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Being "green and competitive": the impact of environmental actions and collaborations on firm performance

ABSTRACT

In this paper, we seek to enhance the understanding of the link between environmental management and firm performance, so contributing to the debate of being "green and competitive". Relying on the resource-based view, we study the effect of different environmental management capabilities on a firm's market and image performance. In particular, we analyze the capabilities to implement product and process-related environmental actions with different types of environmental focus (materials, energy, pollution) and the capabilities to develop environmental collaborations with different types of actors (both business actors and non-business actors). To this aim we conducted a survey on 122 Italian companies. Results show that market performance and image performance have partially different antecedents. Specifically, a firm's market performance is positively affected by the capabilities to implement environmental actions with a focus on energy and pollution and to develop environmental collaborations both with business and with non-business actors. On the other hand, a firm's image performance is positively affected by the capabilities to implement environmental actions with a focus on materials and to develop environmental collaborations with non-business actors.

Keywords: environmental management capabilities, environmental actions, environmental collaborations, market performance, image performance

1. Introduction

The attention to environmental problems has grown worldwide particularly since the United Nations Conference on the Human Environment in 1972. This has emphasized the key role of industrialized countries and the responsibility of firms towards the natural environment. As a result a growing number of firms are embracing sustainability issues into their strategies and activities.

In the literature there is evidence that, by integrating the environmental dimension into firm strategies, several benefits, beyond environmental performance improvement (henceforth non-environmental performance), can be generated. These include return on investment, increased sales, development of new markets, improved corporate image, and product differentiation (e.g. Ameer and Othman, 2012;Miles and Covin, 2000;Orsato, 2006). However, little attention has been devoted to understand which specific environmental actions mainly contribute to the achievement of high firm non-environmental performance. In particular, firms can implement several actions to reduce their environmental impact, such as reducing pollutant emissions, increasing energy efficiency, using renewable energy sources, avoiding the use of toxic substances, increasing the efficiency in the use of materials, and using environmentally friendly materials (e.g. Dangelico and Pontrandolfo, 2010;Luttropp and Lagerstedt, 2006). It could be expected that different environmental actions may differently impact on firm performance.

Another relevant issue that is receiving a growing attention is the role of inter-organizational collaborations undertaken to achieve environmental targets (e.g. Arts, 2002;King, 2007;Vachon and Klassen, 2008). These types of collaborations can take place between companies as well as between companies and non-business actors, such as non-governmental organizations or universities and research institutions. While there seems to be agreement about the effectiveness of these collaborations to enhance a firm's performance,

both environmental and non-environmental (e.g. Rondinelli and London, 2003;Stafford and Hartman, 1996;Vachon and Klassen, 2008), little effort has been so far devoted to investigate whether the type of actor, with whom a firm establishes the collaboration, impacts on its performance (Albino *et al.*, 2012;Vachon and Klassen, 2008).

This paper aims at investigating the capabilities that allow a firm to achieve the best market and corporate image performance through the implementation of environmental management. In particular, this paper will analyze the effect of (i) the capabilities to implement different types of product and process-related environmental actions and of (ii) the capabilities to establish environmental collaborations with different types of actors on a firm's market and corporate image performance.

The paper is structured as follows. First, we provide the theoretical background and present the research model and hypotheses. After that, we describe the sample and the research methodology and present data analysis and results. Finally, we provide discussion and implications of results as well as limitations and directions for future research.

2. Theoretical framework and hypotheses

2.1. Benefits of going green

Over the years the debate of being "green[1] and competitive" has intensified, but still remains a field of inquiry under research (Ambec and Lanoie, 2008;Becchetti and Ciciretti, 2009;Iwata and Okada, 2011;King and Lenox, 2001;Porter and van der Linde, 1995). Literature shows that, through the integration of the environmental dimension into a firm's strategy and activities, several benefits can be generated in terms of i) market performance, such as increased sales, development of new markets, enhanced competitive advantage (Porter and van der Linde, 1995;Pujari, 2006;Shrivastava, 1995;Xueming and Shuili, 2012), ii)

[1] In this paper the terms "green" and "environmental" are used as synonyms.

corporate image[2] performance (Miles and Covin, 2000;Pujari, 2006), iii) manufacturing performance (Vachon and Klassen, 2008), and iv) financial performance (Iwata and Okada, 2011;Klassen and McLaughlin, 1996;Molina-Azorìn *et al.*, 2009;Russo and Fouts, 1997). However, some studies provided an alternative perspective. For example, Jaggi and Freedman (1992) found a slightly negative relationship between environmental activities and financial performance in the short run. Jacobs et al. (2010), studying the link between environmental performance and shareholder value, found that the market is selective in reacting to announcements of environmental performance; this highlights that different environmental actions may have a different effect on a firm's performance. Vachon and Klassen (2008), focusing on the link between environmental collaborations and manufacturing performance, found that collaborations with customers affect product-based performance, whereas collaborations with suppliers affect process-based performance. This highlights that environmental collaborations with different types of actors may differently affect a firm's performance.

The growing demand by a wide range of stakeholders (from customers to local communities) for a responsible behaviour of companies as well as the benefits deriving from the implementation of green management are making companies increase their environmental efforts. The integration of environmental sustainability into their strategies and activities entails several challenges and requires the development of new capabilities to tackle with them (Nidumolu *et al.*, 2009).

Resources and capabilities are widely dealt with in the resource-based view (RBV) literature. The resource-based view conceptualizes a firm as a bundle of resources (Amit and

[2] According to Dowling and Moran's (2012) conceptualization, corporate image represents "the beliefs and impressions held about the organization", in simple terms "what people think about" the company. A slightly different concept is corporate reputation, which represents "the estimation in which the organization is held", in simple terms, if the company is good/bad, admired and respected, better/worse than competitors. In this paper, "image performance" refers to company's performance in terms of corporate image.

Schoemaker, 1993;Mahoney and Pandian, 1992;Penrose, 1959;Wernerfelt, 1984). Firms which own resources that are valuable, rare, inimitable, and non-substitutable are able to achieve competitive advantage (Barney, 1991;Conner and Prahalad, 1996;Nelson, 1991). Capabilities refer to a firm's capacity to deploy resources, usually in combination, using organizational processes in order to achieve a desired end (Amit and Schoemaker, 1993;Collis, 1994). In 1995, Hart expanded the RBV of the firm to include the constraints and opportunities given by the natural environment and proposed a natural RBV of the firm (Hart, 1995). Since then, several studies have been using the RBV to examine the strategic management of environmentally related issues (Christmann, 2000;Lopez-Gamero *et al.*, 2009;Rugman and Verbeke, 1998;Russo and Fouts, 1997). Many of these studies highlight the links between environmental strategies, capabilities development, and competitive advantage (Aragon-Correa and Sharma, 2003;Lopez-Gamero *et al.*, 2009;Sharma *et al.*, 2007;Sharma and Vredenburg, 1998) or financial performance (Aragon-Correa *et al.*, 2008). In particular, Lee and Klassen (2008) define environmental management capabilities (EMCs) as "organizational abilities or skills that enable firms to improve their performance on environmental issues". However, little attention has been so far devoted to the organizational abilities or skills that, besides contributing to improve firms' environmental performance, also enable firms to improve their market and image performance.

This paper will thus investigate the effect of different EMCs on a firm's market and image performance. Specifically, we will focus on the capabilities to implement different types of product and process-related environmental actions and on the capabilities to establish environmental collaborations with different types of actors (ranging from universities and research institutions to suppliers).

2.2. Capabilities to implement environmental actions

Different types of environmental actions can be implemented by firms, as shown by the many meanings of the word ‘green’ discussed in the literature (Kleiner, 1991;McDonagh and Prothero, 1996;Miller and Szekely, 1995;Silverstein, 1993). The wide range of actions that can be implemented is also highlighted by Lee and Klassen (2008). The authors define product EMC as the capability to develop environmentally friendly products through design for the environment, life cycle assessment, elimination of hazardous materials, whereas they define process EMC as the capability to sustain cleaner production and manufacturing processes that adopt preventive approaches, such as mass balance control, source-based emission reduction, and energy-saving technologies.

Dangelico and Pontrandolfo (2010) argue that, whether related to products or to processes, environmental actions can be linked to three main dimensions: materials, energy, and pollution. Environmental actions related to materials, energy, and pollution offer competitive opportunities for firms and have changed the competitive landscape in many industries (Hart, 1995;Shrivastava, 1995). Through the increase of resource productivity, firms can profit from environmental investments and transform them into sources of competitive advantage (Orsato, 2006;Porter and van der Linde, 1995). As highlighted by Porter and van der Linde (1995), pollution represents a form of inefficiency. In fact, the discharge of harmful substances, waste, by-products, or energy into the environment means that resources have been used incompletely, inefficiently, or ineffectively. Thus, pollution prevention measures, efficiency in the use of energy, as well as materials savings and better utilization of by-products are expected to lead to cost reduction as well as to increased profit margins. Further, many environmental actions involving products and processes (such as the use of natural materials or biodegradable components or the development of more energy-efficient products) represent a source of differentiation advantage for the firm and may allow the firm to operate

in new markets, green niche markets, increase market share (Orsato, 2006;Pujari, 2006) as well as improve corporate image (Pujari, 2006).

Based on the above, the following hypotheses are proposed:

H1: The capabilities to implement a) energy-focused environmental actions, b) pollution-focused environmental actions, and c) materials-focused environmental actions positively affect a firm's market performance.

H2: The capabilities to implement a) energy-focused environmental actions, b) pollution-focused environmental actions, and c) materials-focused environmental actions positively affect a firm's image performance.

2.3. Capabilities to develop environmental collaborations

Environmental collaborations can be defined as any formal or informal collaboration between two or more organizations which is aimed at developing common solutions to environmental problems (Crane, 1998). Through these collaborations, an organization can achieve several benefits, including the access to environmental technologies, the acquisition of environmental knowledge and competencies, a presence in green markets and a higher reliability of green claims (Crane, 1998). Lee and Klassen (2008) consider supply chain EMC and relationship EMC (related to the development and exploitation of external relationships with direct and indirect stakeholders) as important environmental management capabilities. Environmental collaborations can be developed by a firm with several types of actors, which can represent sources of environmental knowledge and competencies outside the firm's main domain. These actors include suppliers, customers, other companies outside the supply chain, non-governmental organizations, governmental agencies, universities and research institutions (Foster and Green, 2000). In the literature, several studies emphasize that environmental collaborations along the supply chain lead to several benefits that are not limited to environmental ones. Hall (2000) highlights the important role played by buyer-supplier relationships in stimulating environmental innovation, while Zhu and Sarkis (2004) show that

green supply chain collaborations have a positive effect on both environmental and economic performance. Pujari (2006) highlights that environmental collaborations with suppliers in new product development positively affect a firm's performance, including increased market share, competitive advantage, product differentiation, and environmental image. More recently, Kim et al. (2011) show that a green supply chain management orientation positively influences a firm's bottom-line performance through supply chain partners' trust and information sharing.

A phenomenon that has rapidly grown during the past few years is represented by environmental collaborations between firms and NGOs (Arts, 2002;King, 2007;Kumar and Malegeant, 2006;Peloza and Falkenberg, 2009;Rondinelli and London, 2003;van Huijstee and Glasbergen, 2008). Such collaborations exploit the complementary resources owned by these two types of organization and enable a more effective use of knowledge and capabilities of both, which in turn leads to better environmental performance and higher corporate profitability. In particular, they help companies to develop environmentally friendly programmes and, at the same time, reduce costs and achieve differentiation advantage; they foster environmental innovation resulting in higher operational efficiency as well as new technologies or new green products (Rondinelli and London, 2003;Stafford *et al.*, 2000). Furthermore, collaborations with NGOs may help firms to obtain higher credibility and may help enhance corporate image (Hartman and Stafford 1997; Kumar and Malegeant 2006; Stafford and Hartman 1996). The literature suggests that environmental collaborations with universities and research institutions may help firms to develop green innovations, since these actors represent sources of environmental and technological expertise (Foster and Green, 2000;Noci and Verganti, 1999;Seuring, 2004). Finally, environmental collaborations with government actors (such as government agencies of public administrations) may represent a

means to improve environmental performance and increase a firm's environmental image (Hart, 1995;Roy and Whelan, 1992).

Based on the above, the following hypotheses are proposed:

H3: The capabilities to develop environmental collaborations with a) business actors and b) non-business actors positively affect a firm's market performance.

H4: The capabilities to develop environmental collaborations with a) business actors and b) non-business actors positively affect a firm's image performance.

The proposed theoretical framework, which links the capabilities to implement environmental actions and to develop environmental collaborations with a firm's market and image performance, is depicted in Figure 1. Specifically, on the left side of the figure, there are the capabilities to implement environmental actions and the capabilities to develop environmental collaborations. On the right side there are the benefits (firm performance) deriving from the deployment of these capabilities. The arrows show the links between each of the capabilities and each of the firm performance. Each arrow corresponds to one of the formulated hypotheses.

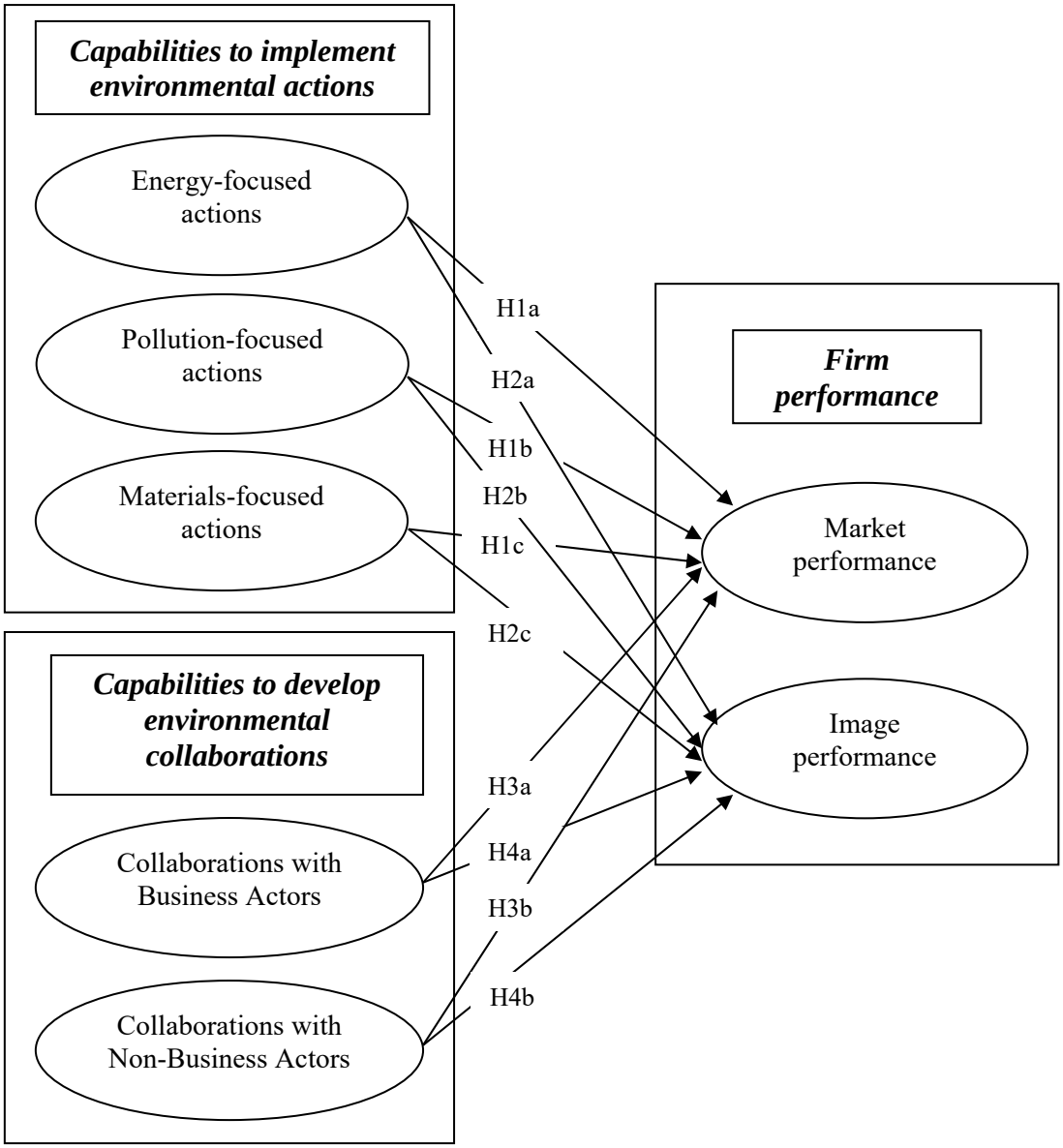

Figure 1: Theoretical framework

3. Methodology

3.1. Sample

As common for this kind of studies, primary data for hypotheses testing were collected through a survey (see for instance, Lopez-Gamero *et al.*, 2009;Pujari, 2006;Sharma, 2000). In particular, 800 Italian companies operating in Apulia Region were surveyed. The choice of Italian companies is due to: (i) the increasing relevance of environmental issues in Italy; (ii) data accessibility; and (iii) a deeper knowledge of the industrial system under investigation.

The focus on companies located in Apulia Region is due to the increasing attention that in the last few years the government of this region has devoted to sustainable development. As a result of this growing commitment, Apulia Region is among the top ranking Italian regions with regard to renewable energies power installed – first region for solar and second one for wind energy (Terna, 2012). Companies where randomly selected by the lists of companies belonging to the local Industrial Associations and to the Industrial Clusters recognized by Apulia Region.

In this study we used the 'key informant' approach, coherently with previous similar studies (Campbell, 1955). Key informants included CEOs, marketing directors, R&D directors, HSE managers, etc., who were considered most knowledgeable about the issues under investigation. Sample statistics, in terms of firms' size and age are reported in Table 1. The majority of companies are medium-small sized (SMEs account for more than 90%). This reflects the overall structure of Italian productive fabric, mostly made of SMEs.

Table 1: Summary statistics of the sample, in terms of size and age.

	Frequency	**Frequency (%)**
Size (number of employees)		
<10	45	36.9%
10-50	42	34.4%
50-249	27	22.1%
250-499	4	3.3%
>500	4	3.3%
Age (number of years)		
<10	25	20.5%
10-25	62	50.8%
25-50	24	19.7%
>50	11	9.0%
Total	***122***	***100%***

Sample statistics in terms of industrial clusters to which firms belong are reported in Table 2.

Table 2: Summary statistics of the sample, in terms of companies' membership to industrial cluster(s) (a company may belong to more than one cluster).

	Frequency
Cluster	
Logistics	4
Publishing and Communication	7

Information technology	10
Engineering industry	16
Sustainable construction	12
Renewable energies and Energy efficiency	23
Natural environment and Reuse	14
Food processing	8
Fashion	7
Wood furniture	5
Boating	7
Stone	3
Aerospace	6
None	17

Finally, in Table 3 the number of firms holding environmental management system (EMS) certifications, ISO14001 or EMAS[3], is reported. Results show that 39 companies out of 122 obtained at least one certification for their EMS.

Table 3: Summary statistics of the sample, in terms of companies' environmental certifications.

	Frequency
Certification	
Only ISO14001	29
Only EMAS	1
Both of them	9
None	83

3.2. Procedure

A structured questionnaire of closed-ended questions was developed to collect data. Responses were recorded on a five-point scale. Most of the scales included in the questionnaire were adapted from earlier studies (Dangelico et al. 2013; Sharma 2000; MIT Sloan Management Review and Boston Consulting Group 2011). The questionnaire was prepared in English and then translated into Italian. It was checked for accuracy in line with the conventional back-translation process. A draft version of the questionnaire was pre-tested with academics and industry experts in order to check content validity and correct any

[3] ISO 14001 is a global standard for EMSs. It maps out a framework that an organization can follow to set up an effective EMS. It provides assurance that environmental impact is being measured and improved. EMAS is the Standard Eco-Management and Audit Scheme issued by the European Community. It is a management tool for organizations to evaluate, report and improve their environmental performance. An organization compliance with ISO14001 or EMAS can be certified by an external third party. Both ISO14001 and EMAS certifications are voluntary.

ambiguity. The questionnaire was divided into four parts: firm's general information, collaborations developed to address environmental sustainability, involvement in environmental actions, and benefits deriving from the integration of environmental sustainability into company's activities.

After preliminary phone calls to identify the 'key informant' within each company, the questionnaire was administered through e-mails. After multiple follow-up e-mails and phone calls, we retained 122 usable questionnaires. The response rate of 15.3%, comparable with similar studies (Dangelico *et al.*, 2013;Pujari *et al.*, 2003), seems acceptable for the study's purposes.

We checked for three types of bias that could affect our dataset: common-method variance, difference between early and late respondents, and non-respondent bias. Specifically, Harman's one-factor test was used to test the presence of common method bias; an analysis of the differences between survey constructs of early respondents (who returned the questionnaire within three weeks) and late respondents (who returned the questionnaire after reminders) was conducted to check for difference between early and late respondents; a t-test for equality of means for firms' size and firms' age between the group of respondents and non-respondents was run to check for non-respondent bias (Armstrong and Overton, 1977;Podsakoff and Organ, 1986). Results of these tests suggest that none of these biases is likely to affect our dataset.

3.3. Measures

The list of the items used in the questionnaire is reported in the Appendix A. In the following, each scale is presented.

Capabilities to develop environmental collaborations

To measure the capabilities to develop collaborations with external actors to address environmental sustainability, a multiple-item scale was developed adapting items already

used in previous studies (Dangelico *et al.*, 2013). In particular, respondents were asked to indicate the extent of collaborations of their company with several types of actors to address the environmental sustainability challenges during the past five years. These actors include: customers, suppliers, competitors, trade associations, universities and research institutions, non-governmental organizations (NGOs), and public administrations.

Capabilities to implement environmental actions

To measure the capabilities to implement environmental actions a multiple-item scale was developed adapting items already used in previous studies (Sharma, 2000). In particular, respondents were asked to indicate the level of their company's involvement in several environmental actions related to processes, products, or packaging, during the past five years. These actions are: reduction in the use of toxic substances, use of eco-friendly materials (biodegradable, natural, recycled, or recyclable), improvement of the efficiency in the use of materials, improvement of energy efficiency, use of energy from renewable sources, and reduction of pollution.

Firm performance

To measure benefits deriving from the integration of environmental sustainability into a company's activities, a multiple item scale was developed adapting items already used in previous studies (MIT Sloan Management Review and Boston Consulting Group, 2011). Respondents were asked to indicate the extent to which integrating environmental sustainability into their company's activities contributed to several types of benefits during the past three years: access to new markets, increased margins or market share, increased competitive advantage, increased customers willingness to pay a premium price for products, improved reputation, improved regulatory compliance, and better innovation. We choose to use this scale since it embraces several dimensions of firm performance. Of these dimensions, the only one that could have been measured through objective data is "increased margins or

market share". However, we opted for subjective measures even for this dimension for three reasons: (i) the sake of homogeneity with the other dimensions, (ii) the fact that these data are not publicly available, since not all surveyed companies (due to company type) have in Italy the obligation to publish the annual balance sheet and the profit and loss account, and (iii) the fact that surveyed companies belong to different industries, so that perceptual measures by managers can be more informative than objective data. Further, Dess and Robinson (1984) found a positive correlation between objective and subjective measures of a firm's return on assets and sales growth.

Control variables

Several control variables were included in the questionnaire to check for other explanations of firms' behaviour. Specifically, measures for a firm's size, a firm's age, a firm's industry, and the existence of a certified EMS were included as control variables. Firm's size was measured by the number of employees, following previous studies (e.g. Dangelico *et al.*, 2013;Kim and Atuahene-Gima, 2010;Spanos and Lioukas, 2001). Firm's age was measured by the number of years since foundation. To check for industry effect, we included 14 dummy variables. Of these, 13 represent the industrial clusters in the sample (*logistics*, *publishing and communication*, *information technology*, *engineering industry*, *sustainable construction*, *renewable energies and energy efficiency*, *natural environment and reuse*, *food processing*, *fashion*, *wood furniture*, *boating*, *stone*, and *aerospace*) and one, named *manufacturing*, takes into account whether the company is a manufacturing one (the variable takes the value 0 if the company only supplies services, 1 if the company supplies both services and products or only products). To check for the existence of a certified EMS, two dummy variables were included, one for ISO14001 certified EMS and the other one for EMAS certified EMS.

4. Data analysis

4.1. The measures

First of all, a preliminary examination of variables was done to check for non-normality: high magnitudes of skewness or kurtosis statistics (indicating departures from normality) were not found for any variable, except for firm's size and age. Then, a logarithm transformation on both variables was performed to correct non-normality (Hair et al. 2006). The new variables were named *log_size* and *log_age* respectively.

An exploratory factor analysis was carried out on items referred to collaborations using principle component analysis (varimax method) in order to extract the main factors from the considered set of items. Following the percentage of variance and the scree test criteria (Hair *et al.*, 2006), we retained two factors accounting for 59.54% of the variance (Kaiser-Meyer-Olkin [K-M-O] statistic 0.824; Bartlett's statistic 210.60; significance 0.000). The first factor refers to collaborations undertaken with business actors (customers, suppliers, competitors, and trade associations) to address environmental sustainability challenges and is named *collaboration_business*. The second factor is related to collaborations developed with non-business actors (universities and research institutions, NGOs, and public administrations) to address environmental sustainability challenges and is named *collaboration_non_business*.

Similarly, an exploratory factor analysis was carried out on items referred to environmental actions using principle component analysis (varimax method). Results show two factors with eigenvalues greater than 1, accounting for 71.90% of the variance (K-M-O statistic 0.683; Bartlett's statistic 253.73; significance 0.000), instead of the three that we had hypothesized. The first factor is linked to the capability to implement environmental actions related to materials (reduction in the use of toxic substances, use of eco-friendly materials, and improvement of the efficiency in the use of materials) and is here named as *materials*. The second factor is linked to the capability to implement environmental actions related to

energy and pollution (improvement of energy efficiency, use of energy from renewable sources, and reduction of pollution) and is thus called *energy&pollution*. This result is coherent with what was highlighted by Dangelico and Pontrandolfo (2010): practices aimed at improving energy efficiency of processes or products or at using energy from renewable sources are strictly linked to pollution reduction. Thus, these two strictly related dimensions will be jointly considered.

An exploratory factor analysis was also carried out on items referred to firm performance using principle component analysis (varimax method) in order to extract the main factors from the considered set of items. Results show two factors with eigenvalues greater than 1, accounting for 75.30% of the variance (K-M-O statistic 0.832; Bartlett's statistic 452.01; significance 0.000). The first factor is linked to market benefits deriving from the integration of environmental sustainability into a company's activities (access to new markets, increased margins or market share, increased competitive advantage, increased customers willingness to pay a premium price for products) and is here named as *market performance*. The second factor is linked to less tangible results (improved reputation, improved regulatory compliance, and better innovation) which positively affect corporate image and is thus called *image performance*.

It should be noticed that, since factor analysis showed two factors instead of three for the capabilities to implement environmental actions, hypotheses 1a and 1b as well hypothesis 2a and 2b will be jointly considered (as H1ab and H2ab). The complete theoretical model, which details all variables as deriving from the factor analysis, the hypothesized links between them, and the control variables is depicted in Figure 2.

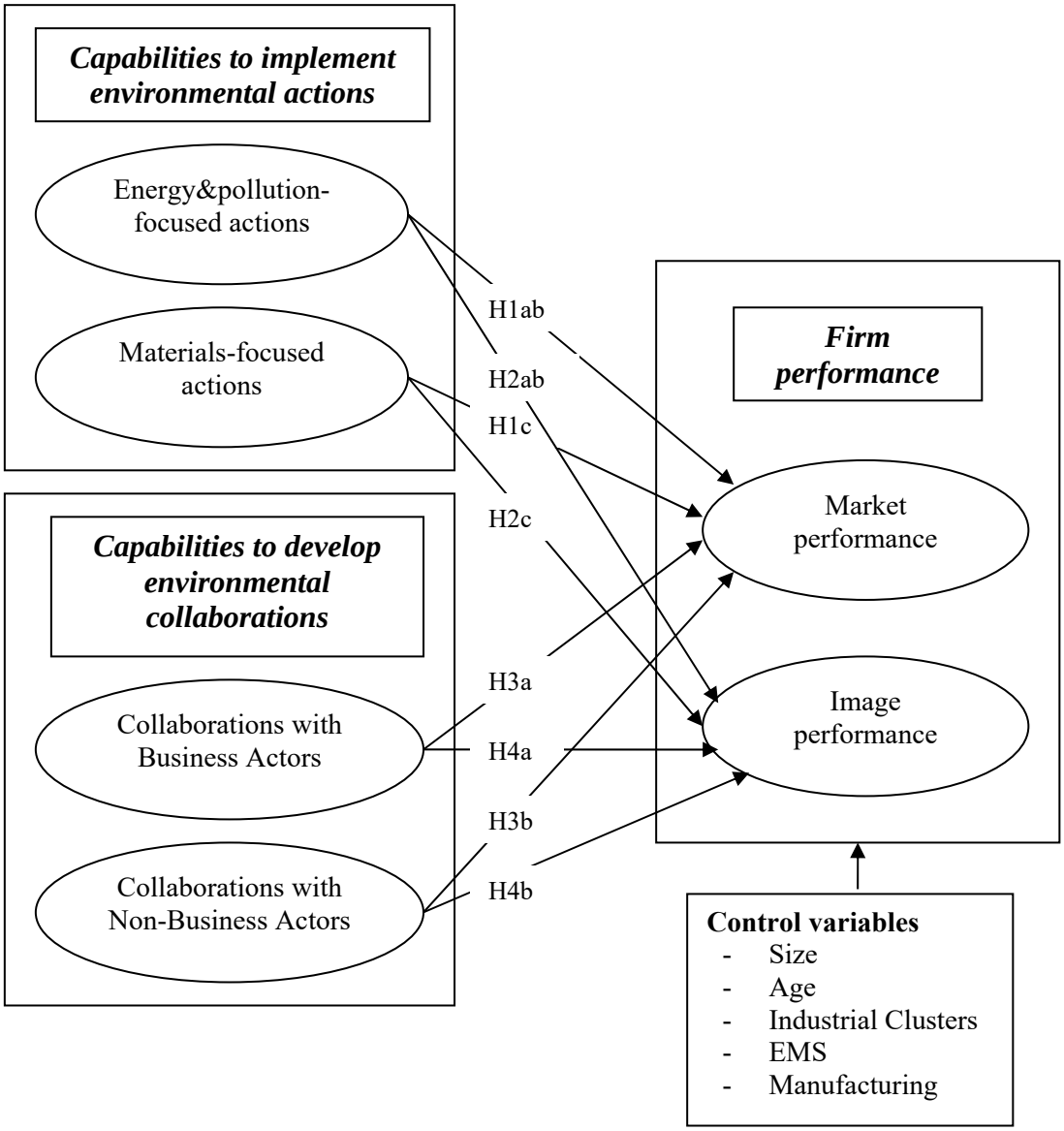

Figure 2: Tested model

A correlation analysis was then performed. The correlation matrix with inter-correlations among constructs and between constructs and control variables is reported in Appendix B. The correlation analysis shows preliminary evidence that *materials* is positively related to *market* and *image performance* and that *energy&pollution* is positively related to *market performance.* Both *collaboration_business* and *collaboration_non_business* show a positive and significant correlation both with *market* and with *image performance*. With regard to correlations between control variables and capabilities variables, some interesting results are

the negative correlation between *log_size* and *collaboration_business* and the positive correlations of both *ISO14001* and *EMAS* with *energy&pollution*. Further, as expected, there is a positive correlation between *manufacturing* and *materials*.

Convergent validity of constructs was assessed by means of item loadings and scales' reliability. All item loadings exceeded 0.50, providing evidence of convergent validity among the measures for each construct (Hair et al. 2006). Cronbach's α coefficient exceeded the recommended cut-off value of 0.60 (Churchill, 1979), providing good evidence of scales' reliability. Constructs' mean, standard deviation and Cronbach's α coefficient are reported in Table 4.

Table 4: Mean, standard deviation, number of items and Cronbach's α of constructs included in the study.

Constructs	**Mean**	**Std Dev**	**Number of items**	**Cronbach's α coefficient**
CollaborationBusiness	2.44	.98	4	.752
CollaborationNonBusiness	2.17	.93	3	.661
Energy&pollution	3.48	1.05	3	.748
Materials	3.79	.95	3	.792
Market performance	2.58	1.09	4	.885
Image performance	3.39	.97	3	.809

Before testing hypotheses, we checked for the independence assumption among independent variables. In particular, variance inflation factor (VIF) and tolerance were used to evaluate explanatory variables collinearity (Appendix C). The VIFs (maximum value 1.913) and the tolerance measures (minimum value .523) support the independence assumption (Hair *et al.*, 2006).

4.2. Results of hypotheses testing

Regression analysis (Ordinary Least Squares) was performed to investigate the role of the capabilities to implement environmental actions and develop environmental collaborations to achieve a firm's market as well as image performance. Results are presented in models 1-8 of Table 5.

Specifically in models 1-4 the dependent variable is *market performance*. In model 1 we entered only control variables; in model 2 we added environmental actions variables; in model 3 we entered control variables as well as environmental collaborations variables; finally, in model 4 we entered all independent variables.

In models 5-8 the dependent variable is *image performance*. In model 5 we entered only control variables; in model 6 we added environmental actions variables; in model 7 we entered control variables as well as environmental collaborations variables; finally, in model 8 we entered all independent variables.

Table 5: Regression analysis results.

Dependent variables / Independent variables	Market performance				Image performance			
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Control variables								
LogSize	-.035	-.044	.034	-.005	.045	.105	.055	.087
LogAge	.034	.051	.012	.026	.120	.131	.101	.113
ISO14001	.099	.000	.074	.002	.031	.017	.023	.027
EMAS	-.140	-.128	-.099	-.110	-.035	.027	-.017	.025
Logistics	.000	.030	-.022	.005	.035	.031	.015	.012
Publishing and Communication	.165	.151	.126	.123	.018	-.015	-.024	-.045
Information technology	.188*	.222**	.171*	.192**	.029	.044	-.004	.006
Engineering industry	.119	.096	.092	.088	.109	.038	.075	.019
Sustainable construction	.113	.080	.105	.072	.076	.071	.035	.029
Renewable energies and Energy efficiency	.219*	.124	.099	.044	.250**	.195*	.142	.123
Natural environment and Reuse	.114	.106	.058	.057	-.050	-.050	-.100	-.091
Food processing	.253**	.202**	.292***	.244***	-.049	-.068	-.042	-.064
Fashion	.164	.101	.136	.092	-.043	-.095	-.092	-.130
Wood furniture	.048	.072	.044	.049	-.099	-.052	-.124	-.088
Boating	.226**	.165*	.221**	.161*	-.107	-.072	-.125	-.091
Stone	.128	.071	.206**	.158*	.039	-.019	.081	.019
Aerospace	-.015	-.038	.017	-.013	.117	.121	.113	.108
Manufacturing	.158	.160	.114	.139	.107	.056	.099	.068
Capabilities to implement environmental actions								
Materials		.204**		.079		.413***		.340***
Energy&Pollution		.333***		.267***		.014		-.019
Capabilities to develop environmental collaborations								
CollaborationBusiness			.411***	.343***			.242**	.151
CollaborationNonBusiness			.273***	.259***			.286***	.247***

F	1.035	1.959**	2.927***	3.320***	1.006	2.111***	.1895**	2.555***
R^2	.153	.279	.367	.425	.149	.295	.273	.362
Adj R^2	.005	.137	.242	.297	.001	.155	.129	.220
***p<.10; ** p<.05; *** p<.01**								

Results show that the capability to implement environmental actions focused on energy and pollution (*energy&pollution*) has a positive and significant effect on a firm's *market performance*, so providing support to hypothesis H1ab. On the other hand, results show that such a capability does not have a significant effect on a firm's *image performance*, so leading to reject hypothesis H2ab. On the contrary, results highlight that the capability to implement environmental actions focused on materials (*materials*) does not affect a firm's *market performance*, thus leading to reject hypothesis H1c, while it positively and significantly affects a firm's *image performance*, so providing support to hypothesis H2c. So, both H1 and H2 are partially supported.

With regard to the effect of the capabilities to develop environmental collaborations on a firm's performance, results show that the capability to develop environmental collaborations with business actors (*collaboration_business*) has a positive and significant effect only on *market performance*, so providing support to H3a and leading to reject H4a. On the other hand, the capability to develop environmental collaborations with non-business actors (*collaboration_non_business*) has positive and significant effects on both *market* and *image performance*, so providing support to hypotheses H3b and H4b. Thus, H3 is fully supported, while H4 is partially supported.

Referring to control variables, results show that belonging to specific industrial clusters affects *market performance*. In particular, companies belonging to the clusters *food processing*, *stone*, *boating*, and *information technology* seem to have a higher *market performance*. On the other hand, the membership to a specific cluster seems not to have any significant influence on a firm's *image performance*. Furthermore, a firm's size, firm's age as well as its manufacturing nature do not seem to affect any of the considered dimensions of

performance. Finally, the existence of a certified environmental management system (*ISO14001* or *EMAS*) does not seem to influence either *market* or *image performance*.

5. Discussion and managerial implications

This paper investigates the capabilities that allow a firm to achieve better performance through the implementation of environmental management. In particular, it has been analyzed how the capabilities to (i) implement different types of environmental actions and (ii) develop environmental collaborations with different types of actors impact on a firm's market and image performance.

Interestingly, different antecedents were identified through regression analysis for a firm's market performance and image performance. Specifically, the capability to undertake environmental actions with a focus on energy and pollution as well as the capabilities to develop environmental collaborations both with business actors and with non-business actors positively affect a firm's market performance. On the other hand, the capability to implement environmental actions with a focus on materials as well as the capability to develop environmental collaborations with non-business actors positively affect a firm's image performance.

The positive effects of the capabilities to develop environmental collaborations (both with business and with non-business actors) on a firm's market performance as well as the positive effect of the capability to develop environmental collaborations with non-business actors on a firm's image performance confirm what is highlighted in the literature about the important role of these capabilities (Albino *et al.*, 2012;Vachon and Klassen, 2008). In fact, through the integration of complementary environmental knowledge and competencies, environmental collaborations allow several benefits to be achieved by a firm, such as the access to environmental technologies, a presence in green markets, and a higher reliability of green

claims (Crane, 1998). Our results highlight that, differently from collaborations with business actors, collaborations with non-business actors have a positive effect on image performance. One of the possible reasons for this is the fact that collaborating with non-business actors, such as NGOs, may prove more suitable to obtain higher credibility and enhance reputation (Hartman and Stafford, 1997;Kumar and Malegeant, 2006;Stafford and Hartman, 1996).

The positive effect of the capability to implement environmental actions focused on energy and pollution on a firm's market performance may be explained through the fact that energy and pollution-focused actions (e.g. reflected in the development of more energy efficient products) may open new markets and increase customers' willingness to pay a premium price for products (Manget *et al.*, 2009). In fact, such actions generally result in products allowing cost reductions to be achieved by customers during product usage. On the other hand, the improvement of energy efficiency, the use of renewable energy sources, and the reduction of pollution during production processes may lead to manufacturing cost reduction and, thus, to increased margins. This is coherent with what suggested by Hart (1995), i.e. that pollution-prevention capability drives competitive advantage by lowering costs in production and operations. This result is also consistent with the statement by Orsato (2006) that green products and services represent an important market niche and that a marketing differentiation based on the environmental attributes of products constitutes a key strategy to improve competitive advantage.

While energy and pollution-oriented actions, if not pushed by stricter environmental regulations, may be induced by economic incentives (for example the strong incentives to the use of renewable energy sources granted by the Italian government during the past few years), materials-focused actions (such as the use of eco-friendly materials and the improvement in material use efficiency) tend to be more proactive. As such, these actions are likely to be included and emphasized within communication strategies of firms, and this may to some

extent explain why this type of environmental actions showed to lead to image-related benefits.

With regard to control variables, results show that a firm's size, a firm's age, and its manufacturing nature do not have a significant influence on either market or image performance.

Similarly, the existence of a certified EMS (either ISO14001 or EMAS) seems not to affect either market or image performance. This is an interesting result. In fact, some studies suggested that the certification of a firm's EMS has the potential to become a source of competitive advantage (Berry and Rondinelli, 1998). However, as highlighted by Orsato (2006), it should be acknowledged that there is a key difference between the certification of an EMS and that of a quality management system. While quality improvements can be easily transferred from processes to the products and services bought by consumers - and this allows quality to become a source of private profit - environmental protection is a public good and, as such, its value may not always be incorporated into products or services. The non-significant effect of a certified EMS on market performance is consistent with results obtained by Link and Naveh (2006) who find that ISO 14001 implementation does not lead to better business performance (such as margins, sales, and R&D investments). On the other hand, the non-significant effect of a certified EMS on image performance (which includes better innovation and improved reputation) is in contrast with other studies that found a positive (even though weakly significant) influence of the certification of EMS on environmental product innovation (Rehfeld *et al.*, 2007). The non-significant effect on reputation improvement may be due to the fact that small-medium sized companies (which represent more than 90% of our sample) often do not publicize the certification of their EMS, so neutralizing the potential to positively impact reputation.

With regard to the influence of industrial clusters, our analysis shows that the membership to certain clusters (food processing, stone, boating, and information technology) is associated with higher market performance. Thus, companies belonging to such clusters achieve higher market benefits from the integration of environmental sustainability into their activities. The most significant link concerns the food processing cluster and market performance. This result may be due to the fact that customers are highly sensitive to environmental initiatives related to food products or processes and are quite willing to pay a premium price for environmentally sustainable food products, such as organic food (Manget *et al.*, 2009). Furthermore, since organic farmers still represent a minority of producers in Apulia Region, those who take care of environmental issues can achieve a differentiation competitive advantage. On the other hand, the membership to a specific cluster does no result in a higher image performance.

With regard to the links between control and capabilities variables, some interesting results did emerge from the correlation analysis. First, a negative correlation emerged between a firm's size and the capability to develop environmental collaborations with business actors. This may be due to the fact that larger companies are more likely to internally own environmental resources and competencies, compared to smaller companies; this makes them less needy to develop environmental collaborations with other companies to face environmental challenges. Further, smaller firms are more flexible, which helps them avoid the organizational inertia that characterizes larger firms (Stock *et al.*, 2002). In particular, when a new technological paradigm emerges, creative destruction of existing competencies takes place, so favouring small firms that are more flexible to pursue new opportunities and develop new capabilities. Green economy can be considered as a new paradigm, which favours the development of new capabilities by smaller firms (Hockerts and Wüstenhagen, 2010), such as the capability to develop environmental collaborations with other companies.

A second relevant result is the positive correlation between the existence of a certified EMS and the capabilities to implement environmental actions focused on energy and pollution. This result highlights that implementing an EMS may help a firm develop capabilities related to energy and pollution management.

Less surprising is the positive link between the manufacturing nature of a firm and the capability to implement environmental actions with a focus on materials.

With regard to managerial implications, this study suggests that companies should invest in the development of capabilities related to environmental collaborations and actions, as these positively affect a firm's performance. Specifically, while there seem not to be relevant differences among collaborations with specific types of actors, materials-focused capabilities and energy and pollution-related capabilities present different effects on a firm's performance. As a result, when deciding how to prioritize their investments in capabilities for the implementation of environmental actions, companies should be aware of the effects of such investments on both market and image performance. In particular, companies more oriented to achieve market performance in the short run should prioritize investments in capabilities related to energy and pollution. On the other hand, companies seeking to increase their reputation and their compliance to environmental regulations or to achieve better innovation results should prioritize investments in capabilities related to materials. These investments will be able to drive market results in the medium-long run.

6. Conclusions

Over the past few years the debate about being "green and competitive" has intensified and still remains an open field of inquiry. This is mainly due to the fact that several aspects of environmental management as well as firm performance can be analyzed and this has led to mixed evidence about the link between these variables. This paper contributes to deepen the

understanding of the effect of environmental management on firm performance. Specifically, we focused on the capabilities to implement product and process-related environmental actions (focused on materials, energy, and pollution), on the capabilities to develop environmental collaborations with external actors (business and non-business actors), and on their effect on two specific dimensions of performance: market and image performance. We have demonstrated that the effect on firm performance depends both on the type of the considered capability and on the specific dimension of performance. We have also contributed to the resource-based view, indicating which of the analyzed capabilities are more relevant to improve firm performance.

Some limitations and future research directions should be highlighted. First of all, with regard to the capabilities to develop environmental collaborations, we decided to focus on the type of actors with which the collaboration is established rather than on the type of collaboration. While such a type of data would have added an interesting perspective to the study, our specific aim is to understand the role of capabilities to develop environmental collaborations, regardless the collaboration features (such as its degree of formalization). Future research should be devoted to investigate the moderating effect of collaboration features on the link between environmental collaborations with specific actors and firm performance. Secondly, with regard to the capabilities to implement environmental actions, we decided to characterize such actions in terms of the environmental focus (materials, energy, and pollution), rather than according to other dimensions, such as product or process-related actions, or life cycle phase associated with the greatest environmental benefits (e.g. before product's usage, during usage, after usage). While all these dimensions are potentially relevant, we believe that the distinction of environmental actions by focus is more easily understandable and convertible into actions by companies. Third, we used cross-sectional data to derive causation. Even though very common in management studies, there are concerns

about the validity of this approach, relating to common method variance bias and causal inferences. To address these concerns, according to what suggested by Rindfleisch et al. (2008), we used survey questions referred to a well specified time period and, to ensure an adequate time lag between causes and effects, performance measures were referred to a time period (past three years) shorter than for independent variables measures (past five years). We also checked for common-method bias. Further, we tested our hypotheses on a sample of Italian companies located in a specific region. While this choice guarantees data accessibility and a deeper knowledge of the industrial system under investigation, it could limit the results' generalizability. With this regard further research could be devoted to test the suggested theoretical framework on other samples, for example on companies belonging to other Italian regions, and/or to other countries, characterized by different levels of attention towards environmental sustainability. Finally, future research could take into account the dynamics characterizing the main market in which a firm operates, investigating whether the effects of different environmental management capabilities on firm performance significantly differ for companies operating in business to business markets compared to those operating in business to consumer ones.

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APPENDIX A

Table A.1: Scales

		Items	Factor loading
Capabilities to develop environmental	***Business***	***To what extent has your company collaborated with each of the following actors to address environmental sustainability during the past five years?*** *[1=to no*	

collaborations Based on (Dangelico *et al.*, 2013)		*extent; 5= to great extent]*	
		Customers	.808
		Suppliers	.754
		Competitors	.691
		Trade associations	.625
	Non-business	Universities and research institutions	.785
		Non-governmental organizations (NGOs)	.770
		Public administrations	.651
Capabilities to implement environmental actions Based on (Sharma, 2000)	***Materials***	***Please rate the level of your company's involvement in each of the following actions (related to processes, products, or packaging) during the past five years.*** *[1=very low; 5= very high]*	
		Reduction in the use of toxic substances	.828
		Use of eco-friendly materials (biodegradable, natural, recycled, or recyclable)	.852
		Improvement of efficiency in the use of materials	.807
	Energy&Pollution	Improvement of energy efficiency	.881
		Use of energy from renewable sources	.885
		Reduction of pollution	.603
Firm performance Adapted from (MIT Sloan Management Review and Boston Consulting Group, 2011)	***Market***	***To what extent integrating environmental sustainability into your company's activities contributed to the following benefits during the past three years?*** *[1=to no extent; 5= to great extent]*	
		Access to new markets	.824
		Increased margins or market share	.821
		Increased competitive advantage	.828
		Increased customers willingness to pay a premium price for products	.819
	Image	Improved reputation	.779
		Improved regulatory compliance	.913
		Better innovation	.707

List of items used in the questionnaire, with sources and factor loadings.

APPENDIX B

Table B.1: Correlation matrix

Variable	1 Collaboration Business	2 Collaboration NonBusiness	3 Materials	4 Energy& Pollution	5 Market Performance	6 Image Performance
1. Collaboration	1.000					

Business						
2. Collaboration NonBusiness	.000	1.000				
3. Materials	.299***	.065	1.000			
4. Energy&Pollution	.083	.116	.000	1.000		
5. Market Performance	.374***	.274***	.249***	.313***	1.000	
6. Image Performance	.227**	.287***	.402***	.039	.000	1.000
7. LogSize	-.224**	.150	-.136	.114	-.110	.134
8. LogAge	-.067	.052	-.046	-.039	-.014	.144
9. ISO14001	-.027	.006	-.119	.321***	.014	-.002
10. EMAS	-.077	.073	-.109	.190**	-.087	.041
11. Logistics	.031	.000	-.044	-.064	-.053	-.041
12. Publishing and Communication	.068	.003	.057	-.073	.028	-.040
13. Information technology	-.046	.026	-.093	-.138	.029	-.065
14. Engineering industry	.057	-.052	.152*	-.110	.019	.114
15. Sustainable construction	-.085	.184**	.000	.003	.010	.054
16. Renewable energies and Energy efficiency	.144	.151*	.049	.181**	.013	.201**
17. Natural environment and Reuse	-.005	.160*	-.082	.070	.026	-.041
18. Food processing	-.092	-.067	.010	.048	.135	-.085
19. Fashion	-.019	.089	.121	.021	.080	-.058
20. Wood furniture	-.015	.028	-.129	.008	.031	-.136
21. Boating	.025	.001	-.085	.178**	.162*	-.161*
22. Stone	-.130	-.115	.146	.039	.076	.022
23. Aerospace	-.177*	.104	-.053	.069	-.060	.103
24. Manufacturing	.083	-.123	.159*	-.046	.131	.117
*** p<.10; ** p<.05; *** p<.01 two-tailed**						

APPENDIX C

Table C.1: Collinearity statistics

Explanatory variables	Tolerance	Variance Inflation Factor (VIF)

CollaborationBusiness	.707	1.415
CollaborationNonBusiness	.763	1.311
Materials	.770	1.299
Energy&Pollution	.734	1.362
LogSize	.523	1.913
LogAge	.701	1.426
ISO14001	.603	1.658
EMAS	.725	1.379
Logistics	.829	1.206
Publishing and Communication	.758	1.319
Information technology	.692	1.446
Engineering industry	.662	1.512
Sustainable construction	.695	1.440
Renewable energies and Energy efficiency	.594	1.684
Natural environment and Reuse	.835	1.198
Food processing	.698	1.432
Fashion	.696	1.437
Wood furniture	.766	1.305
Boating	.717	1.395
Stone	.788	1.268
Aerospace	.798	1.254
Manufacturing	.585	1.711