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Abstract

Purpose –*The purpose of our study is to investigate how an environmental management system (EMS) might affect the environmental product innovation propensity of a firm through its influence on two factors shaping the knowledge process: the human capital management practices of training and development and the organisational context.*

Design/methodology/approach – *To test our hypotheses, an empirical analysis was carried out on 262 companies drawn from 16 developed European markets included in the S&P Europe 350 Dow Jones index over the years 2005–2015. We adopted regression analysis by employing the ordinary least squares and the binary logit econometric models.*

Findings – *Consistently with our predictions, results show that for organisational contexts characterized by the presence of family owners, the EMAS-certified EMS reveals as a significant moderating factor that positively influences their approach to the knowledge management tools for the improvement of the workforce cognitive capabilities, with a significant impact on the firm's openness toward green product innovation. On the contrary, the ISO 14001-certified EMS tends not to stimulate such pro-active behaviour, in both family and non-family firms.*

Practical Implications – *The findings suggest that an EMS can stimulate the knowledge exploration in the environmental protection field. To this end, top managers should overcome the bureaucratic vision of an EMS and conceive it as a knowledge management tool able to support the learning evolution of the organization through an effective commitment to human capital management policies of training and development.*

Originality/value – *Drawing from social identity and institutional theories, this is the first study - to the best of our knowledge - that theorises and tests why the adoption of an EMS might stimulate the knowledge advancement of the organisation in a different way, especially in peculiar organisational contexts of family firms where the identity overlap between the family and the firm tends to affect the knowledge management process.*

Keywords: *knowledge management; learning evolution; organisational context; human capital training and development; environmental management system; EMAS; ISO 14001; green product innovation; family and non-family firms; social identity theory; legitimacy theory.*

Paper type *Research paper*

1.Introduction

According to the resource-based view of a business (RBV), the creation and keeping of strategic resources over time helps firms to build a sustainable competitive advantage (Wernerfelt, 1984; Peteraf, 1993). A strategic resource should be valuable, rare, difficult to imitate and substitute so

that the firm can generate a sustained competitive advantage (Barney, 1991). The advent of the "new knowledge economy" has led to an increased emphasis on knowledge as the main strategic resource of companies, and is critical for firm performance and competitive advantage, especially in an increasingly dynamic and globalised business environment (Nonaka and Takeuchi, 1995; Spender and Grant, 1996; Carayannis et al., 2014). According to Drucker (1989, p. 251), knowledge is information that "changes something or somebody either by becoming grounds for action, or by making an individual or an institution capable of different and more effective action". In the last decades, to reduce the environmental impacts of both production and consumption processes, several governments in industrialised countries have urged companies to acquire knowledge in the environmental protection field (Demirel and Kesidou, 2011; De Marchi and Grandinetti, 2013). To better meet legal requirements and, increasingly, stakeholder pressures, several companies have chosen to implement environmental management systems (EMS) according to the most diffused voluntary certification schemes: International Organization for Standardization's ISO 14001 and European Eco-Management and Audit Scheme (EMAS; Boiral, 2007). Both these environmental standards foresee training for employees and their representatives in order to acquire (or increase) and transfer knowledge within organisations for good environmental management performance (EMAS and ISO 14001, 2011; EMAS, 2013). Owing to the skills and competencies required for their implementation, EMS are viewed as knowledge management tools fostering firms' eco-innovation (Kesidou and Demirel, 2012), but with mixed empirical results (for a review, see for example Bossle et al., 2016). The non-univocal findings might be linked to different commitments of firms in the knowledge process. Indeed, the mere assumption of the EMS as a source of knowledge lacks consideration of the process through which it is achieved. As discriminating factors of the knowledge process, both cognitive capabilities of the agents and the organisational context in which they interact should be analysed (Del Giudice, 2011), whereas previous studies considering the influence of EMS on eco-innovation have failed to examine such key aspects. The purpose of our study is thus to fill this gap in the literature, by firstly investigating the propensity of firms who have implemented an EMS to undertake effective knowledge management practices for the improvement of the cognitive capabilities of their workforce, and then analysing their impact on corporate openness toward green product innovation. In order to capture a possible different effect arising from the organisational context, we distinguish between family and non-family firms.

Family firms are complex organisational contexts where the simultaneous presence of family, firm and the equity component might lead to the "institutional overlap" (Chua et al., 2003; Lansberg 1983; Astrachan and Kolenko, 1994), with the management policies conceived within the family institution, and affected by the identity overlap between the family and the firm (Zellweger et al.,

2010; Del Giudice, 2017). Identity overlaps arise from inextricable ties between the family group and the firm (Dyer and Whetten, 2006). As observed by Zellweger et al. (2013), this forms a level of concern for the firm and its public perception that is absent among other controlling actors (i.e., non-family owners; non-family managers). Particularly, the mutual dependence between family and firm identities would lead family members to link their own reputation with the firm's image, thereby creating incentives for management policies preserving firm image and, hence, family reputation (Deephouse and Jaskiewicz, 2013). The knowledge management process is also said to be influenced by the identity overlap phenomenon, contributing to generating idiosyncratic practices that affect knowledge and their peculiar configuration (Miller and Le Breton-Miller, 2005; Le Breton-Miller and Miller, 2006; Del Giudice, 2011). However, some factors might strengthen or weaken the identity overlaps, thereby affecting management policies and processes adopted by family firms (Zellweger et al., 2013). In this study, we argue that the high level of external visibility and monitoring of corporate environmental conduct arising from the EMAS adoption strengthens the importance of family-to-firm identity fit, creating greater incentives for effective knowledge management practices to ensure better firm conduct, and, ultimately, to preserve family reputation. Consistently with our predictions, the findings show that the adoption of an EMAS-certified EMS encourages family firms to engaging more than their counterparts (EMAS-certified non-family firms) in the knowledge management practices of employee training and development, with a significant impact on the firm's openness toward green product innovation. On the contrary, the ISO 14001-certified EMS tends not to stimulate such pro-active behaviour, in both family and non-family firms. For family firms, the EMAS scheme thus reveals as a significant moderating factor that positively influences their approach to the knowledge management tools for the improvement of the workforce cognitive capabilities. Interestingly, it also emerges that an effective commitment in the knowledge management practices of employee training and development constitutes a significant driver of green product innovation, in both family and non-family firms.

The remainder of the paper is structured as follows. Section 2 provides the theoretical framework and the hypotheses development. Section 3 describes the research design. The results and discussion are presented in Section 4, and the study's implications and conclusions are drawn in Section 5.

2. Theoretical Framework and Hypotheses Development

2.1 EMS, knowledge and organisational context

The amount of attention paid to environmental issues has increased considerably in the last two decades, especially in the most industrialised countries. Evidence of continued environmental

degradation has led to the rethinking of the models of economic growth, in favour of sustainable development (Adams et al., 2016). Particularly, the ability of a firm to successfully address environmental issues is becoming a competitive issue (Hansen and Mowen, 2007). In light of the increasingly turbulent and competitive environment, in addition to consumers' growing awareness eco-friendly goods, an expanding body of management literature (Porter and Van Der Linde, 1995; Nidumolu et al., 2009; Medeiros et al., 2014; Dangelico, 2016) highlights the strategic opportunity to gain sustainable competitive advantages through green product innovation. However, the development of products through new solutions for a cleaner consumption requires commitment from the firm to acquire and manage knowledge in the field of environmental protection (Demirel and Kesidou, 2011; De Marchi and Grandinetti, 2013). Particularly, skills and competences in this area within an organisation can be promoted (or enhanced) and managed through the adoption of environmental management systems certified under EMAS or ISO 14001. Indeed, according to the standards, the implementation of the EMS requires companies to identify their training and awareness needs from an environmental perspective, and then supporting their employees and representatives through the training programmes (EMAS, 2013; ISO 14001, 2011). The adoption of an EMS in a firm is therefore viewed as an indicator of the resilient organisational capabilities stimulating innovation in the environmental protection field (Wagner, 2007; Horbach, 2008; Demirel and Kesidou, 2011). However, the presence of an EMS within an organisation might not ensure that the company will advance its eco-innovation knowledge **(**Rondinelli and Vastag, 2000; Fryxell and Szeto, 2002; Russo and Harrison, 2005; Boiral, 2007). As suggested by Della Peruta (2011), a certain management process is likely to become inertia until effective changes for the evolution of the organisational knowledge take place. Similarly, for firms adopting an EMS, this might become a mere procedural inertia, as long as the organisational context is not open to improvements in its knowledge.

2.2 Family firms and the identity overlaps

Family-owned companies are referred to as organisational contexts often engaged in idiosyncratic strategic behaviours, mostly driven by non-economic, family-centered motivations (Miller et al., 2014). The identity-based rationale would represent one of the fundamental non-economic motives behind the distinctive behaviours of family firms (Miller and Le Breton-Miller, 2005; Dyer and Whetten, 2006; Berrone et al., 2010; Zellweger et al., 2013). According to the Social Identity Theory (SIT; Ashforth and Mael, 1989; Ashforth et al., 2008; Cornelissen et al., 2007; Hogg and Abrams, 1990; Hogg and Terry, 2001; Tajfel and Turner, 1979), identifying with a group produces an accentuation of the perceived differences between the self- and out-group members, implying an

intergroup social comparison. Due to the social comparison process, an underlying need for positive distinctiveness (self-enhancement motivation) leads individuals toward goals and behaviours that allow them to positively differentiate their own group – the in-group –compared to other groups – the out-groups (Wilder, 1986; Turner et al., 1987; Hogg et al., 1995). Accordingly, family owners that attribute importance to a fit between family and firm identity, they will identify with the firm and consider it as an extension of themselves (Dyer and Whetten, 2006; Deephouse and Jaskiewicz, 2013). They will strive for preserving or increasing their own reputation (self-enhancement motivation) through valuable management policies able to positively distinguish their firm - and hence the family's reputation - from their counterparts (Berrone et al., 2010; Deephouse and Jaskiewicz, 2013; Zellweger et al., 2013). Particularly, the identity overlap between family and firm would contribute to driving knowledge management decisions (Miller and Le Breton-Miller, 2005; Del Giudice et al., 2011).

2.3 Identity overlap between family and firm and knowledge management

Knowledge constitutes a relevant source of competitive advantage, which enables an organisation to be innovative (Nonaka and Takeuchi, 1995; Park and Kim, 2005; Carrillo, 2007). It resides within individuals and builds on information based on education and experience (Polanyi, 1958, 1967; Nonaka, 1991; Nonaka, 1994; Nonaka and Takeuchi, 1995; Grant, 1996; Del Giudice and Maggioni, 2014; Scuotto et al., 2017) that shapes a firm's capabilities (Eisenhardt and Martin, 2000; Zollo and Winter, 2002). Individual knowledge becomes part of the organisational knowledge that becomes embedded in routines and processes (Carayannis et al., 2017); it is shared and transferred over time (Nonaka, 1991; Nonaka and Takeuchi, 1995; Del Giudice et al., 2015; Shin et al., 2017). To avoid inertia within the organization (i.e. old cognitive automatisms), individual knowledge needs to be updated by promoting the evolution of learning (Cohen and Levinthal, 1990; Zahra and George, 2002; Della Peruta, 2011; Wang and Byrd, 2017). Training and development programmes contribute to the evolution of learning as a form of learning activity by which workers can re-experience what others have previously learned, with the opportunity of creating new knowledge by combining their existing tacit knowledge (i.e. individual skills) with the knowledge of others (explicit knowledge; Nonaka and Takeuchi, 1995; Ferraris et al., 2017). To allow workers to acquire explicit knowledge and develop skills over time, their cognitive capabilities should thus be supported through training and development activities. According to Lansberg (1983), in the phases of training the identity overlap between family and business might become an obstacle caused by the distinction between the individual's needs (family members) and the firm's needs. The prevailing concern for their own family-centered needs might lead family owners to underestimate

the firm's need to advance the learning of its human capital, which significantly contributes to the development of the firm's knowledge, and therefore its subsequent development, over time. Nevertheless, some factors contribute to generating a strong mutual dependence between the family's and the firm's identities, stimulating family owners to converge their needs towards the firm's needs, with a greater commitment to the improvement of the firm and its capabilities. Particularly, as argued by Zelleweger et al. (2013), the judgments by non-family stakeholders about the relative success of family firms in meeting non-financial goals would favour a convergence between family and firm needs, enhancing the family owners' concern for the firm's reputation through the which they can maintain (or enhance) their self-distinctiveness (i.e., self-reputation). Accordingly, it is expected that the more a firm's non-financial conduct and results are exposed to external visibility and monitoring, the stronger the importance of family-to-firm identity, thereby supporting the improvement of firm's capabilities to ultimately preserve (or enhance) the family owners' reputation. In family firms adopting an EMS, family owners might thus feel more motivated to promote the enhancement of employees' skills and competences when there is higher external visibility and monitoring of corporate environmental conduct. For EMAS-adopting firms, environmental commitments and behaviours are exposed to a high level of external visibility and monitoring. Indeed, EMAS requires and sets stricter rules on external communication than ISO 14001 does (Testa et al., 2014). Particularly, EMAS-registered organisations must disclose an annual update through a publicly available document called the "Environmental Statement"; the key performance indicators of significant environmental aspects, environmental targets, the achieved results and other relevant information will appear on their EMS. Moreover, the data reported in the Environmental Statement has to be validated by an accredited environmental verifier during the certification audit (EMAS, 2013). Finally, the EMAS scheme focuses on the firm's commitment to the continual improvements of its environmental performance and it foresees an active involvement of employees and their representatives (EMAS and ISO 14001, 2011). Under EMAS certification, it is thus expected that to preserve (or enhance) their self-reputation, family owners will be strongly stimulated to support the improvement of the organisational capabilities, thereby further sustaining the knowledge management practices for the advancement of human resource skills and competences. Our first hypothesis is hence formulated as follows:

H_1: family firms adopting an environmental management system certified under the EMAS scheme will be more stimulated to effectively engage in employee training and development programmes

Contrary to the EMAS scheme, the implementation of EMS under ISO 14001 does not require mandatory annual disclosure of the corporate environmental programme, environmental targets and the relating achieved results (EMAS and ISO 14001, 2011).

Owing to the lower exposition of environmental conduct to the external visibility and monitoring, family owners of firms that are just ISO 14001-certified might attribute less importance to the fit between family and firm identity, with a corresponding lower family concern for corporate reputation. Rather, the lack of mandatory external communication of environmental targets and their results might induce family owners to view the ISO 14001-certified EMS as a mere management tool instrumental in gaining organisational legitimacy[1] (Suchman, 1995; Deephouse and Carter, 2005), by showing a behavioural conformity to the internationally recognised environmental rules and procedures. Indeed, from an institutional perspective (DiMaggio and Powell, 1983; Oliver, 1991), it has been argued that rational operating standards, such as ISO 14001, could be implemented for reasons of social legitimacy rather than out of genuine concern for improved environmental practices (Rondinelli and Vestag, 2000; Bansal and Hunter, 2003; Boiral, 2007; Schaefer, 2007; Müller et al., 2009; Neugebauer, 2012), thereby limiting the efforts of the knowledge management policies in employees training and development. In this sense, Boiral (2007, p. 127) stated and found that the standard ISO 14001 "often appeared to be some sort of 'rational myth' (Meyer and Rowan, 1977) to which organisations superficially committed themselves". The adoption of an EMS under the ISO 14001 certification might thus not encourage family owners to support more than their counterparts the advancement of employees' knowledge through programmes of training and development. Accordingly, we formulate our second hypothesis:

H_2: family firms implementing an environmental management system certified under ISO 14001 will not be stimulated to engage to a higher level than their counterparts in employee training and development programmes.

According to Soliman (2000), knowledge management consists of five essential processes aiming to create, capture, organise, access and use knowledge, with human resources constituting the key element of knowledge creation (Drucker 1993; Nonaka and Takeuchi, 1995; Gao et al., 2008). Organisations ultimately learn through their individual members (Kim, 1993; Antonacci et al., 2017) by exploiting the knowledge transferred within the organisation by the workers involved in the firm's processes (Soliman, 2000; Messeni et al., 2010; Matsuo, 2015;). Knowledge exploration (to create

[1] As stated by Deephouse and Carter (2005, p. 329), "legitimacy emphasizes the social acceptance resulting from adherence to social norms and expectations whereas reputation emphasizes comparisons among organisations."

new knowledge) and knowledge exploitation (to use and benefits from the existing knowledge) are both essential for the longevity of the organisation and should be balanced (March, 1991). By focusing only on the knowledge exploitation, the organisation might suffer in the long-term from the "competency trap", thereby closely the organisation to new ideas and innovation (March, 1991). New knowledge is created by individuals (Israilidis et al., 2015), but organisations play a critical role in stimulating and amplifying that knowledge (Nonaka, 1994). Supporting the evolution of the individual learning of employees through training and development programmes stimulates knowledge creation, thereby promoting the organisation's openness to innovation (Yahya and Goh, 2002; Bontis and Serenko, 2007; Della Peruta, 2011; Matsuo, 2015). Based on these arguments, it is thus expected that the greater commitment in the knowledge management practices of employee training and development by EMAS-certified family firms will lead to higher environmental product innovation propensity than their counterparts. The following hypothesis is therefore formulated:

H_3: the greater engagement of family firms adopting the EMAS scheme in human resource programmes of training and development stimulates more environmental product innovation than their counterparts.

3. Research design

3.1 Description of the variables

Dependent variables

Human capital training and development programmes

We proxied the effective engagement of a firm in employee training and development activities (*HCT&D*) using the score provided by Thompson Reuters in the Asset4 Database (SOTD). It is a number between 0 and 100 and "measures a company's management commitment and effectiveness towards providing training and development (education) for its workforce. It reflects a company's capacity to increase its intellectual capital, workforce loyalty and productivity by developing the workforce's skills, competences, employability and careers in an entrepreneurial environment." (Asset4 Description, SOTD - Workforce /Training and Development).

Environmental product innovation

The corporate propensity toward eco-product innovation (*EPI*) is measured according to Thomson Reuters Asset4 (ENPID04S). *EPI* is a dummy variable that takes a value of 1 if the company sets specific objectives to be achieved on environmental product innovation, and 0 otherwise.

Independent Variables

To test our first hypothesis (H_1), the independent variable of interest is the interaction term *FF*EMAS*. The variable *FF* is a dichotomic variable that takes a value of 1 if a founder or a member of the family, by either blood or marriage, is the owner of at least 5% of voting rights, individually or as a group (Villalonga and Amit, 2006), and 0 otherwise. Concerning the data on family characteristics (i.e., the ownership involvement), we relied on different sources: corporate governance statements of the firms, Osiris and Lexis Nexis databases. The variable *EMAS* was collected from Thomson Reuters Asset4 (ENERDP074). It is a dummy variable that takes a value of 1 if a company is EMAS certified, and 0 otherwise. Our second hypothesis (H_2) was checked by using the interaction term *FF*ISO 14001*. The variable *ISO 14001* was retrieved from Thomson Reuters Asset4 (ENERDP073 and ENERDP074). It is a dummy variable that takes a value of 1 if a company has *ISO 14001* certification but not *EMAS* certification, and 0 otherwise. Finally, to verify the third hypothesis (H_3), the independent variable of interest is the interaction term *FF*EMAS*HCT&D*. All the three variables are above described.

We considered several control variables that could have influenced the ability of the firm to support the knowledge advancement of the organisation, all gathered from the Datastream database of Thomson Reuters. We checked for *R&D intensity* (Parisi et al., 2006; Hervas-Oliver et al., 2011) measured by the ratio between R&D and net sales (WC01201/WC01001). We also controlled for the firm's profitability (Bhattacharya and Bloch, 2004; Chrisman and Patel, 2012) and leverage (Czarnitzki and Kraft, 2009; Block et al., 2013). We proxied the firm's profitability by using the return on assets (*ROA* - WC08326), whereas the *Leverage* was measured as the firm's financial debts divided by total assets (WC08236). We controlled for firm size (Shefer and Frenkel, 2005; Kok et al., 2006), using the variable *Size*, which is the natural logarithmic transformation of the net sales (log(WC01001)). *Firm age*, measured as the number of years since the firm was established (year *t*-WC18273), was also included (De Kok et al., 2006; Lin et al., 2011). Since the strategic behaviour adopted in the previous year may have influenced the corporate conduct in the following year, to test our first two hypotheses (H_1 and H_2), we also controlled for the firm's commitment towards employee training and development activities in the previous year ($HCT\&D_t$).

Finally, we included in our models dummy variables for each 2-digit SIC code to control for industry effects (ID); year dummies to capture the time effects (YD) and country dummies (CD) to capture the countries effects. The inclusion of industry, year and country fixed effects allows the study to address the inherent heterogeneity in strategical orientation across industries, years or countries.

3.2 Econometric model

As seen in the previous empirical literature dealing with human resources management practices (Huselid, 1995; De Kok et al., 2006; Lee, 2015) and eco-innovation (Kesidou and Demirel, 2012; Bossle et al., 2016), we adopted regression analysis to undertake our study; in particular, to verify whether family firms who adopted an EMS within the EMAS scheme are more motivated to engage in employees' training and development programmes (H_1), we performed the regression function as follows (Equation 1):

$$HCT\&D_{i,t+1} = \alpha + \beta_1 FF_{i,t} + \beta_2 FF_{i,t} * EMAS_{i,t} + \beta_3 EMAS_{i,t} + \Upsilon_1 R\&DIntensity_{i,t} + \Upsilon_2 ROA_{i,t} + \\ + \Upsilon_3 Leverage_{i,t} + \Upsilon_4 Size_{i,t} + \Upsilon_5 Firm\ age_{i,t} + \Upsilon_6 HCT\&D_{i,t} + \Upsilon_7 ID_i + \Upsilon_8 YD_i + \Upsilon_9 CD_i + \varepsilon_{i,t} \quad (1)$$

Our second hypothesis (H_2), which predicts that family firms who adopted an ISO 14001-certified EMS do not show any more engagement in human capital training and development programmes than their counterparts, was tested through the following (Equation 2):

$$HCT\&D_{i,t+1} = \alpha + \beta_1 FF_{i,t} + \beta_2 FF_{i,t} * ISO14001_{i,t} + \beta_3 ISO14001_{i,t} + \Upsilon_1 R\&DIntensity_{i,t} + \Upsilon_2 ROA_{i,t} + \\ + \Upsilon_3 Leverage_{i,t} + \Upsilon_4 Size_{i,t} + \Upsilon_5 Firm\ age_{i,t} + \Upsilon_6 HCT\&D_{i,t} + \Upsilon_7 ID_i + \Upsilon_8 YD_i + \Upsilon_9 CD_i + \varepsilon_{i,t} \quad (2)$$

Finally, in order to investigate whether a higher commitment to human resource programmes of training and development by EMAS-adopting family firms nurtures more than their counterparts the propensity towards environmental product innovation (H_3), we estimated the following (Equation 3):

$$EPI_{i,t+1} = \alpha + \beta_1 FF_{i,t} + \beta_2 FF * EMAS * HCT\&D_{i,t} + \beta_3 EMAS * HCT\&D_{i,t} + \\ + \beta_4 EMAS_{i,t} + \beta_5 HCT\&D_{i,t} + \Upsilon_1 R\&DIntensity_{i,t} + \Upsilon_2 ROA_{i,t} + \Upsilon_3 Leverage_{i,t} + \\ \Upsilon_4 Size_{i,t} + \Upsilon_5 Firm\ age_{i,t} + \Upsilon_6 ID_i + \Upsilon_7 YD_i + \Upsilon_8 CD_i + \varepsilon_{i,t} \quad (3)$$

For the regression models (1) and (2), we employed the ordinary least squares. To correct for heteroskedasticity and serial correlation, we used robust standard errors by clustering on the firm-level identifier (HAC). As our dependent variable in Equation (3) is dichotomous, we employed a binary logit regression using robust standards errors. Before performing the regressions, we verified the possible multicollinearity among the explicative variables by using the VIF (*variance inflation*

factor). To address potential causality issues, the dependent variables were taken at year $t + 1$, whereas all the independent variables were taken at year t.

3.3 Sample Selection

To empirically test our hypotheses, we analysed a large representative sample of listed family and non-family firms located in Europe by selecting all companies that were in the S&P Europe 350 Dow Jones index. The S&P Europe 350 consists of 350 leading blue-chip companies drawn from 16 developed European markets (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom). We excluded firms from the banking and finance sectors due to their different market features, obtaining an unbalanced panel of 262 firms from 2005 to 2014, totally 2,620 firm-year observations.

4. Results

4.1 Descriptive Statistics

Table 1 reports the summary statistics for the full sample, along with a test of equality in means between family firms and non-family firms.

Insert Table 1 about here

The full sample consists of 32% family firms, with a slightly and not statistically significant difference (*diff. EMAS* =0.010*; p-value*>0.10) between the family companies that, on average, engage in the *EMAS* (17%) and their counterparts (16%); while a significantly higher percentage of non-family firms (63% *vs.* 54% of family firms) adopted an EMS certified under the *ISO 14001* (*diff. ISO 14001* =-0.089*; p-value*<0.01). No statistically significant differences exist between family and non-family firms with reference to the mean values *R&D intensity* (*diff. RD_S=0.002; p-value*>0.10) and *Leverage* (*diff. L=0.073; p-value*>0.10). On the contrary, it reveals that family firms are, on average, more prone to the environmental product innovation (*diff. EPI =0.046; p-value<0.01*), more profitable (*diff. ROA* =1.071*; p-value<0.01)* and older (*diff. Firm Age* =8.906*; p-value<0.01*), whereas non-family firms are bigger (*diff. Size* =-4,342,618; *p-value<0.01*) and tend

to engage more in human resources programmes of training and development than their counterparts (*diff. HCT&D* = -3.696*; p-value<0.01).*

4.2 Multivariate regressions

Table 2 reports the findings from the performed Equation (1), by giving empirical support to our first hypothesis (H_1).

Insert Table 2 about here

Indeed, we find that family firms that implemented an EMS under the EMAS scheme (*FF*EMAS*) are significantly more stimulated ($\beta_2>0$*; p-value*<0.05) to support human capital training and development programmes (*HCT&D)*, whereas their counterparts (i.e. EMAS-certified non-family firms) appear no significantly orientated towards such practices ($\beta_3>0$*; p-value*>0.10). Table 3 provides the results of estimating Equation (2), with our main independent variable of interest, *FF*ISO 14001*, that shows a positive but not statistically significant coefficient ($\beta_2>0$*; p-value*>0.10).

Insert Table 3 about here

In accordance with our second hypothesis (H_2), we thus find that ISO 14001-certified family firms do not engage in higher levels of human resources practices of training and development programmes (*HCT&D*) than their counterparts. In particular, it emerges that for both family and non-family firms, the adoption of an EMS under the standard ISO 14001 tends no stimulating corporate commitment for such programmes ($\beta_3>0$*; p-value*>0.10). Interestingly, it also emerges from results in Tables 2 and 3 that family firms who do not adopt an EMS show a lower propensity than their counterparts toward the promotion of training and development activities ($\beta_1<0$*; with p-value*<0.01 and <0.05 in Table 2 and 3, respectively). Finally, results in Table 4 empirically validate our third hypothesis (H_3), by showing that the greater commitment by EMAS-adopting family firms towards providing training and development for its workforce positively influences their green product innovation propensity significantly more than their counterparts ($\beta_2>0$*; p-value*<0.01).

Surprisingly, Table 4 also reveals that an effective commitment to human capital management programmes, such as training and development activities, tends to significantly affect the openness of a company towards environmental product innovation, regardless of the environmental certification ($\beta_5>0$; *p-value*<0.01).

Insert Table 4 about here

4.3 Results Discussion

An EMS is often viewed as an indicator of resilient organisational capabilities that favours a firm's propensity towards green innovation (Wagner, 2007; Horbach, 2008; Demirel and Kesidou, 2011). According to the two most diffused environmental certifications, ISO 14001 and EMAS, the EMS is an integral part of the overall firm's management system and for its operation are explicitly foreseen training activities for the workforce of the organisation (EMAS and ISO 14001, 2011). However, an EMS's effectiveness in supporting eco-innovation might primarily be influenced by the firm's commitment in management practices supporting the knowledge process and its evolution. As suggested by Nonaka and Takeuchi (1995), training and development programmes would contribute to the evolution of the knowledge process, allowing workers to acquire explicit knowledge and develop skills. However, certain organisational contexts might become an obstacle to the evolution of learning through such activities, thereby hindering some organisational benefits for the advancement of knowledge. Consistent with Lansberg (1983)'s arguments, our results suggest that the identity overlap between family and firm might create conflicts between family-centered priorities and the firm's needs, leading family owners to underestimate the firm's needs of learning evolution. Indeed, our findings show that family firms tend to have a lower propensity than their counterparts toward training and developments activities. However, the adoption of an EMS can significantly contribute to inverting such low propensity in family firms when it is certified under the EMAS scheme. By providing empirical support to Zelleweger et al.'s (2013) arguments, our results suggest that some factors that increase the importance of a fit between the family and the firm identity would drive family owners to giving priority to a favourable firm's reputation in order to preserve (or enhance) the family reputation. In particular, and consistent with our predictions (H_1), it appears that the exposition to high external visibility and monitoring of environmental conduct arising from adopting an EMS under the EMAS scheme would significantly contribute to increasing the sense of identification of the family with the firm by enhancing the family owners' concern for the improvement of organisational capabilities, with a pro-active approach toward

knowledge practices for the advancement of workers' cognitive capabilities. On the contrary, the lack of mandatory external communication on environmental *modus operandi* for firms adopting an EMS ISO 14001 would not stimulate a strong integration of identity overlap between the family and the firm, thereby discouraging family owners from assigning priority to the improvement of organisational capabilities through learning activities. Indeed, the findings verifying our second hypothesis (H_2) reveal that family firms compliant with the international standards of ISO 14001 are not more prone than their counterparts to the knowledge management practices of employee training and development.

Rather, our results suggest that for ISO 14001-certified companies, the lack of mandatory external communication of the environmental targets and the relating achieved results leads such companies – both family and non-family - to mostly conceive the environmental management system as a mere management tool instrumental to gain social legitimacy. The firm's concern for legitimacy would not stimulate an effective interest in improving organisational capabilities (Deephouse and Carter, 2005), thereby discouraging corporate initiatives for the enhancement of employees' skills and competences (Boiral, 2007).

Finally, consistent with our predictions in hypothesis 3 (H_3), our findings reveal how the greater engagement in the knowledge management policies of training and development by family firms adopting an EMS under the EMAS scheme stimulate their innovation propensity for green products. Interestingly, Table 4 displays the effectiveness of knowledge management practices of training and development in stimulating green innovation ($\beta_5>0$*; p-value*<0.01). Particularly, this result suggests how an effective commitment to such activities would support workers in acquiring explicit knowledge and to develop skills for the evolution of learning in the development of products with a lower environmental impact.

5. Implications and Conclusions

5.1 Implications for research

Our paper provides various theoretical contributions. First, our study contributes to the research on behavioural motivations behind family firms approaches to the knowledge management process (Lansberg, 1983; Miller and Le Breton-Miller, 2005; Le Breton-Miller and Miller, 2006; Del Giudice, 2011; Della Peruta, 2011). From a social identity perspective, we argue that the family importance of identity fit between family and firm motivates a significant propensity of family owners to support the firm's need of learning evolution in order to improve organisational capabilities, and, hence preserve their own reputation. Consistent with our predictions, the results

suggest that high external visibility and monitoring of environmental behaviour increases the integration identity between family and firms by motivating a divergent propensity for knowledge management practices between family and non-family firms, with family firms (EMAS adopters) engaging in greater training and development activities which, in turn, positively moderate their openness toward environmental product innovation. On the contrary, the lack of mandatory external communication on environmental conduct for firms adopting an EMS under ISO 14001 would contribute to weakening the importance of identity fit between the family and the firm, leading family owners to underestimate the firm's needs of training and development activities and likely use the ISO 14001 as a management tool to gain organisational legitimacy. Supporting such perspectives, we demonstrated that family firms that adopt an EMS under ISO 14001 are not significantly interested – as well as non-family firms - in advancing the individual learning of their workforce.

The study also contributes to research on the drivers of eco-innovation. Prior research assumes EMS as a management tool stimulating innovation in the environmental protection field (Kesidou and Demirel, 2012; Bossle et al., 2016). However, we demonstrated that a firm's adoption of EMS leads to a corporate openness towards environmental product innovation, as long as it is supported by effective engagement in human capital programmes of training and development that - by enhancing the employees' skills and competences - contribute to the advancement of knowledge within organisations.

Finally, our study adds results to the research emphasising the importance of human capital management practices for knowledge exploration (Yahya and Goh, 2002; Bontis and Serenko, 2007; Della Peruta, 2011; Matsuo, 2015). Our findings show the relevance of employee training and development programmes as knowledge management tools that stimulate the propensity of a firm toward innovation in the environmental protection field.

5.2 Implications for practice

The study also provides managerial implications. The ability to offer new products and services to the market drives firms toward better performance (Carayannis et al., 2015), also in environmental protection field (Golicic and Smith, 2013). Our findings suggest that to stimulate the openness of the company toward environmental product innovation, top managers should overcome the bureaucratic vision of an EMS. This should be conceived as a management tool able to increase knowledge exploration opportunities within the organisation, by supporting the learning evolution through an effective commitment to human capital management policies of training and development.

Our study is also beneficial to family firms by suggesting that identity conflicts between the family and the business can be managed. Particularly, supporting the evolutionary learning of the organisation contributes to the firm's competitive advantage, thus contributing to the long-term prosperity of the firm and, hence, of the family.

Finally, to stimulate the organizations to effectively exploit an EMS as a strategic management tool for the evolution of the organisational knowledge in the environmental protection field, it might also be useful introduce - at national or European level - specific policies aimed at financially supporting the joint adoption of an EMS with effective employee training and development programmes. Such policies might contribute to increasing the competitive advantage of a country by fostering the corporate exploration of 'eco-sustainable' knowledge (Porter and Van der Linde, 1995).

5.3 Conclusions and future research directions

In this study, we investigated how an EMS might affect the environmental product innovation propensity of a firm through its influence on two factors shaping the knowledge process: the human capital management practices of training and development and the organisational context.

Drawing from social identity and institutional theories, this is the first study - to the best of our knowledge - that theorises and tests why the adoption of an EMS might stimulate the knowledge advancement of the organisation in a different way, especially in peculiar organisational contexts of family firms where the identity overlap between the family and the firm tends to affect the knowledge management process.

We are aware that the paper is not without its limitations. Our analysis was carried out over a broad sample of European companies distinguished in family and non-family firms, and covers a long-time period (10 years). In future studies, it might be carried out an analysis by only focusing on the family firms and exploring how the EMS in family firms might motivate a heterogeneous approach toward the evolution of learning of their workforce in dependence on different degree of family involvement in ownership and management.

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Table 1
Descriptive statistics

	All firms (a)			Family firms (b)			Non-family firms (c)			Diff. of means (d)=(b)-(c)
	Mean	*Median*	*Obs.*	*Mean*	*Median*	*Obs.*	*Mean*	*Median*	*Obs.*	*t-stat*
Dependent variables										
HCT&D	*80.953*	*86.035*	*2,554*	78.427	84.560	*809*	82.124	87.060	*1,745*	-3.696*** *(-5.50)*
EPI	*0.216*	*0.000*	*2,554*	0.247	0.000	*809*	0.202	0.000	*1,745*	0.045*** *(2.60)*
Independent variables										
FF	*0.317*	*0.000*	*2,620*							
ISO 14001	*0.597*	*1.000*	*2,554*	0.537	1.000	*818*	0.626	1.000	*1,736*	-0.089*** *(-4.32)*
EMAS	*0.168*	*0.000*	*2,554*	0.175	0.000	*818*	0.165	0.000	*1,736*	0.010 *(0.63)*
R&D Intensity	*0.028*	*0.006*	*2,355*	0.029	0.005	*752*	0.027	0.005	*1,603*	0.002 *(0.81)*
ROA (%)	*7.675*	*6.625*	*2,574*	8.403	7.055	*822*	7.333	6.490	*1,752*	1.070*** *(3.65)*
Leverage (%)	*25.976*	*24.210*	*2,591*	26.026	25.175	*824*	25.953	23.760	*1,767*	0.073 *(0.11)*
Size[§]	*19,295,017*	*8,934,860*	*2,580*	16,329,245	8,235,357	*818*	20,671,863	9,466,210	*1,762*	-4,342,618*** *(-3.19)*
Firm Age	*75.73*	*65.00*	*2,614*	81.81	75.00	*830*	72.91	58.00	*1,784*	8.90*** *(3.61)*
HCT&D	79.987	85.745	*2,544*	77.544	84.420	*808*	81.123	86.430	*1,736*	-3.579*** *(-4,92)*

[§]Data analysed before log transformation.

This table reports summary statistics for: (a) the overall sample; (b) the subsample of family firms (c) the remaining subsample of non-family firms; (d) the equality tests of means (*t-statistic*) between subsamples (b) and (c). To address potential causality issues, the dependent variables were taken at year $t + 1$, thereby covering the period 2006-2015; whereas all the independent variables were taken at year t, over the period 2005-2014.
*t-Statistic in parentheses; *, **, and *** denote statistical significance respectively at the 0.10, 0.05 and 0.01 levels.*

Table 2
EMAS and firms' effective engagement
in Human Capital Training&Development Programmes (*HCT&D*)

		HCT&D
Constant	α	16.732***
		(4.25)
FF	β_1	-2.410***
		(-3.43)
FF*EMAS	$\boldsymbol{\beta_2}$	**2.616****
		(2.45)
EMAS	$\boldsymbol{\beta_3}$	**0.210**
		(0.34)
R&D Intensity	γ_1	4.328
		(0.83)
ROA	γ_2	0.020
		(0.48)
Leverage	γ_3	-0.042**
		(-2.26)
Size	γ_4	1.161***
		(5.36)
Firm Age	γ_5	0.000
		(0.05)
HCT&D	γ_6	0.578***
		(19.36)
Adj-R-sq	*0.52*	
Firm-year obs.	*2,309*	

This table reports the estimates of Equation (1) by using the OLS, with robust standard errors corrected for heterosckedasticity and serial correlation by clustering on the firm-level identifier (HAC). To address potential endogeneity from causality issues, the dependent variable is 1-year lagged. *The industry, period and country fixed effects are included but unreported. t-Statistic in parentheses.*
, **, and * denote statistical significance respectively at the 0.10, 0.05 and 0.01 levels.*

Table 3
ISO 14001 and firms' effective engagement in Human Capital Training&Development Programmes (*HCT&D*)

		HCT&D
Constant	α	15.765***
		(3.96)
FF	β_1	-2.199**
		(-2.38)
FF*ISO 14001	β_2	**0.488**
		(0.45)
ISO 14001	β_3	**0.440**
		(0.70)
R&D Intensity	γ_1	5.196
		(0.99)
ROA	γ_2	0.016
		(0.39)
Leverage	γ_3	-0.039**
		(-2.11)
Size	γ_4	1.193***
		(5.56)
Firm Age	γ_5	0.000
		(0.08)
HCT&D	γ_6	0.580***
		(19.32)
Adj-R-sq	*0.52*	
Firm-year obs.	*2,309*	

This table reports the estimates of Equation (2) by using the OLS, with robust standard errors corrected for heterosckedasticity and serial correlation by clustering on the firm-level identifier (HAC). To address potential endogeneity from causality issues, the dependent variable is 1-year lagged.
The industry, period and country fixed effects are included but unreported. t-Statistic in parentheses.
, **, and * denote statistical significance respectively at the 0.10, 0.05 and 0.01 levels.*

Table 4
EMAS, family firms' effective engagement in Human Capital Training&Development Programmes (*HCT&D*) and environmental product innovation

		EPI
Constant	α	-12.866***
		(-11.40)
FF	β_1	0.100
		(0.68)
FF*EMAS*HCT&D	β_2	**0.010*** **
		(2.77)
EMAS*HCT&D	β_3	**0.004**
		(0.27)
EMAS	β_4	0.142
		(0.12)
HCT&D	β_5	0.028***
		(5.09)
R&D Intensity	γ_1	2.544**
		(2.35)
ROA	γ_2	-0.016*
		(-1.81)
Leverage	γ_3	-0.010**
		(-2.11)
Size	γ_4	0.248***
		(4.47)
Firm Age	γ_5	0.001
		(1.51)
McFaddenR-squared	*0.20*	
Firm-year obs.	*2,309*	

This table reports the estimates of Equation (3) by using the Binary Logit. To correct for heteroscedasticity and serial correlation, all z-scores are computed using Huber-White robust standard errors. To address potential endogeneity from causality issues, the dependent variable is 1-year lagged. *The industry, period and country fixed effects are included but unreported. z-Statistic in parentheses.*
, **, and * denote statistical significance respectively at the 0.10, 0.05 and 0.01 levels.*