-Wright et al., 2017).

Our study contributes to the literature in several ways. First, while there are many studies that compare the innovativeness of small and medium or large family firms versus non-family firms, we did not find any study in the literature that focused on the differences between the innovativeness of small, medium and large FBs. Therefore, as requested by Calabrò et al. (2019), we included the size of FBs in our selected characteristics. Second, by including generation in our selected FB characteristics, we agree, for example with Decker and Günther (2017), that the propensity to innovate is highest in the founding generation and tends to decrease in subsequent generations. However, we argue that the trend changes in the fourth generation and that the innovativeness increases again in the fourth and each subsequent generation. And third, as most articles on FB innovativeness refer to the geographical framework of US, European and Asian firms (Calabrò et al., 2019), we meet the demand for

cross-national research by examining the FB innovativeness from 56 countries all over the world. In this regard, readers could get a more complex overview of FB innovativeness from the perspective of the millennial generation.

In practice, our findings can help public authorities when deciding on the allocation of public funds and investors when deciding on the co-financing of projects. Public authorities should be aware that even if family businesses do not currently have a high level of innovation, this is likely to change once they are passed on to the next generation. Policy makers should therefore take into account all the benefits that family businesses generate and try to support them in passing on the business across generations. Furthermore, this study could help family businesses itself in defining development and innovation strategies for their growth and in terms of motivating the future generation to take over the business.

The study is divided into five main sections, which consist of several subsections. The first section deals with the theoretical background, the theoretical framework and the hypotheses. The second section describes the research methodology. The third section presents the results of the study, including the statistical part, followed by the fourth part that discusses the interpretation of results and discussion. The last part of the study concludes our paper.

1. Theoretical background and hypotheses

In this chapter, we first define the concept of innovation and then introduce the business characteristics that we examine in connection with the innovativeness of FBs. These are size, age/generation and family ownership.

1.1. Innovativeness

Innovation is defined in the Merriam-Webster's dictionary as '*the skill and imagination to create new things*' (Merriam-Webster, 2023). Subramanian (1996) stated that innovation is an integral part of strategy and is a characteristic of a particular organisation. Innovative organisations are those that exhibit stable behaviour over time. Because an objective measurement of innovativeness is very complicated, Subramanian (1996) proposed a multidimensional measure of innovativeness that includes the average number of innovation adoption over time, mean time of innovation adoption over time and the time of adoption of the innovation. He also showed that innovation is directly related to firm performance. The same conclusion can be found in the studies by Christa and Kristinae (2021), Schulze et al. (2022) and Kellermanns et al. (2012). Kellermanns et al. (2012) examined the relationship between family influence and FB performance. They particularly examined how the dispersion of ownership across generations, family involvement in governance and reciprocity among family members affect firm performance, whilst also considering the moderating role of innovativeness. They used subjective criteria of innovativeness to measure the degree of innovation. This type of self-reported performance has been used in many studies, not only because of the ease of access to the data, but also because subjective performance ratings are highly correlated with objective measures of organisational performance (Kellermanns et al., 2012). Therefore, we use the subjective assessments of innovativeness for our study as well.

This article, however, is not about the innovativeness measurement, but rather about observing the characteristics of FB in terms of innovativeness perceived by a potential next generation family member. A gap in the literature when it comes to identifying the specific combination of characteristics of FBs that are innovative exists; therefore, further research is required (Pohjola & Koponen, 2012; Civelek et al., 2021).

1.2. Characteristics of family businesses

FBs have some characteristics that make them a unique form of business. The strategies of FBs are usually based not only on the corporate goals but also on the family's objectives. Sometimes, family goals are more important and even carry more weight than the business goals. One of the most important family goals is to pass the business on to the family's descendants (Nwuke et al., 2020). In contrast to non-FBs, FBs are often not concerned with short-term goals and strategies but rather with focusing on long-term sustainability in the future. They often forgo their own consumption and reduce it for the benefit of their descendants. This desire to preserve the business for future generations and ensure family continuity leads family members to manage their capital effectively (Lim et al., 2010) and invest in research and development (R&D) for the long-term (Craig & Dibrell, 2006). This is linked to the effort to pass on knowledge and experience across all levels of the company (Bell & Pham, 2020; Huang et al., 2023).

According to Kinkel and Lay (2012), FBs are more inclined to enter into permanent employment relationships than short-term and fixed-term ones. Employee turnover has been found to be lower in FBs than in non-FBs (Nejman et al., 2021). This fact motivates employers (owners of FBs) to invest more in human capital. Investments in specific further education only pay off for entrepreneurs if employees stay long enough in the business to compensate for these investments. Further training and education then lead to a higher level of knowledge and subsequently to innovations, because the development of innovations is closely linked to the knowledge base of individual employees and specific skills and abilities that competitors cannot imitate. FBs can benefit from their special characteristics and focus on long-term sustainability. However, the innovativeness of a FB can change over time and generations (Núñez-Cacho & Lorenzo, 2020).

1.2.1. The age/generation of family business

FBs survive longer on average than non-FBs. This is mainly due to the intention of FBs to stay in the market for a long time and to pass the business on to the next generations (Nwuke et al., 2020). FBs are encouraged to find long-term strategic partners who can help them achieve better results for the future. At the same time, the FB's connection with the region and other businesses creates a close network of relationships with customers and suppliers, as well as the mutual exchange of knowledge through established formal or informal channels, which creates a starting point for innovation (Werner et al., 2013). The question is whether this situation encourages the company to use its position to develop innovations in the long-term or whether the lack of competition tends to have a negative effect over time (Gilbert, 2006).

New entrants are characterised by the willingness to take risks and the ability to promote their own ideas, which is also true for starting a FB (Weiblen & Chesbrough, 2015). The first generation of FB founders has the same innovativeness as the founders of non-FBs, which forms the basis for long-term business success when the business is passed on to the next generations. Some studies that compare FB with non-FBs used the equivalence of the generation period of about 30 years (Núñez-Cacho & Lorenzo, 2020). We also use this classification to further investigation in our study. The first generation, i.e. the founding generation, opens new markets because of its willingness to take risks, introduces new technological processes and forms the basis of the company structure. According to studies, however, the number of innovations introduced already decreases when the company is passed on to the second generation (Decker & Günther, 2017).

This fact can be explained by a number of factors (Beck et al., 2011). The first reason is that the founding generation is not prepared for the succession process to the second generation. The company is handed over but may not have the expertise and specific experience that is crucial for the company's innovativeness. The second reason may be a change in strategy, which is accompanied by a change in the new owner's attitude towards risk and investment in innovative projects. The second generation tends to consider the preservation of the company and its subsequent transfer as the most important goal (Werner et al., 2013). A conservative strategy should protect the values of the company, but not at the expense of stopping growth. Another reason may be that people prefer to invest in their own hobbies rather than in the interests of the business (Chrisman & Patel, 2011; Muñoz-Bullón & Sanchez-Bueno, 2011) or that they have no interest in running a FB in a particular sector. Although innovations in the second generation decrease compared with the first generation, FBs still seem to be more active than non-FBs because of their acquired position (Werner et al., 2013).

With the process of business succession to the next generations and with the addition of family members, cooperation in the FB becomes more complicated and at the same time, the innovativeness of the FB decreases from the third generation further (Werner et al., 2013). Beck et al. (2011) and Werner et al. (2013) assumed that the propensity to innovate is highest in the founding generation and tends to decrease with each subsequent generation. On the other hand, following generations usually have a higher level of education than their predecessors, which leads to a higher degree of innovativeness in the FBs of the later generation (Núñez-Cacho & Lorenzo, 2020). Furthermore, because of the future orientation of FBs, long-term investments in R&D are already made, which gradually produce results for other family successors. At the same time, long-term strategic relationships are established with partners, thanks to which the companies can achieve better results and remain on the market for many generations (Werner et al., 2013). Therefore, we formulate the hypotheses as follows:

H1: There are statistical differences in the innovativeness of the business depending on the generation that runs the business.

However, the innovativeness of a FB is influenced not only by its age but also by other characteristics. We further focus on the size of the business, which is, to some extent, related to age and to the ownership structure of FBs.

1.2.2. The size of family business

The size of a company can refer to the number of employees, annual turnover, total assets, annual revenue and other factors. Most commonly, however, firm size is measured by the number of employees (OECD, 2021), which we also use as a classification to further investigation in our study. Small and medium-sized enterprises (SMEs) generally achieve higher levels of innovativeness due to their flexibility, adaptability and ability to make quick decisions in response to market changes (Anning-Dorson, 2021). However, their disadvantages include narrow specialisation in a particular industry and often a lack of experience, human and financial capital, and time to plan and manage more complex projects (Khan, 2022; Vakulenko, 2021). The innovativeness among family and non-family SMEs is examined, for example, in a study by Classen et al. (2014). He concluded that family SMEs are more likely to invest in innovations than their non-family competitors. Comparing innovation outcomes with the investments made, FBs are able to make better use of these investments. However, the conclusions are different for large companies.

According to Krstić and Fedajev (2020), large companies are the driving force of the economy. They often have the financial resources to carry out innovative projects that lead to successful implementation, including legal protection from competition (Vakulenko, 2021). Because of their influential position, large companies influence their environment and generate positive externalities, i.e. innovations that can also be used by surrounding companies to improve their productivity (Léger & Swaminathan, 2007). The innovativeness of large FBs compared with non-FBs is addressed, for example, in Block et al. (2013) and Muñoz-Bullón and Sanchez-Bueno, (2011), who concluded that large FBs are less innovative than non-FBs. Chrisman and Patel (2011) agreed with this statement, adding that although the variability of their investments is greater, large FBs tend to invest significantly less in R&D than non-FBs.

Whilst there are a large number of studies dealing with this issue in the context of SMEs versus large FBs versus non-FBs, we have not found a study in the literature that deals with the differences between the innovativeness of small, medium and large FBs. Therefore, our hypothesis is that the size of the business plays a role in the innovativeness of the FB. The next hypothesis states:

H2: There are statistical differences in the innovativeness of the business depending on the size of the family business.

For the purpose of our study, we compare the business size according to the number of employees and divide the companies into three groups: small (1–49 employees), medium (50–249 employees) and large (250 or more employees) (OECD, 2021).

1.2.3. Family ownership of family business

Much research has already examined the link between ownership and leadership positions, which is relatively typical of a FB (Chung & Chan, 2012; Waldkirch, 2020). Unseparated leadership from ownership can lead to unseparated family and business finances. Most FB owners invest all their capital in the operation of the business and have no other resources left to expand their investment portfolio and undertake innovative activities. This is compounded by the FB's desire to retain ownership and control in the hands of family members, and

the resulting reluctance to invest in uncertain R&D, and unwillingness to take out the loans needed to invest in innovation for fear of losing independence. To maintain their own sovereignty, FBs rarely seek outside help (Oswald et al., 2009), which can lead to inadequate access to capital, limitations in innovation and a loss of position in the competitive environment (Duong et al., 2022). Chrisman and Patel (2011) added that whilst FBs' investments vary more compared with non-FBs, FBs tend to invest significantly less resources in R&D than non-FBs. We therefore assume that there is a relationship between the ownership structure of the company and its innovative strength. Family ownership can be a minority, i.e. less than 50%, exactly half, i.e. 50%, or a majority, i.e. more than 50%. The next hypothesis states:

H3: There are statistical differences in the innovativeness of the business depending on the type of family ownership of the family business.

In the previous subsections, we have described the influence of selected business characteristics on the innovative power of FBs separately, although many researchers have already dealt with this topic. However, as we have already noted, the influence of complex business characteristics on FB innovativeness has received little attention in the literature, despite the fact that the nature of the organisation and its characteristics are crucial for research on innovativeness (Pohjola & Koponen, 2012). Therefore, in our study, we decided to investigate the influence of selected characteristics (size, age/generation, ownership structure) in different combinations on the innovativeness of a FB. For this reason, the following hypothesis was formulated:

H4: There are statistical differences in innovativeness of the business depending on the characteristics combination (age, size/generation and family ownership) of the family business.

All hypotheses are illustrated in the analytical framework presented in Figure 1.

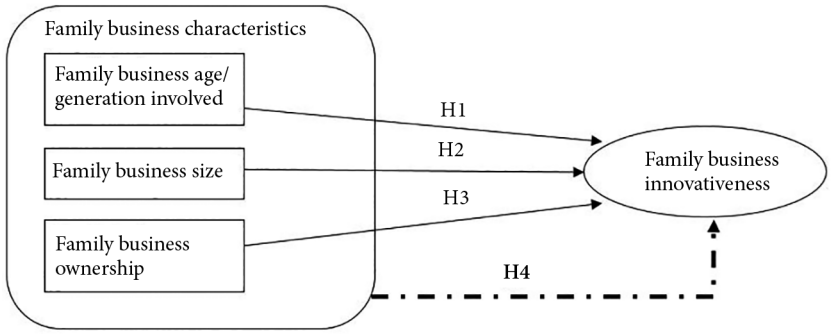

Figure 1. Analytical framework

In Figure 1, we see that the first three hypotheses examine the effects of age/generation, size and family ownership on the innovativeness of FBs individually. The fourth hypothesis focuses on examining the impact of the combination of the three characteristics above on the innovativeness of FBs. To test our hypotheses, we use data from respondents from 56 countries, as we describe in the next chapter.

2. Research methodology

This chapter describes the data collection, the procedure and research sample and the analytical approach used to evaluate our hypothesis.

2.1. Data collection

Family succession, i.e. the transfer of control in terms of ownership and management, is a crucial prerequisite for achieving the goal of transgenerational sustainability of a family business; however, it is also one of the greatest challenges for the continued survival of family businesses (Basco & Calabrò, 2017). Hidayati et al. (2020) found that millennial successors, who are now at the age of participate in the leadership of the company or taking over the family business, prefer innovative strategies compared to the others. Therefore, the innovativeness of a business is a condition that attracts young people to work in such businesses (Setiyani et al., 2020). For this reason, we decided to study the innovativeness of family businesses from the perspective of university students who are not yet involved in the business. Based on their own observations and perceptions of the business, these students can give us a very accurate assessment of the innovativeness of the business.

Data in this study come from the Global University Entrepreneurial Spirit Student's Survey (GUESSS). GUESSS is a large global research project that was launched in 2003 at the University of St. Gallen in Switzerland. In the following years, the project was gradually expanded to many other universities around the world. Today, GUESSS is one of the world's largest research projects on entrepreneurship and aims to understand the business plans and activities of university students by comparing them geographically and over time. Data are collected every 2–3 years using the same methodology, and the number of participating countries is constantly increasing. The survey is based on quantitative data collection through a questionnaire distributed via the internet to all students at selected universities. Although this is not a random selection of respondents, it allows for making some generalisations based on the analysis of a large amount of data collected over 20 years using the same methodological procedure. The survey is based on quantitative data collection through a comprehensive questionnaire. The questionnaire is divided into several sections to which students are directed based on their previous responses. These covers topics such as students' career choice intentions, own and nascent entrepreneurship, and family environment and family business succession. In each participating country, a responsible country team coordinates the data collection in that country. The authors' research team has participated for the last three consecutive years – 2016, 2018 and 2021 – as country team leaders for the authors' country. The last wave of data collection, which took place in spring 2021, reached a new record number. In total, 58 countries participated in the survey, and more than 267,000 completed responses were received (GUESSS, 2021).

2.2. Procedure and research sample

For this study, we used the data from the latest GUESSS 2021. As a research sample, we selected the students who have the potential to become successors of a FB. We did this because

the next generation of FBs are millennials, who usually strive for innovation and technology. Therefore, the innovativeness of a FB could play an important role in their decision whether to continue with the FB (Holmberg-Wright et al., 2017).

The sample of respondents was selected based on three criteria. The most important information we considered in selecting respondents was that at least one of the student's parents was self-employed and/or owned the majority of shares in business. The second criterion was that the students considered this business to be a FB. This criterion was developed following the essence approach for FBs, as there is still no generally accepted definition of the term FB (Steiger et al., 2015). This approach is based on the natural instinct to protect the family, which leads to a focus on the long-term sustainability of the business in the future rather than on making short-term profits (Zellweger, 2017). Thus, if the company sees itself as a FB, it also adapts its behaviour and the creation of plans for a successful handover to its own descendants (Mazzi, 2011). The third criterion, in contrast to Antlová et al., (2020), was the fact that the student did not work in the FB. This allows us to avoid the claim that the student is the source of innovation.

Once we had made these selections, we checked the data. We removed the rows with missing answers to the questions assessing the innovativeness of the FB, as well as the missing answers to the questions about the information about the business, including the year the business was established, the number of employees, and the family's ownership share. Finally, after checking the reliability of the data, we were able to analyse the data from 15,608 respondents from 56 countries.

The selected respondents in our sample consisted of 80.3% undergraduates and 12.8% graduate students. The rest of the students are in doctoral studies or other programmes. Most students are studying business/management (18%) or engineering (incl. architecture) (18%), followed by social sciences (14%) and human medicine/health sciences (13%). About 6% of our respondents study arts/humanities, as well as economics (6%) and law (6%). The rest of the students study natural sciences (5%), computer sciences/IT (4%), science of art (1%), mathematics (1%) or other (6%). All of these students indicated that at least one of their parents is self-employed and/or a majority owner of business and that they consider this business to be a "family business".

2.3. Analytical approach

After reviewing our data, we decided to follow on Núñez-Cacho and Lorenzo (2020), and analysed our data using one-way analysis of variance (ANOVA) followed by Tukey's test or the Kruskall–Wallis test followed by the Bonfferoni interval test. For the purpose of this study, we set 'innovativeness' as the dependent variable and three FB characteristics as the independent variables.

Following Kellermanns et al. (2012), we considered a subjective measurement of the innovativeness of FB from the perspective of the potential next generation to be the most appropriate instrument for our research. Therefore, the dependent variable "innovativeness" of the business was taken from the GUESSS questionnaire from the section on family business performance. The question was: *How do you rate the performance of your parents*'

business compared to its competitors over the last three years in the following dimensions: sales growth, market share growth, profit growth, job creation, innovativeness (1 = much worse, 7 = much better)? This question was developed and used by Sieger et al. (2014, 2016, 2021) following Dess and Robinson (1984) and Eddleston et al. (2008) and further used by e.g. Fragoso et al. (2023) and Gubik and Vörös (2023). For the purposes of our study, following Antlová et al. (2020), we only used the innovativeness assessment data to measure our dependent variable.

To test our hypothesis, we first checked for normality using a histogram and conducted the test for homogeneity of variance for each individual characteristic (age/generation, size and family ownership) as well as for the characteristics grouped together. Once data met the necessary assumptions, they were analysed with ANOVA (the case of H1 and H3) test proposing: *H0: all group population means are equal (i.e.* $\mu 1 = \mu 2 = \mu 3 = \ldots = \mu k$*).*

If the one-way ANOVA allowed us to reject H0, the Tukey post-hoc test was performed to compare the means of all groups and determine which groups were statistically different. If any of the assumptions of ANOVA were not met, we performed the Kruskall–Wallis analysis instead, followed by the Bonferroni interval test (the case of H2 and H4).

3. Research results

In this chapter we evaluate and present the results of our hypotheses. All results relate to FBs and innovativeness. By innovativeness we mean the subjectively perceived and evaluated innovativeness of the FB by the university students – potential next successors of the FB.

3.1. Innovativeness and company characteristics – family generation

For the purpose of this study, to test H1 and in line with the findings of the main literature reviews, we combined the values for firm age and generation. As mentioned in the theoretical background, similar with Núñez-Cacho and Lorenzo (2020), we assume the generation period to be equivalent to about 30 years. For this reason, we divided the companies from the survey into four categories according to the year of their foundation. In this way, we obtained four groups: the first, FBs up to 30 years old; the second, FBs between 31 and 60 years old; the third, FBs between 61 and 90 years old; and the fourth, FBs older than 90 years. We assume that firms founded between 2021 and 1992 are now run by the first generation; firms founded between 1991 and 1962 are run by the second generation; firms founded between 1961 and 1932 are run by the third generation; and firms founded before 1932 are run by the fourth or any subsequent generation. After testing for homogeneity of variance, Levene's test yielded a p-value of 0.526. Therefore, the ANOVA test was performed (see Table 1).

Table 1. One-way ANOVA Generation and Innovativeness

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	398.197	3	132.732	40.515	0.000
Within Groups	51 121.353	15 604	3.276		
Total	51 519.550	15 607			

According to the results of the one-way ANOVA analysis (Table 1), the innovativeness for the different generations was statistically significantly different: $F(3,15604) = 40.515$, $p < 0.05$. Subsequently, the Tukey test allows us to analyse in detail the differences between the four groups proposed. The differences between the groups are shown in Table 2 and Table 3.

As we can see Table 2 and Table 3, differences could be found between the enterprises run by first and second generation and between that run by the first and third generation. There is no statistical difference between the second and the third generation enterprises, between the second and the fourth or any subsequent generation enterprises and between the third and fourth or any subsequent generation enterprises. However, no statistically significant difference was also found between the first and fourth and further generations enterprises.

Table 2. Tukey test difference Innovativeness vs Generation

Dep. Variable:	Innovativeness			
(I) Generation	(J) Generation	Mean Diff. (I-J)	Std. Error	Sig.
first	second	0.356376*	0.033360	0.000
	third	0.274989*	0.066606	0.000
	fourth or any subsequent	0.179404	0.103358	0.305
second	first	–0.356376*	0.033360	0.000
	third	–0.081386	0.070132	0.652
	fourth or any subsequent	–0.176972	0.105665	0.337
third	first	–0.274989*	0.066606	0.000
	second	0.081386	0.070132	0.652
	fourth or any subsequent	–0.095586	0.120369	0.857
fourth or any subsequent	first	–0.179404	0.103358	0.305
	second	0.176972	0.105665	0.337
	third	0.095586	0.120369	0.857

Note: *The mean difference is significant at the 0.05 level.

Table 3. Homogeneous sub sets Generation and Innovativeness

Generation	N	Subset for alpha = 0.05	
		1	2
second	4108	3.92113	
third	795	4.00252	
fourth or any subsequent	316	4.09810	4.09810
first	10389		4.27751
Sig.		0.187	0.177

3.2. Innovativeness and company characteristics – family business size

To test H2, we grouped businesses into three categories according to the number of employees – the most commonly used measure according to OECD (2021). The first group included small FBs with 1 to 49 employees, medium-sized businesses with 50 to 249 employees and large FBs with 250 or more employees.

Levene's test p-value = 0.00. Therefore, we reject the hypothesis that the distribution of a categorical response variable is the same in each population and we cannot use the ANOVA test. Therefore, we applied the Kruskall–Wallis test to test the hypothesis that the medians of innovativeness are the same in all three groups, see Table 4.

The results of the Kruskall–Wallis test (Table 4) show that there is a statistically significant difference in innovativeness in the different size groups. We were then able to analyse the differences between the three proposed groups in detail using the Bonferroni test (Table 5).

Table 4. Kruskal–Wallis test: Size and Innovativeness

Total N	15 608
Test Statistic	194.613
Degree of Freedom	2
Asymptotic Sig. (2-sided test)	0.000

Table 5. Pairwise Comparison Bonferroni test Innovativeness vs Size

Smpl 1–Smpl 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
small-medium	–2451.266	180.839	–13.555	0.000	0.000
small-large	–2788.408	311.866	–8.941	0.000	0.000
medium-large	–337.142	356.774	–0.945	0.345	1.000

Note: [a] Significance values have been adjusted by the Bonferroni correction for multiple tests.

As we can see Table 5, differences could be found between small and medium-sized enterprises as well as between small and large enterprises. There is no statistically significant difference between medium-sized and large enterprises.

3.3. Innovativeness and company characteristics – family ownership

To test H3, respondents were asked to choose one of three options to the question "What is the ownership that is in the hands of your family". The possible answers were as follows: 0–49% (minority owner); 50%; and 51–100% (majority owner). After Levene's test (p-value = 0.397), a one-way ANOVA test was conducted (see Table 6).

According to the results of the one-way ANOVA (Table 6) analysis the innovativeness was statistically significantly different for different family ownership: $F(2,15605) = 34.868$, $p < 0.05$. Subsequently, the Tukey test allows us to analyse in detail the differences between the three proposed groups (see Table 7 and Table 8).

Table 6. One-way ANOVA Family ownership and Innovativeness

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	229.209	2	114.604	34.868	0.000
Within Groups	51 290.341	15 605	3.287		
Total	51 519.550	15 607			

The post-hoc test (see Table 7 and Table 8) indicates that there is a significant difference in innovativeness between the minority family-owned businesses and the 50% family-owned businesses, and between the majority family-owned businesses and the 50% family-owned businesses. There is no statistically significant difference between minority- and majority-owned businesses (Table 8).

Table 7. Tukey test difference Innovativeness vs Family ownership

Dep. Variable:	Innovativeness			
(I) Family ownerhip	(J) Family ownership	Mean Diff.(I-J)	Std. Error	Sig.
0–49%	50%	–0.242491*	0.054548	0.000
	51–100%	0.099583	0.043171	0.055
50%	0–49%	0.242491*	0.054548	0.000
	51–100%	0.342074*	0.041230	0.000
51–100%	0–49%	–0.099583	0.043171	0.055

Note: *The mean difference is significant at the 0.05 level.

Table 8. Homogeneous sub sets Family ownership and Innovativeness

Family ownership	N	Subset for alpha = 0.05	
		1	2
51–100%	11176	4.10147	
0–49%	2094	4.20105	
50%	2338		4.44354
Sig.		0.083	1.000

3.4. Innovativeness and company characteristics – combination

According to the previous results and to test H4, we grouped some of the company characteristics together. The generations are divided into three groups: "first generation", "second/third generation" and "fourth or any subsequent generation". The size is divided into two: "small" and "medium/large". The variable "family ownership" was divided into three groups: "0–49% (minority owner)", "50%" and "51–100% (majority owner)". The combination of these characteristics results in 18 different types of companies (see Figure 2).

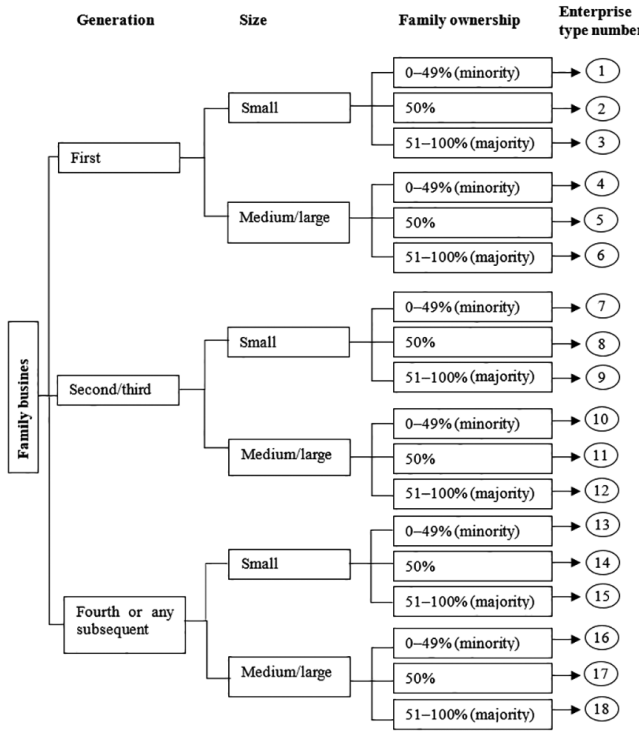

Figure 2. Company characteristics combination

Since Levene's test for homogeneity of variance yielded a p-value of 0.00, we applied the Kruskall–Wallis test (see Table 9).

Table 9. Kruskal–Wallis test: Company characteristics combination and Innovativeness

Total N	15 608
Test Statistic	524.453
Degree of Freedom	17
Asymptotic Sig. (2-sided test)	0.000

Results of the Kruskall–Wallis test (Table 9) showed a statistically significant difference in the innovativeness of the different groups. Therefore, we applied the Bonferroni test. The assessment of the innovativeness according to the combination of company characteristics is shown in Figure 3.

Since the Bonferroni test includes 153 comparisons, we comment only on the most important results. In Figure 3, we see that as the most innovative family businesses are perceived those medium/large FBs that are 50% family owned and run by the first (company type No. 5) or fourth or any subsequent generation (No. 17). We found a statistically significant difference between company type No. 5 and all other company types, with one exception – company type No. 17. However, there were not enough companies in the sample of company

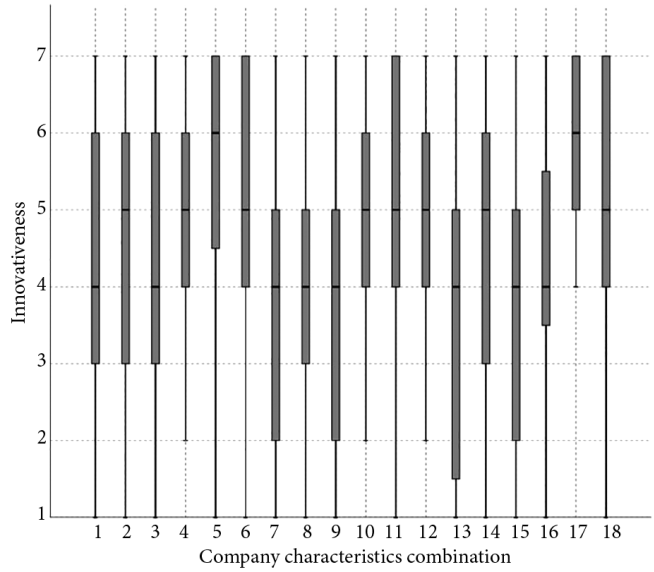

Figure 3. Innovativeness within company characteristics combination

type No. 17, so there is no statistically significant difference when comparing with other groups. Small family businesses, on the other hand, in which the second/third or fourth or any subsequent generation is involved and which are minority or majority family-owned (company types no. 7, 9, 13, 15 – see Figure 2), are perceived by potential successors as the least innovative family businesses (see Figure 3).

4. Interpretation of results and discussion

Innovations are seen as a driving force for entrepreneurship, including FB. They play an irreplaceable role in the entrepreneurial activities that lead to maintaining competitiveness and prosperity of the enterprise in the market (Xiong et al., 2021). However, many factors influence the innovation activity of an enterprise. Although a number of studies have been conducted on this topic over the past decades, no unanimous answer has been found to the question of how the various firm characteristics and family involvement influence the firm's innovativeness. What some of the researchers see as a demonstrable strength for innovativeness, other authors see as the opposite. Research on the innovativeness of FBs has expanded considerably in recent decades, especially in European countries (Germany and Switzerland), Canada, the USA and some Asian countries. Most of them focus on comparing the innovativeness of FBs with that of non-FBs or focus on only assessing the innovativeness of FBs based on few criteria and only compare businesses from one or two selected geographical areas. This could be the reason why individual studies have controversial results.

Therefore, in our study, we examined in detail the influence of three business characteristics – size, age/generation and family ownership – on the innovativeness of FBs, both individually and in combination. According to our findings, the youngest businesses in which

the first generation is involved and, on the other hand, the oldest businesses in which the fourth or any subsequent generations are involved are more innovative than those of the second or third generation. Weiblen and Chesbrough (2015) and Werner et al. (2013) claimed that the second or third generation is afraid of risking the loss of capital resources acquired through the work of the family's predecessors. Moreover, this result is in line with previous findings that the willingness to innovate is higher in the founding generation and tends to decrease with each subsequent generation (Beck et al., 2011; Werner et al., 2013). However, as the company ages, the number of its long-term strategic relationships with partners also increases. Therefore, as these companies age, they are able to achieve better innovativeness and remain in the market for many generations (Werner et al., 2013). The U-shape form of innovativeness line according to generations was confirmed in our study.

Other results emerged when we examined the second characteristic – size. We found that small FBs with up to 49 employees are less innovative than medium and large FBs with 50 and more employees. This claim is consistent with (Krstić & Fedajev, 2020) assertion that large firms are seen as initiators of innovation activities. Jeng and Pak (2016) also agree with this statement and add that, on the contrary, small firms even lag behind medium-sized firms in a competitive environment. As a final characteristic, we examined the influence of family ownership on the innovativeness of FBs. FBs are usually reluctant to hire external employees because they want to keep ownership in the family and avoid conflicts of interest (Beck et al., 2011; Werner et al., 2013). Although we found that the share of family ownership significantly affects the innovativeness of the firm, we found no difference in innovativeness between minority- and majority-family-owned firms. Since the minority and majority ownership is of opposite meaning, we kept all three ownership categories for further research.

The combination of the above-mentioned characteristics resulted in 18 different types of companies (see Figure 2), which we then analysed in terms of their innovativeness. According to our results, medium or large businesses that are exactly 50% family-owned and run by the first or fourth and any subsequent generation are perceived by potential successors as the most innovative FBs, which is consistent with our individual results. In contrast, small FBs involving the second/third or fourth or any subsequent generation and which are minority- or majority- family-owned are perceived by potential successors as the least innovative FBs.

Conclusions

This study arose from the identified gap in the literature on the question of which combination of FB characteristics has the best impact on FB innovativeness. Although many studies have appeared in recent years on the topic of the influence of specific business characteristics on the success of established innovations, most of them have only examined one or two specific characteristic, had only a regional focus or have mainly focused on the comparison between FBs and non-FBs. Therefore, we respond to calls for cross-national research by conducting a large-scale quantitative study focusing on the influence of perceived innovativeness of FBs. To do this, we use a research sample of 15,608 university students from 56 countries who have the potential to become FB successors. We chose university students as our research sample because the next generation of family business owners are millennials,

who typically seek innovation and technology and are sensitive to this issue. Since the students in our sample are not yet involved in the business but are at a stage where they are thinking about becoming part of the business, the innovativeness of a FB could play an important role in their decision whether to continue with the FB. Therefore, they can very accurately assess the innovativeness of the business based on their own observations and perceptions of the business. Understanding how individual characteristics and their combination influence FB innovativeness could therefore have important implications for FB strategy and innovation management, in terms of motivating the future generation to take over the business.

As a next contribution of our study, contrary to most studies, we argue that innovativeness does not decrease with each successive generation working in the firm. However, we claim that innovativeness increases again from the fourth generation onwards. Therefore, we encourage public authorities, when deciding on the allocation of public funds, and investors, when deciding on the co-financing of projects, to think of the long-term plans and to support FBs.

However, this study has some limitations that need to be taken into account when concluding the results. The first limitation concerns the assessment of innovativeness compared with competitors, which is based on the respondents' own perceptions. However, self-reported performance data are usually correlated with objective performance. Second limitation is that our sample includes only university students, whose parents own FBs, and are therefore considered as potential successors. Access to this data allowed us to analyse more than 15 thousand responses, which is considered a sufficient sample size. However, we can expect that the understanding of innovativeness might change by focusing on a group with a lower level of education or with a different relationship to the company. Therefore, we encourage researchers to replicate our results with other categories of respondents (e.g. FB owners, FB employees, etc.). Third, after reviewing our data, the conditions for a regression analysis were not met. Therefore, the study did not use complex statistics, but tested each variable separately. And finally the last limitation, considered to be the major, limitation of this study, is that only three business characteristics were taken into account when comparing the different types of businesses. Some other significant characteristics of FBs, such as family involvement in management, family relationships and the type of government of the FB (owner-manager, sibling partnership/cousin consortium or family enterprise), as well as the industry in which the FB operates, were not considered in our study. This should be taken into account in future research.

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Author contributions

All authors have contributed significantly to this research in all phases and sections.

Disclosure statement

The authors declare that they have no competing financial, professional, or personal interests that relate to the research described in this paper.

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