Investigating the role of Corporate Social Responsibility in the adoption of sustainability oriented innovation

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Investigating the drivers of sustainability oriented innovation: the role of Corporate Social Responsibility

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Abstract:

This contribution explores the role of Corporate Social Responsibility (CSR) on the adoption on Sustainability Oriented Innovation. In accordance with previous research that show the effect of CSR depends on which CSR practices are taking into account, we consider different measures of CSR practices To analyse this relationship we adopt an empirical approach based on a survey carried on in Luxembourg in 2008 on firm CSR practices jointly with the Community Innovation Survey carried on in 2012. With a sample of 286 firms and a Heckman procedure, the study underlines the importance to differentiate the type of CSR strategy (strategic vs responsive). Our results show that strategic CSR explain the adoption of Sustainability Oriented Innovation.

Keywords: CSR, Sustainability oriented innovation, empirical approach, Community Innovation Survey

Introduction

The concept of Corporate Social Responsibility (hereafter CSR) has seen a remarkable popularity over the past decade in academic communities and among managers, consultants or specialists rating agencies. It has almost become an industry in the academic world as in the business world (Banerjee, 2007). In 2001, the Green Paper of the European Commission define Corporate Social Responsibility as the integration of social and environmental concerns to their business operations and their interactions with stakeholder on a voluntary basis (European Commission, 2001). Ten years later, the Commission propose a new definition. The CSR is "the responsibility of enterprises for their impacts on society" (European Commission, 2011: 6). With ISO 26000, the International Organization for Standardization provides guidance on how businesses and organizations can operate in a socially responsible way: acting in an ethical and transparent way that contributes to the health and welfare of society[1].

Numerous research have been conducted to analyze the effect of CSR activities. Many researchers analyze the effect of CSR on economic performance of the company. The literature reviews conducted by Allouche and Laroche (2005), De Bakker et al. (2005), Margolis et al. (2007), Margolis and Walsh (2003) and Orlitzky et al. (2003) show that the existence of a link between responsible activities and economic performance of the company is not clearly established but most studies reveal a positive link. The effect of CSR on social performance is also an important issue. Gond et al. (2008), Mahon (2002), Whetten and Mackey (2002) analyze the effect of CSR activities on the behavior of employees. Some empirical studies highlight a positive link between perceived CSR and employees' attitudes at

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[1] http://www.iso.org/iso/home/standards/iso26000.htm

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work (Brammer et al., 2007; Hansen et al., Kim et al., 2010; Peterson, 2004; Turker, 2009). In many cases, authors focus on organizational commitment. (e.g. Brammer et al., 2007; Maignan et al., 1999; Peterson, 2004). Hansen et al. (2011) and Jones (2010) focus on employees' turnover intentions.

Recently, a growing body of literature concern the relationship between CSR and Innovation. Many scholar argued that CSR has a significant effect on the adoption of firm innovation (Asongu, 2007; Boehe and Cruz 2008). Porter and Kramer (2006) underline the fact that CSR produces more business opportunities and more innovations. If some authors like Bocquet et al. (2013) and Le Bas et al. (2010) analyse technological innovation and shown a link between CSR and technological innovation, new forms of innovation gained the attention of researchers. In the global warming context, an increasing number of firms are taking into account their impacts on the environment (Porter and Reinhardt, 2007) and numerous academic papers focus on environmental innovation like the contribution of Rennings (2000). Over the past decade, environmental issue remains an important subject but is more often associated with social concerns. The term Sustainable development has emerged (Faucheux et al., 2010) and sustainable innovation and sustainability oriented innovation become important subjects in the literature (Ketata et al., 2014).

Hall and Vredenburg (2003) notice that many articles focus on firms' environmental practices while sustainable innovation is more challenging than other types of innovation activities by introducing different layers of complexity. Furthermore, a little attention is given to what drive firms to adopt sustainable innovation (Gilley et al., 2000; Paramanathan et al., 2004). In order to contribute to this literature the aims of this study is to identify the drivers of sustainability oriented innovation, in particular the effect CSR. In practice, CSR can take

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many forms (Brammer et al., 2007). To deal with the existence of various CSR firms' profile, our contribution is not going to focus on a specific measure of CSR. We will take into account CSR in four different ways. With a binary variable equal one when firm implement CSR practices, zero if not, we test the simplest way to take into account CSR. In line with Porter and Kramer (2006), we test strategic CSR and responsive CSR. According to the triple bottom line notion (Elkington 1997), three variables permit us to test the social, economic and environmental commitment of the firms, in others terms the three pillars of CSR. Finally, we catch the intensity of the engagement of the firms with the number of pillars in which the company is engaged. Specifically we ask which CSR practice has a significant impact on the adoption of sustainability oriented innovation.

Using an empirical approach based on survey data, we attempt to answer this question. Two data set are used jointly. The first data set provides information relative to firm CSR practices in 2008. The second is the Community Innovation Survey which offers the possibility to observe if firm introduce innovations in 2010. With the Heckman procedure, we show that implement strategic CSR has significant and positive effect on the adoption of sustainability oriented innovation.

This paper contributes to the literature on the relationship between CSR and innovation, considered scarce by Gallego-Alvearez et al. (2011) and Wagner (2010). We offer a better understanding of how CSR influence innovation practices in firms. Furthermore, because our results identify the drivers of the adoption of sustainability oriented innovation, policy makers can find advice to improve the adoption of sustainability oriented innovation.

The paper is organised as follows. In the next section, the conceptual framework precises what innovations in sustainable context means and their relations to CSR. In the third section

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we describe the empirical strategy. The fourth section is dedicated to the results. Finally, we conclude.

1 : Conceptual framework

1.1 : Innovation practices in firms

During the 30's, Schumpeter (1934) define five types of innovations: introduction of a new product or a qualitative change in an existing product ; process innovation new to an industry ; the opening of a new market ; development of new sources of supply for raw materials or other inputs ; changes in industrial organisation. The management literature mainly focuses on technological innovation which is composed by product and process innovation. These two categories of innovation are defined by the Oslo Manual as follow: "*A technological product innovation is the implementation/commercialisation of a product with improved performance characteristics such as to deliver objectively new or improved services to the consumer. A technological process innovation is the implementation/adoption of new or significantly improved production or delivery methods. It may involve changes in equipment, human resources, working methods or a combination of these*" (OECD, 1997, p. 9). The literature on innovation is generous and show that innovation allow firms to achieve economic performance and competitive advantage (Brown and Eisenhardt, 1995; Darroch, 2005; Colombelli et al., 2013) and also has a positive impact on firms' survival (Cefis and Marsili, 2006).

With climate change, eco-innovation emerged. This new type of innovation is related to environmental issue and is associated to the resolution of environmental deterioration and

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degradation (Aghion et al., 2013; Veugelers, 2012; Ghisetti and Quatraro, 2014). For Schiederig et al. (2012), the concepts of green innovation, ecological innovation and environmental innovation are quite similar. Eco-innovation consist in the "production, assimilation or exploitation of product, production process, service or management or business methods that is novel to the organization (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives" (Kemp and Foxon, 2007). The Community Innovation Survey (CIS) which addresses eco-innovation in 2008 adopts the same definition and specifies that "the environmental benefits of an innovation can occur during the production of a good or service, or during the after sales use of a good or service by the end user"[2]. In comparison with technological innovation, eco-innovations are similar to technological innovation because they refer to the introduction of a significant degree of novelty for the firm but eco-innovation is quite different because they introduce a new dimension: the environment benefits. For the latter, Renning and Rammer (2009) consider that eco-innovation are more complex than technological innovations.

On the other, the social dimensions should no longer be neglected. Social innovations are "Innovative activities and services that are motivated by the goal of meeting a social need and that are predominantly developed and diffused through organizations whose primary purposes are social" (Mulgan, 2007). For OECD[3], social innovation "*can concern conceptual, process or product change, organisational change and changes in financing, and can deal*

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[2] http://ec.europa.eu/eurostat/documents/203647/203701/CIS_Survey_form_2008.pdf/e06a4c11-7535-4003-8e00-143228e1b308
[3] http://www.oecd.org/cfe/leed/Forum-Social-Innovations.htm

with new relationships with stakeholders and territories". Social innovation seeks new answers to social problems by: identifying and delivering new services that improve the quality of life of individuals and communities; identifying and implementing new labour market integration processes, new competencies, new jobs, and new forms of participation, as diverse elements that each contribute to improving the position of individuals in the workforce (OECD, 2011). Over the last 20 years, the social innovation have progressed because the society faces big changes : the service sector is increasing, health or education is an important part of GDP and new forms of activities emerge like open University, microcredit, consumer cooperatives, fair trade movement.

When social and environmental issues are addressed simultaneously, the term sustainability appears. A review made by Glavič and Lukman (2007) provides definitions of different concepts which include the words 'sustainable' or 'sustainability' (sustainable production, sustainable consumption, sustainable policy, sustainable development, sustainability policy). Glavič and Lukman (2007) notice that all these concepts refer to environmental protection, societal welfare and economic performance. The definition of sustainable development illustrates this fact. The Bruntland's commission defines Sustainable development as "development that meets the needs of the present without compromising the ability of the future generations to meet their own needs" (WCED, 1987). In comparison with eco-innovation and social innovation, sustainable innovation is a broader concept because sustainable innovation includes both the environmental and the social dimension. To date, various definitions are available. McElroy and Mark (2004) propose three different definitions: "sustainability of innovation artifacts relative to meeting financial or business goals… sustainability of innovation artifacts relative to meeting social and/or environmental

goals… and sustainability of innovation processes relative to the validity of their outcomes and their internal authenticity". Knot (2003) focuses on the ability to support financial success or business growth over a period of time. It is generally accepted that sustainability innovation is related to innovations which contribute to the triple bottom line concept: economic, ecological and social benefits (Yoon and Tello, 2009; Wheeler and Elkington 2001). To resume, sustainability innovation refers to the definition of innovation gives by Rogers (1995) - "an idea, practice or object that is perceived as new to an individual or another unit of adoption" - and the definition of sustainable development. Sustainable innovation takes into account both the ecological and the social dimension of innovation activities (Ketata at al., 2015).

In line with the concept of sustainable innovation, a growing body of literature in the field of sustainability-oriented innovation (SOI) emerges. In comparison with sustainable innovation Hansen and Goße-Dunker (2012) underline that SOI consider the risk associate with the social and environmental dimensions (Paech et al., 2007). For Hansen et al. (2009), the market success and non-economic sustainability of SOI are uncertain. To illustrate this argument, Hansen et al. (2009) mentioned the research of Kölsch and Saling (2008) and Rennings and Zwick (2002) relative to the negative societal impacts of bio-fuel. With SOI, sustainability is a direction; a goal of the firm linked to a risk (Wagner and Llerena, 2008). "The concept of SOI expresses only an individual declaration of intent. *A priori,* the direction of the actual effects of an innovation to sustainable development is unknown" (Hansen et al., 2009, p. 687). Among all forms of innovation described above, sustainability-oriented innovations show the willingness of the companies to adopt new practices that are both beneficial for the social sphere and the environment. SOI show the willingness of companies

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to adopt new practices that are both beneficial for the social sphere and the environment. We are in the process of innovation. Social and environmental benefits are not yet obtained. The table 1 resume the different types of innovation.

Table 1: Different types of innovation according to the adoption of social and environmental practices

		New environmental practices		
		Unadopted	Targeted	Realized
New social practices	Unadopted	*TECHNOLOGICAL INNOVATION*		*ENVIRONMENTAL INNOVATION*
	Targeted		*SUSTAINABILITY ORIENTED INNOVATION*	
	Realized	*SOCIAL INNOVATION*		*SUSTAINABLE INNOVATION*

1.2 : The link between CSR and Innovation.

If technology-push and a market-pull models explain the adoption of technological innovation, these models could be inappropriate to identify the determinant of sustainable innovation because innovations which take into account environmental concerns differ fundamentally from other types of innovation (Kemp and Soete, 1992). To promote environmental practices, taxes, regulation and incentives remain three important determinants (Acemogulu et al. 2012; Aghion et al. 2009, Veugelers 2012). In addition to these external factors, Demirel and Kesidou (2011) find a positive influence of internal firms' behaviours which are voluntary implemented. Because Corporate Social Responsibility is assimilated to voluntary measures (Antonioli and Mazzanti, 2009), CSR becomes a determinant of the adoption of innovation when innovations pursue an environmental objective.

This hypothesis is strongly supported by a significant body of literature which analyzes the relation between CSR and innovation and try to better understand why, as mentioned by the European Commission (2011), CSR drives innovation. Most of these studies show a positive effect of CSR on innovation. Mcwilliams and Siegel (2001) underlined the fact that CSR generates technological innovation. Nidumolu et al. (2009) consider CSR as one of the key drivers of innovation. For Bocquet et al. (2013), CSR strategies lead to technological innovation. For Hart (1995), Jaffe and Palmer (1997), Surroca et al. (2010) and Renning and Rammer (2011), the implementation of environmental practices in the CSR context has an effect on innovation. Moreover, Poussing and Le Bas (2013) and Bohas et al. (2014, 2016) shown that Corporate Social Responsibility has a positive impact on business practices in favour of the environment. Poussing and Le Bas (2013) adopt an empirical approach with micro-data at the firms level to shown that CSR plays a positive role in the adoption of environmental innovation. In the same vein, Bohas et al. (2014, 2016) underline the positive impact of CSR on the adoption of green IT.

Because in essence environmental practices are a part of sustainability oriented innovation, CSR could be a determinant of this kind of innovation. This effect should be reinforcing by the fact that, as underlined by Yoon and Tello (2009), sustainable innovation contributes to economic, ecological and social benefits which defined the triple bottom line of CSR. In line with this framework, we could formulate a first hypothesis:

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Hypothesis 1: CSR has a positive impact on the adoption of sustainability oriented innovation by firms.

There are different opinions on how CSR should be implement in firms. CSR can take many forms (Brammer et al., 2007). CSR practices are related to the social, environmental and economic dimensions, so called the triple bottom line principle (Elkington, 1997). CSR is not characterized by a single activity, but by a set of very different activities (Lindgreen et al., 2008). CSR activities could be described along a continuum of actions between do nothing to do much (Carroll, 1979). In consequence, CSR is measured in different ways (Wolfe and Aupperle, 1991). Some measures come from firms' publication, other measures from case studies, survey, reputation indices or perceptional scales (Waddock and Graves, 1997). The conceptualization of Carroll (1979), which is certainly the most popular, includes four dimensions: economic responsibilities, legal responsibilities, ethical responsibilities and discretionary responsibilities. Economic responsibilities are related to the obligation for businesses to make profit and produce services and goods. Legal responsibilities refer to the respect of the law. Ethical responsibilities expects that organizations adopt moral rules. Discretionary responsibilities refer to voluntary and charitable activities. For each of the dimensions of Carroll's conception, Maignan and Ferrell (2000) develop measures. They also elaborate a typology of measure in three categories: expert evaluations, single- and multiple-issue indicators, and surveys of managers (Maignan and Ferrell, 2000). Other researchers proposed to distinguish two types of CSR practices: environmental practices and social practices (Baden et al., 2009; Fernando, 2010). It is also possible to investigate the reason why firms deploy CSR practices. In line with this point of view, Sethi (1979) propose a

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typology in four categories: reactive, defensive, responsive, and proactive. Other researches

distinguish only two types of CSR initiative: proactive vs reactive (Groza et al., 2011; Du el

al., 2007). Reactive strategy permits to protect the image after irresponsible actions occur.

Proactive CSR consist in deploying CSR practices to prevent irresponsible actions.

In recent years, CSR is considered as value-driven (Porter and Kramer, 2006; Vilanova et al.,

2009). Some authors distinguish two kinds of CSR: CSR driven by pure altruism *versus*

strategic CSR which is profitable (Lyon and Maxwell, 2008; Baron, 2001). Porter and

Kramer (2006) distinguish strategic CSR, which is part of the business strategy and ties in

with the highest level of commitment, to responsive CSR which is a limited level of

commitment in the firms. Burke and Logsdon (1996, 497) propose differentiating strategic

CSR from responsive CSR through five strategy dimensions: (1) centrality (the 'closeness of

fit to the firm's mission and objectives'); (2) proactivity (the 'degree to which the programme

is planned in anticipation of emerging social trends and in the absence of crisis'); (3)

voluntarism ('the scope for discretionary decision-making and the lack of externally imposed

compliance requirements'); (4) visibility ('observable, recognizable credit by internal and/or

external stakeholders for the firm'); (5) specificity (the 'ability to capture private benefits by

the firm')[4].

Because strategic Corporate Social Responsibility and sustainability oriented innovation

contribute to the improvement of firms' performance (Porter and Kramer, 2006; Maletič et

al., 2015), we could hypothesis that the firms are going to implement both. In consequence,

Strategic Corporate Social Responsibility and sustainability oriented innovation should be

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[4] Husted and Allen (2007) propose measures for each dimension of Burke and Logsdon's conceptual framework (1996).

positively linked. According to these considerations we could improve our first hypothesis by formulating a more detailed hypothesis:

Hypothesis 2: Strategic Corporate Social Responsibility is a driver of sustainability oriented innovation.

2 : The empirical strategy

2.1 : The data

To assess the effect of strategic CSR on the adoption of sustainability oriented innovation, we use two Luxembourgish data sets. The first data set comes from a survey relative to CSR practices by firms. The second data set comes from the Community Innovation Survey (CIS 2010).

The CSR survey was conducted by LISER[5] (Luxembourg) in 2008. This survey included firms, with 10 employees and more, belonging to all economic sectors. This survey gives details about the CSR activities of firms in 2008. Among a population of 3.296 firms, we built a sample of 2.511. With a questionnaire in French, German and English, we obtain 1.114 responses. The survey provides details about CSR activities of the firms; in particular on the implementation of their CSR activities: the existence a CSR department, allocation of a CSR budget, definition of measurable objectives, creation of a reporting system, training of the staff, etc.

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[5] Luxembourg Institute of Socio-Economic Research, formerly CEPS/INSTEAD, http://www.liser.lu

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The Community Innovation Survey was conducted by LISER in 2012, on behalf of the National Statistics Institute of Luxembourg (STATEC) with financial support from the European Commission (EUROSTAT). The target population of the CIS 2010 is the total population of enterprises, with 10 employees or more, in NACE Rev. 2[6] sections A to N (these sections include most market activities). From a sample of 958 firms, we obtain 652 responses with face-to-face interviews. Many of the CIS questions have been used in prior versions of the survey. The survey describes firms' innovation behaviour in terms of product, process or organizational innovation for the period 2008-2010. In CIS 2010 a specific part of the survey is dedicated to innovation objectives. The ten questions introduced in this specific part of the questionnaire allow us to know if the firms implement sustainability oriented innovation[7].

These two surveys followed exactly the same methodology for the sampling process: a stratified random sample of firms from the national database of companies located in Luxembourg, available from STATEC. In consequence, using an identification number for the firms, we merge the two data sets. Our final dataset contain 286 firms. To obtain representative results of the studied population, we use a weighting procedure based on the sampling probability and the response rate.

In the sample, the proportion of small firms (between 10 to 49 employees) is 34.9%, medium (50 to 249 employees) is 39.5% and 25.5% of large firms (with 250 employees and more). The proportion of industrial firms is 47.5%. The percentage of firms which are belonging to a group is 53.4%. We observe that around one firm in three (33.5%) adopts CSR practices.

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[6] Statistical classification of economic activities in the European Community.
[7] The harmonized survey questionnaire is available (Last access: July 2015) at:
http://ec.europa.eu/eurostat/documents/203647/203701/CIS_Survey_form_2010.pdf/b9f2c70e-0c46-4f82-abeb-c7661f1f2166

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Concerning innovation practices, 45.4% of firms implement a product innovation; 36.7% a process innovation. 57.3% of firms are innovative (implement product or process innovation).

2.2 : Sustainability oriented innovation variables

In the Community Innovation Survey, a section concerns the importance given by the firms for ten different objectives for their activities to develop product or process innovations during the three years 2008 to 2010.

Among these objectives, two of them are relative to environmental issue: Reduce material and energy costs per unit output (ENERGY) and Reduce environmental impacts (IMPACT). One item concerns social issue: Improve health or safety of your employees (HEALTH). The other objectives are more market oriented: Increase range of goods or services (LARGE), Replace outdated products or processes (REPLACE), Enter new markets or increase market share (MARKET), Improve quality of goods or services (QUALITY), Improve flexibility for producing goods or services (FLEXIBILITY), Increase capacity for producing goods or services (CAPACITY), Reduce labour costs per unit output (COST). For each items, the firms indicate the importance given to each objective (high, medium, low, not relevant).

The analysis of the importance given to each objective (with an importance considered high or medium) shows that the proportion of innovative firms which consider that market oriented objectives are important is higher than the proportion of innovative firms which consider that environmental and social objectives are important (cf. Figure 1). Among the 164 innovative firms, the most important objective is to improve quality of goods or services (90.4%). At the opposite, less than half of the innovative firms consider important to improve health or safety of your employees (45.5%) or to reduce environmental impacts (43.7%).

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Adopt an innovation with the objective to reduce material and energy costs per unit output are considered important for 35.3% firms.

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Figure 1: Objectives pursue by innovative firms (product or process innovative firms) during the three years 2008 to 2010 (% of innovative firms)
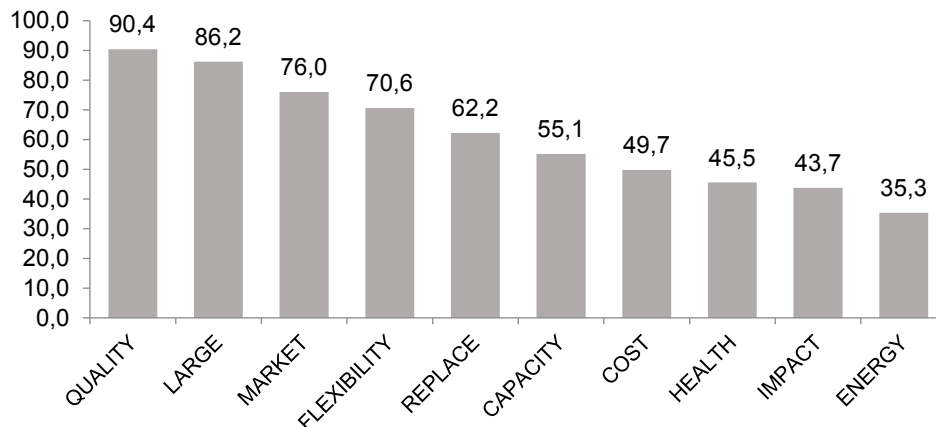
When we analyze in more detail the number of objectives pursue by the innovative firms (n=164), we notice that more 95% of the innovative pursue more than one objective at the same time (cf. Figure 2). More frequently, the innovative firms follow six objectives.

Figure 2: Number of objectives pursue by the innovative firms.
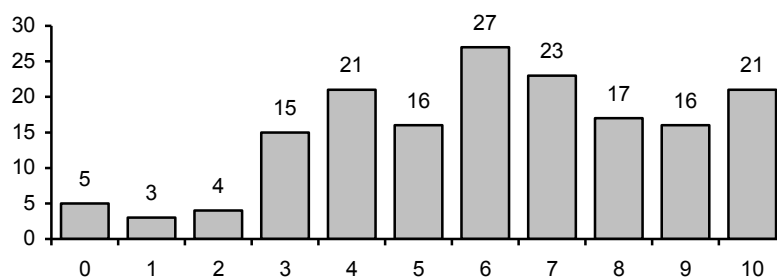
In accordance with Ketata at al. (2015), we consider that firms adopt sustainability oriented innovation when they pursue environmental and social objectives at the same time. For this

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reason, we construct the sustainability oriented innovation variable from three objectives listed in the questionnaire. The firms have to pursue the objective of Reducing material and energy costs per unit output (ENERGY) or reducing environmental impacts (IMPACT) and they have improve health or safety of your employees (HEALTH). Among innovative firms, 20.1% pursue sustainable objective or in other words, adopt sustainability oriented innovation. If we breakdown the objectives in two categories: sustainable oriented objectives vs market oriented objectives, we notice that sustainable oriented objectives are always associated with market oriented objectives (cf. Table 2). At the opposite, many firms (126 among 164 innovative firms) pursue only market oriented objectives.

Table 2. Distribution of innovative enterprises by type of objectives pursue (number, percentage in brackets)

| | | Pursue sustainable oriented objective | | TOTAL |
		NO	YES	
Pursue market oriented objective	NO	5	0	5 (3.1)
	YES	126	33	159 (96.9)
TOTAL		131 (79.9)	63 (20.1)	164 (100.0)

Source: Community Innovation Survey 2010 and CSR 2008 survey (Luxembourg)

To identify the effect of CSR on the adoption of sustainability oriented innovation, we are going to compare the effect of CSR on the probability to pursue only market oriented objectives (variable: MARKET, 126 firms among 286 in our population) and the effect of CSR on the probability to pursue both market oriented and sustainable oriented objectives (variable: MARKET_SUSTAIN, 159 firms among 286 in our population).

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2.3 : CSR variables 2

In most studies, the effects of CSR are not clear cut because the effect depends on which CSR practices are taking into account (Lankoski, 2009). For exemple, when Brammer and Milligton (2008) or Barcos *et al.* (2013) analyse the link between CSR and firm performance, they show that some CSR practices have a positive impact on firm performance while other are not. To deal with this problem, four different constructs take into account CSR practices. First, a dummy variable (CSR) takes the value 1 when the firm is adopting CSR, and otherwise a value of 0. Second, three dummy variables are defined according to the three pillars of CSR: CSR_ENV takes the value 1 when the firm is adopting practices in favour of the environment, and otherwise a value of 0; CSR_SOC takes the value 1 when the firm is engaging in the social pillar, and otherwise a value of 0; CSR_ECO takes the value 1 when the firm is engaging in the economical pillar, and otherwise a value of 0. Third, to catch the intensity of the engagement of the firms, the variable PILLAR reports the number of pillars in which the company is engaged (between 0 to 3). Finally in line with Porter and Kramer (2006), two dummy variables (STRATEGIC, RESPONSIVE) concern strategic and responsive CSR practices.

To identify these two types of CSR, we use the results of Bocquet et al. (2013, 2015). With a cluster analysis, they differentiate firms according to their CSR policy (strategic versus responsive). They use questions, available in the CSR survey, about the implementation of CSR policies according to the five strategy dimensions mentioned by Burke and Logsdon (1996). The first dimension, 'centrality', is taking into account with two items: a document

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exists that describes the firm's values and whether the firm communicates about its CSR commitment on the Web or in a report. For the second dimension, 'proactivity', Bocquet et al. (2013) examine the existence of a CSR action plan and the existence of an agenda. One item measure 'Voluntarism': the identification by the firm of its stakeholders. 'Visibility' is captured through the existence of a communication plan. Three items linked to value creation for the firm measure 'Specificity': the capacity to attract clients, the capacity to improve the firm's image and the level of differentiation from the competition. With the items presented above, Bocquet et al. (2013) conduct a principal component analysis (PCA). The PCA identifies the uncorrelated factors which best summarise the information contained in the theoretical dimensions. Next, a non-hierarchical cluster analysis determines the final number of clusters[8].

Among our population of 286 firms, 33.5% adopt CSR practices. In this population, the proportion of firm is higher in the environmental pillar than in the other: 30.0% of firms are active in the environmental pillar, 25.5% in the social pillar, 13.9% in the economic pillar. When the firms adopt CSR, they are most frequently engaged in two pillars (48.9% adopt two pillars among the 96 firms which adopt CSR). 8.7% adopt a strategic CSR policy (STRATEGIC), whereas 24.8% have a responsive one (RESPONSIVE).

2.4 : Other control variables

To identify which factors we could include as control variables in our model, we referred to the evolutionary framework. More specifically, because firm capabilities play a major role in innovative performance (Teece and Pisano, 1994), we capture it by taking into account the

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[8] Appendix 1 provides the CSR questions introduced in the CSR survey used in this study.

presence of employees with a higher education degree (dummy variable EDUCATION). The speed in which products and services becomes old-fashioned (dummy variable PRODPER) measures technological opportunities which are another important innovation driver (Dosi, 1997). To take into account the effect of competitive intensity on firm innovation, we included in our model a dummy variable (MARCONC), which takes the value 1 when the competition of the market in which the firm is operating in is very intense, and otherwise a value of 0. Previous research show a positive effect of research and development on the adoption of innovation (Raymond et al., 2010). R&D practices have a positive effect on the creation of new processes and new products (Griffith et al., 2004). Because R&D expenditure is not well collect, R&D is captured with a dummy variable (RD) equal 1 when the firm undertakes in-house Research & Development.

Cost is a serious obstacle for implementing environmental practices (Min and Galle, 2001; Orsato, 2006, Revell et al., 2009), we introduce the variable called TURNOVER to obtain indicator on the economic situation of the firm. TURNOVER is a dummy variable equal 1 when the profits of the firms increase during the last three years. Because CSR extends the economic advantage of the firms (Smith, 2007), firms which are leader on their market should implement CSR. This feature is introduced with the dummy variable (LEADER) equal 1 when the firm is leader on her market. In accordance with Laudal (2011), CSR could be driven by the dimension of the firm's market. When a firm operates in foreign countries, a damaged reputation may have critical consequence and the adoption of CSR practices may be both a defensive and an offensive strategy. To take into account the dimension of the market of the firm, we introduce the variable FOREIGN which is equal 1 when foreign countries constitute the largest market of the firms in terms of turnover during the last three years.

As usual in previous research, the size, the sector of activity and belonging to group are taking into account. We follow the Commission Regulation N°1450/2004 of the European Parliament and of the Council concerning the production and development of Community statistics on innovation to introduce the size of the firms with three dummy variables: SMALL, from 10 to 49 employees; MEDIUM, from 50 to 249 employees; and LARGE, more than 249 employees. According to Wagner (2010), the innovation performance of the firms is linked to their size. Because the resources of large firms are bigger then small firms, the latter are less innovative, except in high-technology sectors (Cohen, 1995). With the dummy variable INDUS, we distinguish two sectors of activities: industry versus services (Gallego-Alvarez et al., 2011; Husted and Allen, 2007). We also introduce a dummy variable (GROUP) which indicates whether the firm belongs to a group. It is important to take into account this characteristic because the headquarter of the group influences the innovation strategy (Mairesse and Mohnen, 2010) and it is easier for a group to finance innovation adoption (Love and Roper, 2001).

Appendix 2 shows the set of variables introduced into our econometric analysis. Appendix 3 gives descriptive statistics regarding the variables.

3 : Empirical Analysis

3.1 : Method

Our objective is to identify the determinants of sustainability oriented innovation. The decision to implement SOI is conditional on the decision of adopting innovation. These decisions are sequential, but the second decision is only made by innovative firms. As the characteristics of this population are different from the general population's characteristics, the estimates of the second step equation can be biased. This selection bias can be corrected by applying the Heckman method (1979), which consists in a two-stage estimation procedure. The Heckman selection model provides consistent, asymptotically efficient estimates for all the parameters in such models.

The first step is the sample equation (probit model) in which the individual must choose between adopting or not an innovation. The total utility of adopting an innovation for a firm i is given by

$$y_{i0}^* = x_{i0}\beta_0 + \varepsilon_{i0}$$

where x_{i0} is the set of independent variables (size, sector, …) that explain the adoption decisions, β_0 is the vector of coefficients and ε_{i0} is the random error term (normally distributed). Of course, total utility is unobservable, but we observe the choice to innovate or not. Let y_{i0} be the result of a decision-making process influenced by independent variables x_{i0}. Then $y_{i0} = 1$ when the firm decides to innovate and $y_{i0} = 1$ otherwise. Formally, $y_{i0} = 1$ if $y_{i0}^* > 0$ and $y_{i0} = 1$ if $y_{i0}^* \leq 0$.

Conditional on the decision to innovate, the firms have again to choose the objectives of their innovations. The innovation objective j (with $j=1,...,J$) is defined by the equation

$y_{ij} = x_{ij}\beta_j + \varepsilon_{ij}$ where y_{ij} measures the innovation objective, x_{ij} is the set of independent variables (size of the firm, sector, belonging to a group, …) and ε_{ij} is the random error term (normally distributed).

The Heckman model is estimated by the Maximum Likelihood Estimation procedure, assuming that ε_{i0} and ε_{ij} are drawn from a bivariate normal distribution, with mean zero and $Corr(\varepsilon_{i0}, \varepsilon_{ij}) = \rho$. If the estimated coefficient *RHO* is significantly different from zero, the presence of selection bias is proven (Maddala 1983; Breen 1996).

3.2 : Results

With our estimations, we would like to test the effect of different CSR measures on the adoption of sustainability oriented innovation. To test this idea, we compare the determinants of the probability to pursue market oriented innovation objectives (dependant variable: MARKET) to the probability to pursue market and sustainable oriented innovation objectives (dependant variable: MARKET_SUSTAIN). For these two types of dependant variables, only the CSR variables vary. Model 1 and 2 analyze the effect of strategic and responsive CSR. Model 3 and 4 focus on the effect on CSR as a dummy variable. Model 5 and 6 introduce the three pillars of CSR. Model 7 and 8 takes into account the number of CSR pillars implements by the firms (cf. Table 3)[9].

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[9] Asked the author to receive the correlation matrix of the variables introduced in the models.

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Table 3. The determinants of sustainability oriented innovation (Heckman procedure)

Second step Probit of the Heckman procedure.								
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Dependant variables	MARKET	MARKET_SUSTAIN	MARKET	MARKET_SUSTAIN	MARKET	MARKET_SUSTAIN	MARKET	MARKET_SUSTAIN
STRATEGIC	0.834* (0.467)	4.906*** (1.33435)	/	/	/	/	/	/
RESPONSIVE	0.550 (0.364)	0.603 0.718)	/	/	/	/	/	/
CSR	/		0.616* (0.327)	0.681 (0.603)	/	/	/	/
NO_CSR	Ref.	Ref.	Ref.	Ref.	/	/	/	/
CSR_ENV	/	/	/	/	0.533 (0.480)	0.091 (0.852)	/	/
CSR_SOC	/	/	/	/	-0.355 (0.844)	0.963 (0.636)	/	/
CSR_ECO	/	/	/	/	0.724 (1.095)	0.292 (0.703)	/	/
PILLAR	/	/	/	/	/	/	0.306* (0.173)	0.393 (0.241)
FOREIGN	0.411 (0.362)	-1.128 (0.830)	0.416 (0.365)	-1.091 (0.766)	0.313 (0.884)	-1.049 (0.703)	0.481 (0.343)	-1.100 (0.740)
LEADER	-0.665** (0.285)	-1.049 (0.656)	-0.675** (0.282)	-1.098* (0.608)	-0.735 (0.554)	-1.050 (0.647)	-0.627** (0.285)	-1.068 (0.631)
TURNOVER	-0.204 (0.353)	0.269 (0.370)	-0.204 (0.355)	0.259 (0.330)	-0.240 (0.631)	0.530 (0.351)	-0.120 (0.334)	0.390 (0.457)
SMALL	0.242 (0.351)	1.206** (0.567)	0.257 (0.346)	1.176** (0.525)	0.330 (0.400)	1.294** (0.562)	0.259 (0.343)	1.270** (0.564)
MEDIUM	Ref	Ref	Ref	Ref.	Ref	Ref	Ref	Ref.
LARGE	-0.102 (0.335)	1.001 (0.847)	-0.105 (0.342)	0.931 (0.922)	0.075 (0.461)	0.669 (0.590)	-0.149 (0.344)	0.835 (0.603)
INDUS	-0.248 (0.256)	-0.773 (0.622)	-0.265 (0.256)	-0.756 (0.818)	-0.365 (0.303)	-0.834* (0.453)	-0.281 (0.251)	-0.808 (0.499)
CONSTANT	1.746*** (0.420)	2.041** (0.880)	1.750*** (0.423)	2.140*** (0.676)	1.638* (0.974)	1.961** (0.855)	1.734*** (0.429)	2.013** (0.788)
Selection probit of the Heckman procedure. Dependant variable: Innovate in product or in process. Coefficient, standard error in parentheses.								
RD	0.723** (0.308)	0.798** (0.333)	0.721** (0.308)	0.801** (0.330)	0.743* (0.443)	0.796** (0.333)	0.722** (0.309)	0.798** (0.337)
PRODPER	-0.436 (0.417)	-0.445 (0.456)	-0.440 (0.417)	-0.443 (0.455)	-0.454 (0.459)	-0.447 (0.455)	-0.434 (0.418)	-0.445 (0.455)
EDUCATION	0.817** (0.339)	0.665 (0.461)	0.817** (0.337)	0.658 (0.467)	0.743* (0.419)	0.670 (0.441)	0.773** (0.342)	0.665 (0.444)
FOREIGN	-0.511* (0.271)	-0.620** (0.284)	-0.511** (0.273)	-0.619** (0.283)	-0.590* (0.318)	-0.621** (0.283)	-0.507* (0.273)	-0.620** (0.283)
SMALL	-0.180 (0.280)	-0.122 (0.285)	-0.175 (0.281)	-0.122 (0.285)	-0.125 (0.287)	-0.121 (0.285)	-0.180 (0.281)	-0.122 (0.284)
MEDIUM	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
LARGE	-0.268 (0.270)	-0.185 (0.272)	-0.266 (0.271)	-0.187 (0.273)	-0.206 (0.308)	-0.183 (0.271)	-0.264 (0.269)	-0.184 (0.271)
INDUS	0.199	0.155	0.199	0.159	0.146	0.153	0.188	0.155

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	(0.217)	(0.226)	(0.220)	(0.236)	(0.216)	(0.219)	(0.219)	(0.222)
GROUP	-0.100	-0.242	-0.096	-0.236	-0.193	-0.246	-0.096	-0.242
	(0.279)	(0.339)	(0.283)	(0.342)	(0.483)	(0.325)	(0.283)	(0.327)
CONSTANT	-0.705**	-0.605	-0.709**	-0.602	-0.659	-0.606	-0.665*	-0.605
	(0.350)	(0.401)	(0.351)	(0.401)	(0.405)	(0.397)	(0.348)	(0.397)
rho	-0.993	-0.416	-0.990	-0.531	-0.498	-0.311	-0.986	-0.389
	(0.059)	(1.814)	(0.068)	(1.957)	(2.396	(1.312)	(0.068)	(1.229)
Log pseudolikelihood	-2277.674	-1697.857	-2278.762	-1698.7	-2279.612	-1695.672	-2284.887	-1696.352
Number of obs	286	286	286	286	286	286	286	286

Notes: * coef. Significant at a threshold of 10%, ** coef. Significant at a threshold of 5%, *** coef. Significant at a threshold of 1%

The first step of the Heckman procedure shows the drivers of the probability to innovate. The different models give the same results. The most significant determinant is in-house Research & Development. RD has a positive impact on the probability to be an innovative firm. This probability is negatively affected when foreign countries constitute the largest market of the firms in terms of turnover during the last three years. The effect of the presence of employees with a higher education degree is not clear cut. Our models show a no significant effect of the size of firm, the economic sector and belonging to a group.

The second step of the Heckman procedure explains the probability to pursue market oriented innovation objectives and the probability to pursue market and sustainable oriented objectives. The coefficients estimated from Model 1 and 2 tell us that adopt responsive CSR has a no significant effect. At opposite, adopt strategic CSR has a most significant and positive effect on the probability to pursue a market and sustainable objectives than on the probability to pursue only market oriented objectives: the coefficient is significant at a threshold of 1% and the value of the coefficient is bigger.

Model 3 and 4 shows the effect of CSR taken into account with a binary variable. In this case CSR has a very weak effect (significant at a threshold of 10%) on the probability to pursue

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market oriented objectives (Model 3). CSR is not a driver of the probability to pursue market ans sutainable oriented objectives (Model 4).

From Models 5 and 6, the results show no significant effect of CSR when we introduce CSR in our models with the three pillars of CSR.

With a coefficient significant at a threshold of 10%, the effect of the CSR, catches with the number of pillars in which the company is engaged, on the probability to pursue market oriented objectives is not obvious (Model 7). In Model 8, we see that the number of pillars doesn't affect the probability to pursue market and sustainable objectives.

In the four models, the results related to control variables are the same. If the propensity to adopt market oriented objective doesn't depend on the size of the firms, we show that small firms have a bigger probability to pursue market and sustainable oriented objective, in comparison with medium firms. The variable INDUS has no significant effect meaning that industrial firms have not a larger probability to implement SOI than firms in the service sector. The dimension of the market of the firm (FOREIGN) does not have any effect on the probability to pursue the different type of objectives. The firms which are leader on our market have not a bigger probability to adopt sustainable objective, this characteristic impact negatively the probability to adopt market oriented objectives.

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4 : Discussion and Conclusion

In this article, we have analyzed the relationship between CSR and the adoption of sustainability oriented innovation. In accordance with previous research that show the effect of CSR depends on which CSR practices are taking into account (Lankoski, 2009; Brammer and Milligton, 2008, Barcos *et al.,* 2013), we consider different measures of CSR practices. In particular, we refer to Porter and Kramer (2006) and distinguish strategic CSR, which is part of the business strategy and ties in with the highest level of commitment, to responsive CSR which is a limited level of commitment in the firms. Combining strategic management theory of CSR and the evolutionary approach of innovation, our findings confirm that strategic CSR has a significant and positive effect on the adoption of both market and sustainable oriented objective and no effect on the adoption of market oriented objective.

By focus on sustainability oriented innovation, we contribute on a challenging type of innovation (Hall and Vredenburg, 2003) on which a little attention is given (Gilley et al., 2000; Paramanathan et al., 2004). If the literature mainly focuses on technological innovation (product and process innovation), new forms of innovation emerge. Eco-innovations are related to environmental issue. Social innovations takes into account the social dimension. In more recent contribution, these two dimensions are combined and Ketata at al. (2015) focus on sustainability oriented innovation when firms pursue environmental and social objectives at the same time.

With respect to previous research, we confirm the importance of CSR as a driver of the adoption of innovation. As mentioned by the European Commission (2011), CSR drives innovation. However, your contribution goes beyond that statement. We find that it is more important to focus on the type of CSR strategy (strategic vs responsive) than on CSR

study reveals that Strategic CSR is linked positively with sustainable objectives while the different pillars of CSR, the number of pillars have no effect.

Our methodological approach seeks to address a criticism often made. With cross section data, the most common limitation comes from the fact that it is possible to explain significant (positive or negative) relationships between two variables but, the causal relationship is not proven. To deal with this problem, researcher could use panel data. In our case, we take into serious consideration this limitation and solve this problem in another way. We use two cross section data sets jointly but with data related to different periods of time. The first data set provides information relative to firm CSR practices in 2008. The second is the Community Innovation Survey which offers the possibility to observe if firm introduce innovations in 2010. With this delay of two years, a causal relationship can be analyzed.

This study is subject to several further limitations. First, we only tested the effect of four different measures of CSR. All these measures come from a survey. Other measures should be tested like from case studies, reputation indices or perceptual scales (Waddock and Graves, 1997). Second, the size of the sample represents a limitation. A larger sample, permit us to introduce more variables in the models. Third, in the Community Innovation Survey, sustainable objectives just concern product and process innovative firms but non-technological innovations, such as marketing, organizational, or business model innovations, might pursue sustainable objectives.

From a managerial perspective, this contribution confirms the importance of strategic CSR as a driver of new forms of innovation. Because strategic Corporate Social Responsibility and sustainability oriented innovation contribute to the improvement of firms' performance

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(Porter and Kramer, 2006; Maletič et al., 2015), manager have to implement CSR as part of

the business strategy to strongly support innovation and economic prosperity of the firm.

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Appendix 1: Questionnaire items from the Corporate Social Responsibility Survey used in the econometric model

Is your company active in the field of Corporate Social Responsibility (CSR)?

□ Yes   □ No, but it is scheduled   □ No
                         within less than 2 years   ⇒ End of
                         ⇒ End of questionnaire   questionnaire

> Glossary: *corporate social responsibility is the voluntary integration of companies' social and ecological considerations into their business operations and relations with their stakeholders. Being socially responsible means not only fully meeting the legal obligations applicable, but going still further, and investing "even more" in the human capital, the environment and relations with stakeholders (employees, customers, suppliers, non-governmental organisations, local authorities and shareholders).*

Where is your CSR policy described? (several replies possible)

In your activity report   □
In a report dedicated to CSR   □
On your Web site   □
Nowhere   □
Other (give details): _____

Do you have a document describing the values and priority concerns and/or motivations of your company in social and environmental terms?

□ Yes   □ No

Have you identified the stakeholders targeted by your CSR policy?

□ Yes   □ No

Before initiating your CSR policy, did you enter into contact with your stakeholders?

□ Yes   □ No

What are the three main effects you wish to achieve with your CSR policy?

Attracting new employees |__|
Attracting investors |__|
Attracting new customers |__|

Improving the company's image |__|
Standing out from the competition |__|
Anticipating changes in legislation |__|
Reducing your costs |__|
Satisfying your stakeholders |__|
Reducing your impact on the environment |__|
Increasing the well-being of your employees |__|
Other (give details): _____

Before initiating your CSR policy, did you:
(several replies possible)

	Yes	No
Make a list of the actions already carried out within your company	☐	☐
Make a list of the actions that could be envisaged within your company	☐	☐
Study the actions carried out by other companies	☐	☐
Collect information from specialised bodies	☐	☐
Collect information from the public authorities	☐	☐
Find out about existing CSR standards and labels	☐	☐
Assess the costs of implementing CSR	☐	☐

Have you drawn up a schedule for the CSR actions you wish to carry out?

☐ Yes   ☐ No

Have you drawn up any communication plans on your CSR commitments?

In-house   ☐ Yes   ☐ No
External   ☐ Yes   ☐ No

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Appendix 2. Description of the variables introduce in the models

Variables	Definition
MARKET	Firms pursue market oriented objectives
MARKET_SUSTAIN	Firms pursue market an sustainable oriented objectives
CSR	Firms implement CSR practices
STRATEGIC	Firms with a strategic CSR profile
RESPONSIVE	Firms with a responsive CSR profile
CSR_ENV	Firms adopt practices in favour of the environment
CSR_SOC	Firms adopt practices in the social pillar
CSR_ECO	Firms adopt practices in the economical pillar
PILLAR	Number of pillars in which the company is engaged
INNO	Firm implements a product or a process innovation
MARCONC	The competition of the market in which the firm is operating in is very intense
PRODPER	Products and services become rapidly old-fashioned
EDUCATION	The firm has employees with higher education (who have either completed a master's degree in a graduate school, or a university degree, or who hold a doctorate / PHD degree)
RD	Firms undertake in-house Research & Development
TURNOVER	The profits of the firms increase during the last three years
FOREIGN	Foreign countries constitute the largest market of the firms in terms of turnover during the last three years
LEADER	Firm is leader on her market
SMALL	Total number of employees is between 10 and 49
MEDIUM	Total number of employees is between 50 and 249
LARGE	Total number of employees is more than 249
INDUS	Belongs to the manufacturing sector
GROUP	Firm is part of a group

Appendix 3. Summary statistics of the variables

	Among the population			Among innovative firms		
Variable	N	Mean	Std Dev	N	Mean	Std Dev
MARKET	286	0.440	0.497	164	0.768	0.423
MARKET_SUSTAIN	286	0.555	0.497	164	0.969	0.172
STRATEGIC	286	0,087	0,283	164	0.085	0.280
RESPONSIVE	286	0,248	0,433	164	0.207	0.406
CSR	286	0,335	0,473	164	0.292	0.456
CSR_ENV	286	0,300	0,459	164	0.256	0.437
CSR_SOC	286	0,255	0,437	164	0.207	0.406
CSR_ECO	286	0,139	0,347	164	0.128	0.335
PILLAR	286	0,696	1,063	164	0.591	0.995
EDUCATION	286	0,850	0,358	164	0.908	0.289
FOREIGN	286	0,416	0,494	164	0.531	0.500
SMALL	286	0,350	0,478	164	0.353	0.479
MEDIUM	286	0.395	0.489	164	0.409	0.493
LARGE	286	0,255	0,437	164	0.238	0.427
INDUS	286	0,476	0,500	164	0.469	0.500
GROUP	286	0,535	0,500	164	0.609	0.489
LEADER	286	0,552	0,498	164	0.548	0.499
TURNOVER	286	0,434	0,496	164	0.475	0.500
INNO	286	0,584	0,494	164	1	0
RD	286	0,252	0,435	164	0.396	0.490
PRODPER	286	0,080	0,272	164	0.091	0.289

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