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# SME AND INNOVATION IN AUTOMATION: THE INFLUENCE OF FAMILY GOALS

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***Abstract***

***Purpose.*** The paper examines whether, on the basis of Socio Emotional Wealth (SEW), family SMEs differ from non-family firms in their propensity to innovate in automation.
***Design/methodology/approach.*** Built on SEW, we hypothesise that family firms, especially SMEs, differ from non-family SMEs, in two needs: (a) the care for their employees and (b) the preservation of the image and reputation of the family and the firm in the community. The empirical analysis is based on a sample of 3,618 Italian SMEs and adopts the two-stage procedure proposed by Heckman (1976, 1979).
***Findings.*** Consistent with the SEW perspective, family SMEs are less inclined to innovate in automation.
***Practical and Social implications.*** The evidence of this study could be used to design policies that promote the innovation and application of automation by helping family SMEs to evaluate the positive and negative aspects and to overcome any resistance due to the influence of socio-emotional endowment on strategic decisions. From a managerial point of view, the critical issues that family SMEs face when deciding to innovate in automation are highlighted.
***Originality of the study.*** For the first time it is analysed how much family involvement affects the strategic decision to innovate in automation in SMEs by applying SEW.

## 1. Introduction

Automation technologies, such as artificial intelligence, big data and robotics, are spreading rapidly worldwide (Schwabe and Castellacci, 2020) and becoming essential for organisational survival as a source of competitive advantage (Acemoglu et al., 2020). In particular, literature recognises innovation in automation as a very important strategic decision, especially for most small and medium-sized firms (SMEs) (Ballestar et al., 2020). Moreover, since SMEs represent 99% of all businesses in the EU (EU Commission), research on the context of SME and innovation is quite relevant.

Innovation enables firms to compete and survive (Aziz and Samad, 2016; Udriyah et al., 2019) and has become an integral part in value creation for many industries (Hitt et al., 1996; Olson et al., 2006). At the same time, due to its negative consequences, automation is receiving increasing attention in the literature. Indeed, while automation technologies can increase firms' productivity (Bessen and Righi, 2019; Acemoglu et al., 2020), they can decrease firm employment (Bonfiglioli et al., 2020; Jung and Lim, 2020), as well as negatively affect employees' satisfaction and well-being (Schwabe and Castellacci, 2020). These aspects mainly lead both to economics and non-economic goals. However, if literature posed emphasis on the economic consequences of innovation in automation, research analysing both the influence of the non-economic and economic consequences of automation on the propensity to innovate is lacking. The presence of this gap takes momentum if we consider the impact that non-economic aspects have on the strategic decisions of family firms. Family firms still remain the most relevant part among the SMEs (Rondi et al., 2020)

To fill this gap, we aim to understand for the first time how much family involvement affects the strategic decision to innovate in automation in SMEs by considering the socio-emotional wealth (SEW) (e.g., Gast et al., 2018). SMEs present certain peculiarities with respect to the management-ownership structure and management models: the overlap between the family system and the firm system is particularly high (Sciascia et al., 2013) and can impact the strategic decision to innovate (Rondi et al., 2020; Überbacher et al., 2020). Thus, research on the context of SME on innovation in automation is quite relevant. From another point of view, family firms are generally defined as small- or medium-sized firms that are owned and controlled by one or a group of families. While family SMEs may be encouraged to innovate in automation because they can achieve an increase in firm productivity and thus enjoy a competitive advantage, they may be reluctant to do so because of the negative non-economic consequences of automation. In particular, the decrease in firm employment and in the satisfaction and well-being of employees may lead to the disappointment of key stakeholders (in particular, employees) and thus the risk of souring

the relationship with them. It is therefore believed that the choice to innovate in automation for the family is, in other words, driven by two needs of a socio-emotional nature: the care for employees with particular regard to their level of satisfaction and well-being; and the pride in building and maintaining the image and reputation of the family and the firm. In this study, we aim to understand whether, due to the presence of these two needs and the preservation of the SEW, family SMEs innovate less in automation than non-family firms.

To address the research question, from a theoretical perspective we draw on previous findings from the literature on automation (Koch et al., 2019; Acemoglu et al., 2020; Schwabe and Castellacci, 2020) by re-reading them from the SEW perspective. From the empirical point of view, instead, we exploit a database of 3,618 Italian SMEs (both family and non-family ones) that have or have not innovated in automation.

This study contributes to the literature on automation and family firms. First, we show that automation is influenced also by non-economic aspects that the family involvement in the firm implies. Second, we advance the knowledge of the strategic decision-making process of family firms, considering the case of innovation in automation. A more detailed discussion of the contributions to the literature is offered in the conclusions.

## 2. Theoretical background

### *2.1 Family SMEs and innovation*

Family firms operate with the aim of preserving their SEW (Gómez-Mejía et al., 2007; Jiang et al., 2016). Family firms thus pursue, in addition to financial objectives and business goals, non-economic objectives focused on family values and needs (Cennamo et al., 2012; Chrisman et al., 2012; Miller and Le Breton-Miller, 2014; Nordqvist et al., 2008). These goals may dominate economic ones (Kotlar and De Massis, 2013). In particular, on the one hand, being a family within a firm implies management that takes into account issues, values and preferences of family members through their involvement (Ibrahim et al., 2001; Gómez-Mejía et al., 2007). On the other hand, the awareness of "being a family" outside the firm means operating while preserving relationships with stakeholders (Berrone et al., 2012).

Family managers are stewards and act in trustworthy, collectivistic, and pro-organizational ways (Neckebrouck et al., 2018). Due to the overlap between ownership and management, they are intrinsically motivated to care about the welfare of the firm and tend to be deeply embedded in its socioeconomic context (Gómez-Mejía et al., 2011).

The literature on family SMEs confirms this evidence and report how

families in SMEs desire to continue the firm for the next generation (Mahto et al., 2014; Rondi et al., 2020) and to favour family goals over business goals (Koiranen, 2003).

Long-term orientation is one characteristic of family firms (Chua et al., 1999; Miller and Le Breton-Miller, 2006). Especially in sfamily SMEs, leaders plan to pass on the firm to heirs within the family (Miller and Le Breton-Miller, 2006). For this reason, they work to create a successful firm in the long run building long-term relationships with stakeholders (Zellweger et al., 2012). Particular attention is devoted to their employees, who are considered as an extension of the family (Marler et al., 2021).

Indeed, the unique SEW configuration of family SMEs (e.g., differences in the intensity of family control, identification, binding social ties, emotional attachment, and dynastic succession) (Harms et al., 2009) has a strong effect on how these firms manage technological innovations (Gast et al., 2018).

While innovation is a source of competitive advantage (Aziz and Samad, 2016; Udriyah et al., 2019), it also involves risks and uncertainties and significant financial and human resources (Chrisman et al., 2015). The literature on innovation in family SMEs provides interesting results that need to be advanced focusing, according to a recent call, to understand how and under what conditions family ownership influences innovation of family SMEs (Kellermanns et al., 2012; Gast et al., 2018). Family SMEs are more risk-averse and have less innovative behaviour (Craig et al., 2014; Mahto and Khanin, 2015; Rondi et al., 2020). Family SMEs create innovations with lower economic and technological importance compared to their non-family counterparts (Block et al., 2013; Kotlar et al., 2013). Differences are mainly due to the affective value family owners derive from their firms (Carnes and Ireland, 2013).

In summary, based on the literature on the topic, it is believed that the SEW framework provides relevant insight in order to predict the influences of the family goals on the decision to innovate and in particular to innovate in automation.

### *2.2 Innovation in automation: positive and negative aspects in light of the SEW*

The decision to innovate in automation is particularly difficult given that automation technologies are associated with both negative and positive consequences that can generate both economic and non-economic implications. On the one hand, they can significantly decrease firm employment (Bonfiglioli et al., 2020; Jung and Lim, 2020) and employees' satisfaction and well-being (Schwabe and Castellacci, 2020). On the other hand, they can also increase productivity (Bessen and Righi, 2019; Acemoglu et al., 2020). Non-strictly economic aspects are extremely relevant for the family decision-maker such that economic benefits might be overshadowed.

Regarding the impact of automation technologies on employment, on the one hand, they cause a substitution effect, as they are designed with the aim of performing tasks previously done by workers or increasing labour productivity (Acemoglu and Restrepo, 2019a). On the other hand, they produce some compensation mechanisms, i.e. indirect effects that mitigate the initial reduction in employment (Acemoglu and Restrepo, 2019a). However, the final impact could be a net decrease in employment (Acemoglu and Restrepo, 2019b). While according to some studies the impact on automation at the firm level is positive (e.g., Bessen et al., 2020; Domini et al., 2021), other studies point to the possibility of a decrease (e.g., Bonfiglioli et al., 2020; Jung and Lim, 2020; Ballestar et al., 2021; Ni and Obashi, 2021). In light of this evidence, we consider that the possible negative impact on employment may generate SEW losses in family firms, including the fear of ruining the relationship with employees and the fear of losing the firm's reputation due to the reduction in societal welfare as a result of job losses.

The second aspect concerns the impact on employees' satisfaction, commitment and well-being. Automation technologies could have an impact on the non-pecuniary aspects that determine employees' well-being (Kaplan and Schulhofer-Wohl, 2018; Schwabe and Castellacci, 2020). These include many job outcomes (e.g., expectations, job prospects, career satisfaction, and organisational commitment) and well-being outcomes (e.g., mental health and stress) (Brougham and Haar, 2018). When company management is considering the adoption of automation technologies, employees begin to fear that they may be replaced by these technologies and thus lose their jobs (Schwabe and Castellacci, 2020): employees perceive that they are undervalued and unappreciated by the employer and that they are no longer "part of the family" (Meyer et al., 1993; Brougham and Haar, 2018).

Automation technologies may also have an indirect effect on well-being as they may decrease job satisfaction (Böckerman et al., 2011) and increase the likelihood of psychological stress, nervousness and burnout due to job insecurity in the future (Dekker and Schaufeli, 1995; Chen et al., 2004; Abeliansky and Beulmann, 2019). We believe that, as in the case of the impact on employment, the negative consequences of automation on employees' satisfaction, commitment and well-being may decrease SEW in the firm.

The last aspect to consider is the effect of innovation in automation on productivity. According to some studies, automation technologies increase both labour productivity and total factor productivity, especially in larger firms (Dinlersoz and Wolf, 2018; Ballestar et al., 2021).

We believe that the possibility of achieving productivity gains has a positive impact on the economic aspect of the strategic decision to innovate in automation both within family and non-family firms.

## 3. Hypothesis development

Family SMEs are typically guided by unique norms, cultures, and processes that rarely exist in non-family counterparts (Kellermanns et al., 2012). When making decisions, the family tends to balance strictly economic aspects with non-economic aspects aimed at preserving the family's SEW (Gomez-Mejia et al., 2007). In reference to the choice to innovate in automation, two non-economic aspects are considered relevant: the care for their employees and the reputation and image of the family and the firm in the community where the firm is located.

Caring for employees with reference to the choice of innovating in automation is expressed in the attention to limiting the job losses that automation can generate (Bonfiglioli et al., 2020; Jung and Lim, 2020) and to ensuring employees' satisfaction and well-being (Schwabe and Castellacci, 2020). Family firms are, in fact, recognised to be firms where employees are considered part of an extended family (Christensen-Salem et al., 2021). Family firms are strongly committed to creating stable employment conditions (Stavrou et al., 2007) and tend to avoid decisions that are considered even potentially harmful to their employees (Christensen-Salem et al., 2021) and that may ruin the relationship with them (Kaplan and Schulhofer-Wohl, 2018; Schwabe and Castellacci, 2020). This is particularly true for family SMEs, which are unlikely to make use of external human capital (Colombo et al., 2014). Thus, we consider that the employees of family SMEs may be strongly related to the family owners. Further, the typical limitations in human resources faced by family SMEs constrain their innovativeness (Gang et al., 2018). For these reasons, we expect family SMEs to limit innovation in automation compared to non-family firms.

Another aspect of a socio-emotional nature is the need for the image and reputation of the family and the firm in the community where it is located (Miller and Le Breton-Miller, 2005; Kellermanns et al., 2012). In family SMEs, such behaviour might be even more present as due to the strong identification between owners, managers and firms, any damage caused by innovations equally damages the family's and firm's reputation as well as the family's SEW (Sageder et al., 2018). A firm's image and reputation is largely built on how its stakeholders view the way it deals with different demands from the external and internal environment (Neubaum et al., 2012). In general, proactive stakeholder engagement refers to anticipating stakeholder needs and carrying out activities that proactively involve these people (Laplume et al., 2008). Family firms may be more incentivised in such behaviour than non-family firms because it allows them to gain economic benefits and, above all, greater reputation and legitimacy (Laplume et al., 2008; Surroca et al., 2010).

Proactive stakeholder involvement can be directed at internal stakeholders (e.g., employees) whose well-being is affected by the decisions and actions of family firms (Cennamo et al., 2012). Family firms tend, with reference to these stakeholders, to gain relational trust and approval for their activities and to improve the image and reputation of the firm (Cennamo et al., 2012). For the same purpose, firms can be concerned with increasing the well-being and prosperity of external stakeholders (Brickson, 2005, 2007). These aspects can influence the decision-making process in family firms (Baron, 2008). Therefore, family firms act with the dual purpose of increasing their recognition among the community and internal stakeholders and avoiding all actions that may conversely limit it.

Automation can decrease employees' satisfaction and increase employee insecurity about the workplace (Abeliansky and Beulmann, 2019; Chen et al., 2004). These aspects negatively affect the well-being of the individual by creating psychological stress (Abeliansky and Beulmann, 2019). Therefore, we believe that the conditions created by innovation in automation may lead the decision-makers of family SMEs to perceive a risk of loss of image and reputation both in relation to the family and in relation to the firm so that they tend to limit this type of innovation.

In summary, SEW leads us to consider how needs such as care for employees and family and firm reputation in the community influence the strategic decision to innovate in automation. Specifically, we advance the following hypothesis:

*To preserve social-emotional wealth, family SMEs innovate in automation less than non-family firms.*

## 4. Method

### *4.1 Sample and data*

The sample for the analysis includes 3,618 Italian SMEs identified according to the European commission definition (EU recommendation 2003/361). Italy represents an interesting context both for the presence of family firms and for the adoption of automation technologies (Baltrunaite et al., 2019). Italy has been the second country in Europe for robot stock since the 1990s (Dottori, 2021), but Italian firms lag behind in the adoption of automation technologies due to the characteristics of the production structure (Codogno, 2009; Bruno and Polli, 2017), the family structure of firms (Bugamelli et al., 2012) and the institutional context (Sestito and Torrini, 2019).

The dataset[1], which collects data as of 2019, results from a merging process of three datasets. Patent information is extracted from the EPO Worldwide Patent Statistical Database (EPO-PATSTAT). Patents related to the three automation technologies considered - artificial intelligence, big data and robotics - and filed by small and medium firms based in Italy were selected. To identify the patent codes relevant for the analysis, a literature search was carried out (Fujii and Managi, 2018; IPO, 2014a, 2014b, 2019; Keisner et al., 2015; Martinelli et al., 2019; Webb et al., 2018).

The information regarding the firms is obtained from the AIDA database (Bureau van Dijk), which contains identification data (location, year of foundation, sector), financial data and information regarding the ownership structure (the family name of each board member and shareholder along with the ownership share).

Finally, information regarding the internationalisation of the firm was added. This information was obtained from Reprint, which provides data on outgoing and incoming FDI of Italian firms since 1986.

[1] For the selection of the sample, the universe of active Italian small and medium firms that have filed at least one patent in automation was considered. The control sample was selected randomly; $\chi^2$ tests on the distribution of firms confirmed the representativeness of the population of Italian small and medium firms.

## 4.2 Variables and measures

Table 1 reports the sources and definitions of the variables used in the empirical analysis.

*Tab. 1: Definitions and sources of the variables used in the empirical analysis*

| Variable | Definition | Source |
|---|---|---|
| **Dependent variables** | | |
| Innovation | Dummy variable equal to 1 if the firm holds at least a patent and 0 otherwise | EPO-PATSTAT |
| Automation | Number of patents in automation registered by the firm | EPO-PATSTAT |
| **Independent variable** | | |
| Family firm | Dummy variable equal to 1 if a firm is majority owned by the family and the BoD is composed by family members for the majority; and 0 otherwise | AIDA |
| **Control variables** | | |
| Firm size | Logarithm of domestic sales | AIDA |
| Firm age | Logarithm of number of years since firm foundation | AIDA |
| Internationalisation | Dummy variable taking the value 1 if the firm is part of a multinational group or has foreign subsidiaries, 0 otherwise | REPRINT |
| Return on investment | Net income on investment | AIDA |
| Return on equity | Net income on equity | AIDA |
| Value added | Value added per employee (euro, thousands) | AIDA |
| Risk | Standard deviation of return on assets on the last five years | AIDA |
| Liquidity ratio | Liquidity ratio, calculated as the ratio of current assets (net of inventory) and current liabilities | AIDA |
| Leverage | Debts on equity | AIDA |
| Fixed assets | Fixed assets (euro, millions) | AIDA |
| Gross investments | Annual growth rate in fixed assets | AIDA |
| Labour costs | Labour costs (euro, millions) | AIDA |
| North | Dummy variable equal to 1 if the firm is located in North Italy | AIDA |
| Industry | Categorical variable describing the industry in which the firm operates, with these levels: "Pavitt science based", "Pavitt specialised suppliers", "Pavitt scale and information intensive", "Pavitt suppliers dominated", "Pavitt other" | AIDA |

***Dependent variables***. The dependent variables are *Innovation* and *Automation*.

***Innovation*** is a dummy variable equal to 1 if the firm holds at least a patent and 0 otherwise. Automation measures the number of patents in automation registered by the firm.

***Independent variable***. In line with previous studies we classify a firm as a family firm considering whether simultaneously the control of the shares and the composition of the board of directors is in charge of the family (e.g., Littunen and Hyrsky, 2000; Lee, 2006) (*Family firm*).

***Control variables***. The control variables relate to the specific characteristics of the firm. The size of the firm (*Firm size*) and the age of the firm (*Firm age*) are included as they influence the propensity to innovate (Bannò, 2016). We control for the internationalisation of the firm (Internationalisation) as multinational firms have more knowledge and can better capitalise on investments in innovation (Kotabe et al., 2002; Kafouros et al., 2008). Since the propensity to innovate is associated with firm profitability and productivity, the relevant control variables are included in the analysis (Hanel and St-Pierre, 2002). Firm profitability is measured by the variables *Return on investment* and *Return on equity*, while firm productivity is measured as value added per employee (*Value added*) (Bannò, 2016). A measure of risk is also included in the analysis (Miller and Chen, 2004) (*Risk*). Since the availability and cost of capital can limit the ability of firms to invest in innovation, the *Liquidity ratio* (Goodstein and Boeker, 1991) and *Leverage* (Simerly and Mingfang, 2000) are also included as control variables. *Fixed assets* and *Gross investment* are included (Van Roy et al., 2018). *Labour costs* are also considered. The geographical area in which the firm operates (North) is considered as the context can influence both the strategy and the performance of firms (Wright et al., 2007; Bannò et al., 2015). Finally, the industry to which the firm belongs is included with the aim of capturing structural differences between industries (Pavitt, 1984).

### *4.3 The econometric models*

Since only firms that innovate can hold a patent in automation, the two-stage procedure proposed by Heckman (1976, 1979) is adopted to test our hypothesis. The first-stage selection equation estimates the probability that a firm innovates (i.e., dependent variable *Innovation*), while the second-stage regression estimates the number of patents registered in automation subject to the results obtained in the first stage (i.e., dependent variable *Automation*).

[2] The correlation matrix, available upon request, shows the acceptable correlation indexes (Greene, 2003).

## 5. Results

### *5.1 Descriptive statistics*

Table 2 reports the means and standard deviations for the explanatory variables both for the whole sample (Panel A) and for the two subsamples of FFs and non-FFs (Panel B)[2].

*Tab. 2: Descriptive statistics*

| | Panel A | | | Panel B | |
|---|---|---|---|---|---|
| | | | | Family firms (2.085 firms, 58%) | Non-family firms (1.533 firms, 42%) |
| **Variable** | **Mean/%** | **Min** | **Max** | **Mean/%** | **Mean/%** |
| Innovation | 48.65% | 0 | 1 | 42.69% | 56.75% |
| Automation | 0,39 | 0 | 89 | 0,11 | 0,77 |
| Family firm | 57,63% | 0 | 1 | - | - |
| Firm size | 6,61 | 0 | 9,51 | 6,64 | 6,58 |
| Firm age | 1,42 | 0,48 | 2,17 | 1,44 | 1,38 |
| Internationalisation | 31,92% | 0 | 1 | 33,48% | 29,81% |
| Return on investment | 6,38% | -29,72 | 29,71 | 6,36% | 6,42% |
| Return on equity | 6,65% | -144,23 | 109,26 | 6,50% | 6,84% |
| Value added | 105,99 | -3.159,07 | 88.708,12 | 73,02 | 150,83 |
| Risk | 4,75 | 0,03 | 327,88 | 4,07 | 5,68 |
| Liquidity ratio | 1,58 | 0,02 | 9,91 | 1,52 | 1,66 |
| Leverage | 1,60 | -294,84 | 742,5 | 1,72 | 1,43 |
| Fixed assets | 17,29 | 0 | 5.497,04 | 12,33 | 24,08 |
| Gross investments | 35,93% | -100 | 32.258,06 | 13,17% | 66,87% |
| Labour costs | 2,78 | 0 | 130,65 | 2,33 | 3,40 |
| North Italy | 69,79% | 0 | 1 | 67,39% | 73,06% |
| Pavitt science based | 12,30% | 0 | 1 | 6,91% | 19,63% |
| Pavitt specialised suppliers | 26,42% | 0 | 1 | 23,55% | 30,33% |
| Pavitt scale and information intensive | 11,19% | 0 | 1 | 12,37% | 9,59% |
| Pavitt suppliers dominated | 40,55% | 0 | 1 | 46,47% | 32,49% |
| Pavitt other | 9,54% | 0 | 1 | 10,70% | 7,96% |

Exactly half of the firms in the full sample hold at least one patent. On average, firms in the full sample registered 0.39 patents in automation. While family firms hold on average 0.11 patents in automation, non-family firms hold 0.77 patents.

In the sample considered, 57.63% of firms are family firms according to the Italian distribution. Both size and age are similar for family firms and non-family firms. 31.92% of firms in the full sample are internationalised. Further differences emerge when analysing the other control variables except for location and type of industry.

*5.2 Empirical findings*

Table 3 shows the regression results for the model developed.

*Family firm* has a negative and significant impact both on firm innovation ($b$ = -0.1624, $p < 0.01$; First stage) and on firm innovation in automation ($b$ = -0.8669, $p < 0.01$; Second stage). Our hypothesis is thus confirmed: family SMEs tend to innovate in automation less than non-family firms.

*Firm dimension* has a positive and significant impact on the propensity to innovate (First stage). *Firm age*, while decreasing the probability of innovation (First stage), has a non-significant impact on firm innovation in automation (Second stage). The internationalisation of the firm increases its propensity to innovate (First stage). Generally, indexes related to the economic and financial situation of the firm do not have a significant impact on its propensity to innovate and innovate in automation. The only exception is *Labor costs*, which has a very small positive effect on the propensity to innovate (First stage). The variable *North* has a positive and significant impact in the first stage and not significant in the second one. Industries have positive and significant impact only in the first stage.

As a robustness check, the impact on innovation in automation was examined by distinguishing the three types of technologies: artificial intelligence, big data and robotics. The results obtained are consistent with those above.

*Tab. 3: Regression results*

| | *First stage* | *Second stage* |
|---|---|---|
| | **Innovation** | **Automation** |
| Family firm | - 0.1624 *** | -0.8669 ** |
| | (0.0471) | (0.1851) |
| Firm dimension | 0.0459 ** | |
| | (0.0231) | |
| Firm age | -0.2838 *** | -0.3647 |
| | (0.0957) | (0.3482) |
| Multinational enterprise | 0.4248 *** | |
| | (0.0532) | |
| ROI | -0.0039 | |
| | (0.0025) | |
| ROE | | 0.0040 |
| | | (0.0034) |
| Risk | | -0.0022 |
| | | (0.0074) |
| Liquidity ratio | 0.111 | 0.0825 |
| | (0.0019) | (0.0634) |
| Leverage | -0.0012 | -0.0176 |
| | (0.0019) | (0.0249) |
| Fixed assets | | 0.0001 |
| | | (0.0001) |
| Gross investments | 0.0001 | |
| | (0.0001) | |
| Labour costs | 0.0001 *** | |
| | (0.0001) | |
| Productivity | 0.0001 | |
| | (0.0001) | |
| North | 0.4208 *** | 0.0.752 |
| | (0.0516) | (0.2293) |
| Pavitt science based | 1.3065 *** | 1.0330 ** |
| | (0.1036) | (0.4823) |
| Pavitt specialised suppliers | 0.7980 *** | 0.2181 |
| | (0.0884) | (1.4537) |
| Pavitt scale information intensive | 0.4721 *** | 0.1103 |
| | (0.0996) | (0.4847) |
| Pavitt suppliers dominated | 0.0977 | 0.4877 |
| | (0.0836) | (0.4339) |
| Intercept | -1.8308 *** | 1.2765 * |
| | (0.1796) | (0.7165) |
| Observations | 3,618 | |
| Rho | -0.0653 | |
| | (0.059) | |
| Sigma | 3.6576 | |
| | (0.0622) | |
| Lambda | -0.2390 | |
| | (0.21655) | |

*Standard errors in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$*

## 6. Conclusions

This study analyses for the first time how much family involvement affects the strategic decision to innovate in automation in SMEs by applying SEW. Specifically, it aims to understand whether family SMEs innovate less in automation than non-family firms due to the preservation of the SEW and the presence of important needs of socio-emotional nature (i.e., care for employees with particular regard to their level of satisfaction and well-being; pride in building and maintaining the image and reputation of the family and the firm). We found that family SMEs tend to innovate in automation less than non-family firms, thus confirming a different behaviour of family firms compared to non-family firms (De Massis et al., 2013; Dibrell and Memili, 2019).

Our results are in line with previous literature on automation highlighting the relevance of both economic and non-economic implications of automation: we confirm that in addition to the possibility to obtain an increase in firm productivity, the risks of significantly decreasing firm employment and employees' satisfaction and well-being are taken into account when deciding to innovate in automation. Our results are also in line with previous literature regarding SEW: we confirm that family firms pursue, in addition to financial objectives and business goals, non-economic objectives focused on family values and needs (e.g., care for employees, need to build and maintain the image and reputation).

This study contributes to the literature on automation, which has mainly focused on the consequences of automation technologies, including the impact on firm employment, employees' satisfaction and well-being, and productivity. Our study builds on this literature and shows that when deciding to innovate in automation both the traditionally analysed (mainly economic) aspects and the non-economic aspects attributable to the peculiarities of family involvement in the firm are considered.

There are two contributions to the literature on family firms. The first is an advancement in the knowledge of the strategic decision-making process to innovate in automation of this type of firms. Our results confirm that the need to preserve the SEW plays a crucial role in the decision of family SMEs. The second contribution points to the need to investigate how and to what extent employee's care and family and firm reputation in the community influence other strategic decisions (e.g., internationalization and/or product diversification).

The work has both policy and managerial implications. The evidence from this study could be used to design policies that promote innovation and the application of automation by helping family SMEs to carefully evaluate the positive and negative aspects of automation and to overcome any resistance due to the influence of the need to preserve the SEW on strategic decision-making.

These policies could act on drivers such as the possibility of achieving an increase in productivity and provide support instruments (e.g., labour tax incentives) to prevent innovation in automation from resulting in a reduction of firm employment and employees' satisfaction and well-being.

From a managerial perspective, our work has highlighted the critical issues that family SMEs face when deciding to innovate in automation. In the literature, innovation has been treated as a homogeneous strategic decision. In this study, we showed that it is crucial to consider the type of innovation (i.e., the specific technology) because it can generate different emotional aspects and therefore different strategic decisions.

This study is not devoid of limitations. The analysis focuses exclusively on the Italian context. It might be interesting to conduct the analysis for other countries to examine whether contextual factors (e.g., labour legislation) intertwine with the non-economic implications of automation we identified as relevant (e.g., care for employees with particular regard to their level of satisfaction and well-being; pride in building and maintaining the image and reputation of the family and the firm), giving rise to a different result from the one we found (i.e., lower propensity of family firms to innovate). Some contextual factors may indeed decrease the perceived risk of reducing firm employment and employees' satisfaction and well-being, thus giving greater relevance to the economic consequences of automation.

Another limitation of the research concerns the sample, which only considers small- and medium-sized firms. It might be interesting to replicate the analysis on a sample of larger firms in order to verify whether the larger size reduces the risk of a reduction in firm employment as a result of the innovation in automation. In larger firms, employees displaced by automation technologies might be relocated to other work activities, resulting in an internal reorganisation of work rather than a reduction in firm employment.

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