Internal resources and stakeholders engagement affecting environmental innovations: an exploratory research

Ivana Quinto[*], Giuseppe Scandurra[**], Antonio Thomas[***]

Ricevuto 8.10.2019 – Accettato 16.10.2019

Abstract. The propensity towards the adoption of innovations has long been considered an essential condition ensuring firms competitiveness in an increasingly dynamic and turbulent globalized context. Today, however, companies must ensure that these innovations are consistent with the pursuit of a model of sustainable development that does not compromise the ability of future generations to reach at least similar levels of well-being. This need requires to implement production systems and processes that are as environmentally friendly as possible, as well as those of workers. To this aim firms have to adopt environmental innovations.

Also prompted by specific regulatory interventions, this subject is attracting the attention of many scholars from various disciplines. At managerial level, part of the interest is directed towards identifying the factors that can encourage or support investments in eco-innovations. In this context, the paper proposes an empirical survey focused on a population of Italian enterprises characterized by a strong predisposition to change and innovation in general. Findings shows a marked sensitivity of these companies towards environmental innovations, while the investments actually made still seem to be overall inadequate with respect to the objective of becoming first-movers at international level.

Key words: environmental innovations, empirical survey, competitiveness.

[*] Research Fellow, Department of Industrial Engineering, University of Naples Federico II. ivana.quinto@unina.it

[**] Associate Professor, Department of Management and Quantitative Studies, University of Naples Parthenope.
giuseppe.scandurra@uniparthenope.it

[***] Associate Professor, Department of Engineering, University of Naples Parthenope. antonio.thomas@uniparthenope.it

Sommario. *L'influenza delle risorse endogene e degli stakeholders nelle dinamiche dell'ecoinnovazione. Un'indagine esplorativa.* In un contesto globalizzato sempre più dinamico e turbolento, la propensione verso l'adozione di innovazioni è storicamente ritenuta una condizione essenziale perla futura competitività delle imprese. Oggi, tuttavia, le aziende devono anche garantire che le innovazioni implementate siano coerenti con il perseguimento di un modello di sviluppo sostenibile; ovvero tale da non compromettere la capacità delle generazioni future di raggiungere livelli di benessere almeno simili a quelli delle attuali. Questa necessità richiede l'implementazione di sistemi e processi produttivi il più possibile rispettosi dell'ambiente, così come quelli dei lavoratori. A tal fine le imprese hanno necessità di adottare le cosiddette innovazioni ambientali. Un tema che, sollecitato anche da specifici interventi normativi, sta attirando l'attenzione di molteplici studiosi di varie discipline. A livello manageriale, parte dell'interesse è diretto all'identificazione dei fattori che possono incoraggiare o sostenere gli investimenti nelle innovazioni ambientali. In tale ottica, il presente contributo mostra i riscontri di un'indagine empirica focalizzata su una popolazione di imprese italiane caratterizzata da una forte predisposizione al cambiamento e all'innovazione in generale. I risultati mostrano una spiccata sensibilità di queste aziende verso le innovazioni ambientali, mentre gli investimenti effettivamente sostenuti nel complesso sembrano ancora inadeguati rispetto all'obiettivo di raggiungere posizioni di avanguardia a livello internazionale.

Parole chiave: Innovazioni ambientali, indagine empirica, competitività.

1. Environmental innovations and firms competitiveness

Consistent with Schumpeterian theories, the adoption of innovations is considered a *conditio sine qua non* of corporate competitive capacity. Nowadays, however, a high predisposition towards innovations is inadequate to guarantee a harmonious development of the economic organization.

In fact, at least in Western countries, companies must be able to meet the expectations of a growing number of stakeholders, often external to the organization, who are as interested in the characteristics of the output, as in the way in which it was made. As widely demonstrated (Golinelli, 2000; Sciarelli, 2007), an effective management of relations with stakeholders in the decision-making processes strongly facilitates access, control, management and protection of firms' critical resources.

Such expectation now affects all economic units, regardless of their size or sector of activity. It is rooted in the increasing sensitivity of the community towards the environmental issues and awareness of environmental risks. In line with the principles of *Corporate Social Responsibility*, to tackle

with these requests companies need to put in place production systems and processes that are as environmentally friendly as possible, as well as of workers, in the meantime ensuring the respect of the basilar financial and economical equilibriums.

In turn, the implementation of these new productive systems is supported by the so-called *environmental innovations* more briefly named *ecoinnovations* (hereafter EIs). They are commonly understood as innovations whose effect is to increase energy efficiency and promote a wider use of renewable generation sources, as well as improve the well-being of the community by limiting the impact that human activities exert on the natural environment. EIs include «the introduction of any new or significantly improved product (good or service), process, organizational change or marketing solution that reduces the use of natural resources and decreases the release of harmful substances across the whole life-cycle» (EIO, 2012: 8). Hence, even if the introduced innovation can be incremental or radical, the key aspect of sustainable innovation is its being the result of the application of environmental criteria on the entire life cycle of products or services.

In so doing, EIs presuppose the involvement of the entire firm structure in its different phases; from design to the production process, and from logistics to marketing. By determining the rethinking of processes and their continuous monitoring, EIs also tend to permeate the corporate culture itself (Calvelli and Cannavale, 2013; Cafferata, 2018).

The increasing attention paid to environmental issues has made the theme of EIs a key topic within the flourishing multidisciplinary scientific debate on the sustainable development. In managerial literature, researchers' efforts aimed at understanding what the factors that can encourage or support the adoption of EIs are. In fact, like any other business innovation, EIs does not only impact on production processes, but also on economic and competitive dynamics; hence referring both to the operating conditions, and to the strategic choices.

Moreover, according to a consolidated stream of literature (Porter and van der Linde, 1995; Porter and Kramer, 2006), the adoption of techniques, technologies and eco-sustainable production processes determines, at the same time, virtuous paths of environmental safeguard (*go-green*), and benefits for firms. The latter range from an enforcement of the image to the creation of new markets, and from the obtaining of monetary incentives to the achievement of cost savings. It is not surprisingly, therefore, to pursue environmental sustainability is increasingly considered an indispensable investment, rather than a cost that a venture is obliged to bear. This statement has a key meaning for firms which aspire to become market leaders, *first movers* or to be positioned in the highest market brackets.

It should not be forgotten, however, that the new environmental protection regulations require companies to comply with increasingly stringent rules. The EU directive 2014/95, for instance, has imposed to present a non-financial report showing the advancement in the environmental and social dimensions. This rule, although for now only aimed at corporations with more than 500 employees due to their significant environmental impact, is a fundamental step in making the efforts of companies towards improving the exogenous environment clear and monitored.

From this point of view, it becomes increasingly urgent for scholars to deepen their knowledge of the logic behind the choice to adopt EIs by the various types of firms. This knowledge is essential for policy makers who intend to propose stimulus interventions or adequate regulations, given the extreme heterogeneity that characterizes the economic units in terms of decision-making processes, R&D activities, governance systems, innovation processes and competitive conditions.

With this in mind, this paper aims to identify the level of diffusion of EIS, and the main factors that support their adoption within a specific population of companies. It is a matter that this topic has so far been poorly dealt with the national scientific research streams (Mazzanti and Zoboli, 2009; Marin *et al*., 2015). In addition, due to the ambiguities connected to this cause and effect relationship, so far the international empirical surveys do not provide an exhaustive overview of this phenomenon, neither show certain and unquestionable results sound in every circumstance and context. Based on this premise, the paper aims to verify whether the factors supporting EIs may really differ according to contextual circumstances and specificities of firms investigated.

With this in mind, the paper is structured as follows. Section 2 discusses some features related to the factors affecting EIs. Sections 3, 4 and 5 report, respectively, the sample investigated, the findings and a clusters analysis. Conclusion, implications and limits are in section 6.

2. The theoretical framework

For several years the economic and managerial researchers have been trying to identify the various factors contributing to influence the behavior of companies towards EIs. Even if at the moment no single body of literature has succeeded in providing a comprehensive framework for the study of EIs explanatory variables (Kiefer *et al.*, 2019), the majority of theoretical approaches have tried to lead back the firms' behavior to a list of selected drivers. They include both stimuli of a positive nature that encourage firms

to adopt EIs, and negative stimuli, the *barriers*, that discourage, hinder or slow down companies' investments in EIs.

Both positive and negative drivers may arise as a result of contextual market situations, as a result of policies introduced by public bodies, or as independent management choices. For example, in the first case we refer to the ambition of differentiating from competitors, increase customer satisfaction, adapt to the choices of other companies or the changing expectations of consumers. In the second case, reference is made to the objective of obtaining tax or monetary incentives, to compliance with specific mandatory regulations or to the impossibility of accessing certain markets or contracts. In the third case we specifically refer to the subjective desire of the entrepreneurial team to preserve the natural and human resources with which their company relates.

The above distinction does not exclude that a same driver can be interpreted in positive or negative terms, since drivers concern essentially the same factors of influence (Marin *et al*., 2015; Hojnik and Ruzzier, 2016). It is also plausible that every driver has a different impact on the firms' choices and decisions, depending on the case, or that they can influence each other, strengthening or nullifying (Horbach *et al*., 2013; Marin *et al*., 2015).

Obviously, some EIs can be very simple to implement when incremental or with small deltas of difference from previous routines (e.g. the replacement of a device with another similar but more performing and/or more energy saving). While other EIs are particularly complex. All the innovations, however, as with any investment decision, alter the dynamics of the costs against uncertain revenues, the organizational model and the production process of the firm (Prahalad and Krishnan, 2008; Genco and Penco, 2017). Nor is it always easy to predict the time for learning new techniques and technologies or to adapt the plant, the factory or the entire company structure to the EIs (Schilling, 2009; Parente and Feola, 2015).

All the described elements increase the managerial and organizational complexity of the firms (Zanin and Bagnoli, 2016), at least during the initial period where they have to sustain higher investment costs, with obvious consequences on the economic, financial and patrimonial dynamics, and on the pursuit of the respective equilibrium of the second level subsystems (Paolone, 2007). In so doing new elements of uncertainty in company governance that complicate the decision-making process are introduced (Lombardi, 2012; Cafferata, 2018). Each change, therefore, has an impact on the medium/long-term competitive capacity of the firm, since the management and the entrepreneurial team must have skills consistent with the needs of the EIs; therefore, perhaps also of technological nature (Calvelli and Cannavale, 2013; Zanin and Bagnoli, 2016; Fageberg, 2018).

These assumptions amply justify the efforts of scholars who try to assess the impact of the various drivers on the choices of EI of companies, as well as the relative weight that they can acquire from time to time. This is all the truer considering that with respect to similar solicitations drivers can determinate not univocal or standardized business reactions (Mazzanti and Zoboli 2009; Carrillo-Hermosilla *et al*., 2010; de Jesus Pacheco *et al*., 2017). Nevertheless, some drivers may impact differently on EIs decisions depending on the type of innovation (Kiefer *et al.*, 2019).

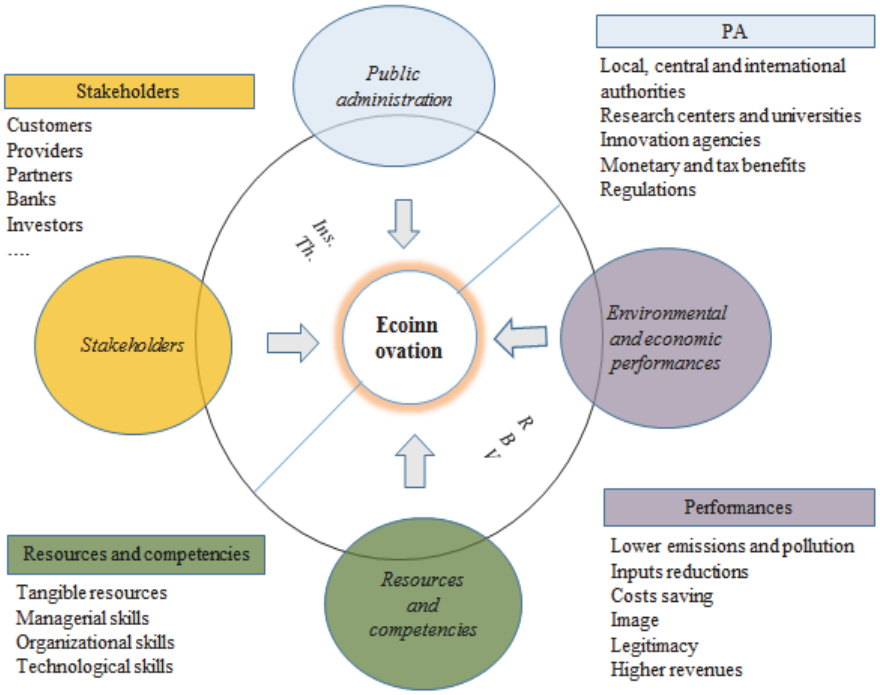
It is not surprising, therefore, if up to now no investigation has been proved to be exhaustive. Each survey carried out has been basically limited to verifying the impact of a limited number of drivers (Hojnik and Ruzzier, 2016; Xavier *et al*., 2017), often conditioned by the availability of data, the type of innovation considered, the final users, the sectorial or quantitative characteristics of the company, or even by the same adopted concept of EI (del Rio *et al.*, 2016; García-Granero *et al.*, 2018).

The considered drivers

Usually, drivers are analyzed by referring to a dichotomous classification (e.g. *internal* or *external*, *technology-pushed* or *marked-pulled*) which contains similar but of course not coincident drivers, or at economic level (*macro*, *meso* or *micro*) (De Marchi, 2012; Horback *et al.*, 2012; Triguero *et al.*, 2013). Other scholars have also remarked the relevance of the *Resource based view* and *Institutional theory* with refers to the resources and competencies owned by the firms, or to the expectations descending from the economic and social context (Kesidou and Demirel, 2012; Zhu *et al*., 2012; Cai and Li, 2018).

This paper follows the latter distinction as the questionnaire adopted to investigate the chosen population widely recalls that proposed by the mentioned Cai e Li (2018). Consistently, within the *RBV* approach, we include the pressures coming from the endogenous resources and competencies. In addition, we include the expectations of firms about the future economic and environmental *performance* linked to the adoption of EIs. While within the *Institutional Theory* approach we consider the influence played by *stakeholder*, with a distinct focus on the *public administrations* (Figure 1).

Fig. 1 – The ecoinnovation drivers



The first group of drivers considers the technological, organizational and management competencies deemed crucial by the management to favor the adoption of EIs requested by internal or external stakeholders (Mazzanti and Zoboli, 2009; Kesidou and Demirel, 2012). They must be strong enough to overcome possible intrinsic resistance to change (Golinelli, 2000; Genco and Penco, 2017). Similarly, often problems with the availability of adequate financial and human resources arise (Wagner and Llerena, 2012; del Rio *et al.*, 2016).

Conversely, management may believe that the sacrifices for the adoption of EIs are more than balanced by the possibility of obtaining an advantage. Since EIs are considered to positively affect the environmental performances, determining a reduction of the consumption of resources, emissions and pollution (Horbach *et al.*, 2012; Kesidou and Demirel, 2012), this advantage can be as much of an economic nature, such as greater revenues, higher distribution efficiency, higher profit margins on output, or of intangible nature for the future competitiveness. In this second case,

reference is made to aspects such as the improvement of the image or of the working conditions of the employees, the legitimation on the part of the stakeholders or the desire to be first mover in the adoption of EIs (Guoyou *et al*., 2013; Marin *et al*., 2015; Qu *et al*., 2017). These latter aspects refer to other dimensions of firm growth, in a perspective of integral development of the company (Catturi, 2009; Paternostro and Sorci, 2017).

The second group of drivers refers to the requests of stakeholders, who are increasingly pressing for ethical management of the society (Sciarelli, 2007). Since the seminal contribution of Freeman (1984), there has been a flourishing of valuable articles that have emphasized the growing role played by stakeholder engagement in influencing business decisions (e.g. Cucari, 2018; Saviano *et al*., 2018).

The solicitations normally believed most influential are those coming from customers, other companies and final consumers, who are increasingly attentive to the needs of the green economy but also willing to pay higher prices for environmentally friendly products and services (Horbach *et al*., 2012; del Rio *et al*., 2016; Hojnik and Ruzzier, 2016). Hence, disregarding customer expectations creates a serious risk of disaffection with the firm. Similarly, suppliers can also put pressure on their customers' firms in order to ask the adaption to EIs that are consistent with those they have already adopted, or to implement EIs that are functional with those which suppliers have implemented (Yalabik and Fairchild, 2011; Guoyou *et al*., 2013). The greater the degree of integration and cooperation with other firms, the greater the drive to adopt EIs (Wagner and Llerena, 2011; Triguero *et al*., 2013; Tumelero *et al*., 2019). International openness (Zhao *et al*., 2012; Hojnik *et al*., 2018) and competitive intensity (Yalabik and Fairchild, 2011; del Rio *et al*., 2016) also have a positive impact on EI.

Also other stakeholders increasingly interested in creating the image of green institution can solicit companies to adopt EIs. They can be as external to the venture, such as banks or serial investors (Gangi *et al*., 2018), or internal, such as staff. Employees can be encouraged to adopt or adapt to the EIs because solicited by the company itself, as customers/consumers or beneficiaries of the changes introduced (e.g. because they get a more pleasant working environment).

Among external stakeholders, a key role is clearly played by public administrations (hereafter PAs). In order to achieve the environmental targets established at national/international level, PAs call for the adoption of EIs through moral suasion, monetary and fiscal incentives or by imposing binding rules. Although the adoption of regulations is considered a particularly effective tool (Hojnik and Ruzzier, 2016; He *et al*., 2018), probably the best way to reduce the environmental diseconomies caused by productive activi-

ties is to widespread an ecofriendly culture within the territorial contexts (Mazzanti and Zoboli, 2009; de Jesus Pacheco *et al*., 2017). In this perspective, a strong contribution can be offered by universities and research centers (Cainelli *et al.*, 2012; Triguero *et al.*, 2013).

3. The empirical investigation

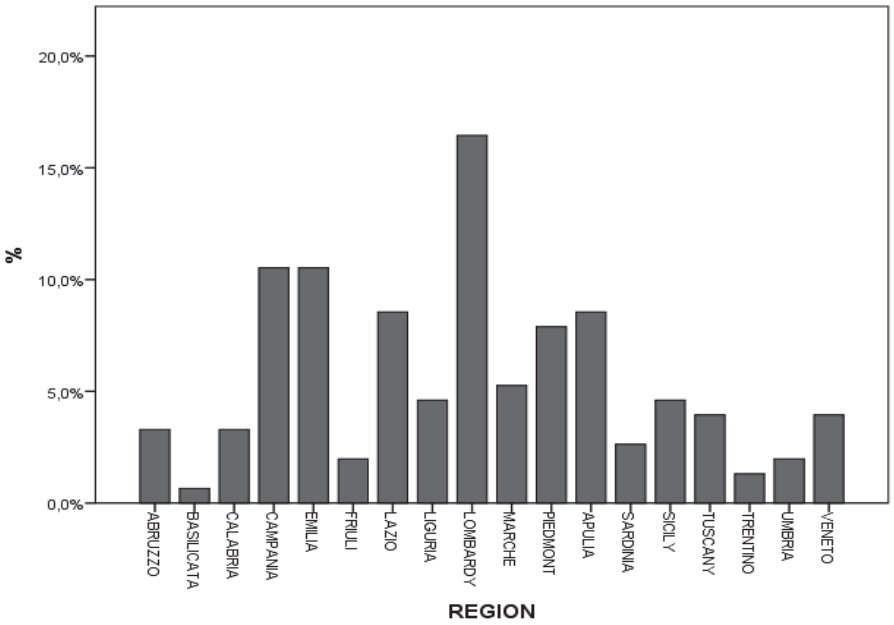
To reach the aims of the paper, a web survey was conducted between May, 1st and May, 31st. The survey has investigated a population of 1.035 innovative firms enrolled at April 1st 2019 in a specific register of the Ministry of Economic Development. The register concerns a detailed type of firms introduced by the Law 33/2015. The law aims to favor sustainable growth, technological progress and the employment in so doing contributing to the creation of an ecosystem more suited to innovation grounded on the processes of technology transfer, the exploitation of research and the attraction of talent and capital from abroad.

The enquired companies profit from a series of benefits that include the possibility of raising capital through equity crowd-founding, facilities for credit, tax incentives for investments. But they must satisfy stringent parameters concerning the technological innovation. Consequently, they should represent one of the best share of the domestic innovation-oriented sectors and with high chances to become *high-growth firms*. A category of ventures that is unanimously supposed essential for countries which aspire to remain among the most advanced ones. In addition, by virtue of their homogeneous young age, these firms should exhibit a greater openness of mind towards the theme of environmental sustainability.

In this regard, previous researches specify that young age and large dimensions generally are positively linked to EIs (Berrone *et al*., 2013; De Marchi, 2012; del Rio *et al*., 2017), while drivers differ among sectors (Cainelli and Mazzanti, 2013; Triguero *et al*., 2013). Since, as shown shortly, the investigated enterprises are basically small and belonging to the service sector, it is to be expected also a negative correlation with the EIs.

To avoid possible qualitative limitations inherent the use of data coming from administrative sources (for example the missed or delayed update) that can introduce bias effects to the final estimates, all the 1.035 companies included in the register were initially contacted. Therefore, the list was purified by firms for which it was not possible to individuate a website, an e-mail or a telephone number (51 in all). Due to the spatial heterogeneity of firms' distribution, stratified sampling was used, using the region as a stratification variable (Figure 2).

Fig. 2 – Regional distribution of firms' sample



The sample size, determined considering the heterogeneous spatial distribution of the companies, was originally set at 155 units (15% of the reference population). All the firms taken from the list were invited to participate in the survey by filling in an online questionnaire with closed questions on a 5-mode *Likert scale*. Three units did not provide satisfactory feedback so that the final sample size is 152. It includes 9 enterprises in commerce, 35 in manufacturing sector and 108 in services.

In line with the theoretical framework, the questionnaire consisted of 19 questions specifically aimed at investigating the categories of drivers discussed in the previous section (endogenous competences, expected performance, stakeholders, role of the PAs). As already specified, the questionnaire conceptually follows the similar questionnaire adopted by Cai and Li (2018). In order to improve the overall understanding, some changes have been introduced in the questionnaire, specifically i) three questions related to the approach toward the sources of innovation in general, the R&D, and the relationships with the public institutions were added, ii) some other alternatives to answer for the questions regarding expected economic and environmental performances were included.

Tab. 1 – Distribution of characteristic variables (%)

Italy	North (71)		Middle (35)		South (46)		Total (152)	
Employees	n_i	*%*	n_i	*%*	n_i	*%*	n_i	*%*
0-9	31	38.1	16	19.7	34	42.0	81	100
10-49	32	54.2	16	27.1	11	18.6	59	100
>50	8	66.7	3	25.0	1	8.3	12	100
Turnover ('000€)								
0-500	25	39.1	16	25.0	23	35.9	64	100
501-2.000	33	47.1	15	21.4	22	31.4	70	100
>2.001	13	72.2	4	22.2	1	5.6	18	100
Capital ('000€)								
0-100	43	43.4	24	24.2	32	32.3	99	100
101-1.000	15	44.1	6	17.6	13	38.2	34	100
>1.001	13	68.4	5	26.3	1	5.3	19	100
Sector								
Trade	3	33.3	2	22.2	4	44.4	9	100
Manufacturer	14	40.0	8	22.9	13	37.1	35	100
Services	54	50.0	25	23.1	29	26.8	108	100

Table 1 shows the distributions, absolute and percentage, by geographical distribution of some structural variables of the firms included in the sample. It emerges that the sample is basically made up of small businesses, in particular in the South, for the most part active in the service sector, with reduced capitalization but with relatively higher turnover values. This higher turnover could reflect the greater added value of the activities that investigated firms started up.

To assess the existence of a dependency relationship between the corporate characteristics and the sector of activity, Table 2 shows the values of the test statistic $\chi 2$. The absence of a significant relationship between the same characteristics and the territorial distribution is shown (the same happens considering the region). It confirms that the characteristics of the investigated companies are independent of the distribution in sectors.

Tab. 2 – Values of test χ^2 according to firms' features

Features	*$\chi 2$*	*p-value*
Employees	14,963	0,133
Turnover	14,469	0,272
Capital	20,092	0,328
Sector	2,497	0,645

4. The drivers impact

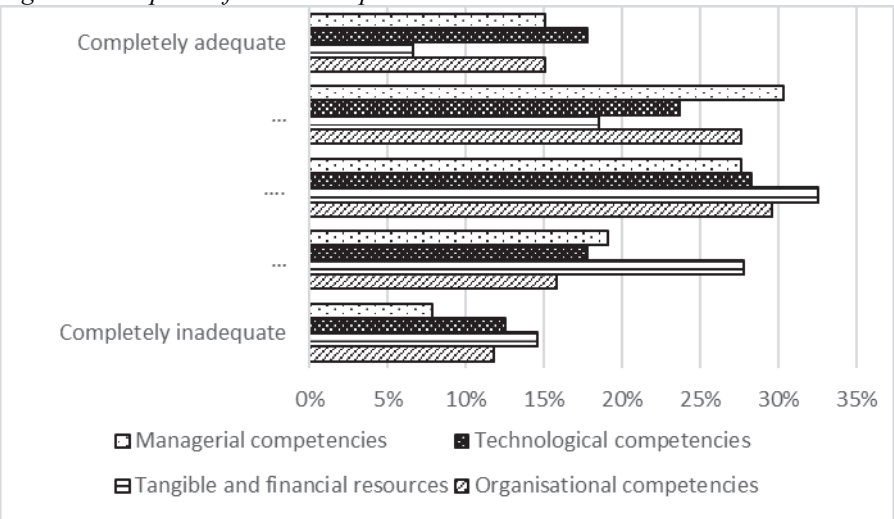
The analysis conducted on the data collected through the web surveys allows to draw a reference framework both on the predisposition to environmental innovations by companies, and on the perception of the considered drivers. It clearly emerges that only 10% of firms claims to have a documented plan or rules for ecological management, compared to 32% who admit they do not own it at all. Furthermore, only in 10% of the cases is there an ad hoc professional figure, such as the *energy manager*, although 15% of the respondents foresee to look for this professional position. This last requirement is particularly felt in the manufacturing sector, where 26% of the firms foresee the hiring of an energy manager, while it represents a necessity only for 8% of the companies active in the service sector.

This picture does not seem very consistent with recognizing, for a third of respondents, that both their own output, and production processes must meet specific environmental compatibility requirements. The findings are slightly better with regards to considering the *environmental auditing* as a management standard.

The solicitation towards employees for implementing virtuous behaviors from the energy and environmental front is strong. The staff, however, seems to only partially accept the management invitations in proposing sustainability actions.

Having said that, about internal drivers, the first aspect investigated concerned the possession of the technological, organizational and managerial skills and the tangible resources necessary to adopt the EIs of interest. While the three types of competencies are considered to be sufficiently or completely adequate for the needs, the endowment of material and financial resources is highly deficient (Figure 3). This observation amplifies, in the perception of companies, the weight of the weak presence of public incentives (see infra), with the consequent effect of discouraging the EIs.

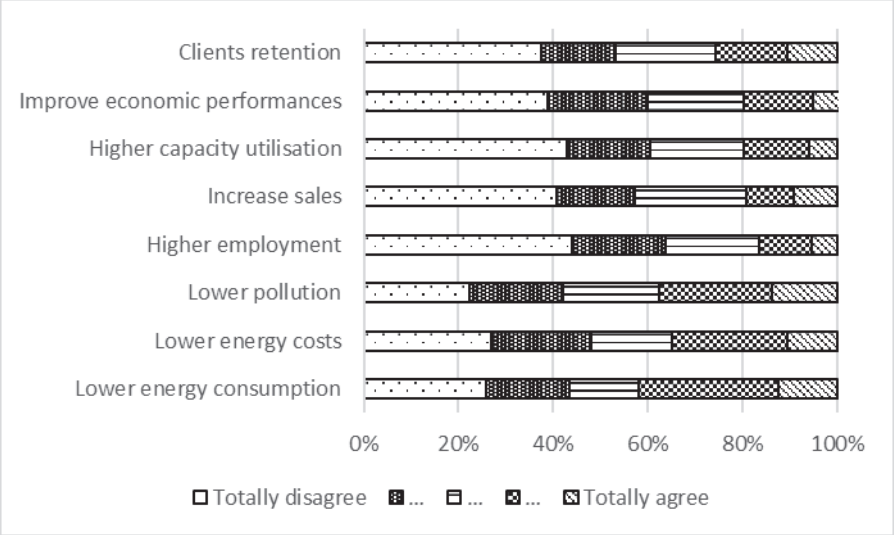
Fig. 3 – Perception of owned competencies



As regards to the stimuli linked to the possibility that the EIs favor better environmental and economic performances, the findings appear to be quite differentiated (Figure 4). From an environmental standpoint, over 42% of enterprises recognize that the adoption of ISIs has led to a clear reduction in the consumption of raw materials, emissions (47%), costs for energy and other production inputs.

About the economic performance, on the other hand, around 60% of companies did not record a benefit in terms of increases in sales or production capacity of the plants. Nor has there been a positive impact on profitability, an improvement in the competitive position or greater customer loyalty. Moreover, for over 60% of respondents, the impact of EIs on job creation is negligible.

Fig. 4 – Economic and environmental effects of EIs



About the stakeholders' category, a substantial territorial equivalence emerges in considering, on average, the customer expectations of high impact. This influence is far superior to that exercised by the other stakeholders (Table 3). The influence of the suppliers is very limited, only greater than that of the venture capitalists, but inferior both to financial intermediaries, and to other actors in the economic system.

On a closer look, the result is in line with the high weight that companies assign to the internal capacities that support the R&D function for access to innovations in general; also with respect to the role played by research centers (considered useful or very useful by 66.5%), by partnerships (61.9%) or by specialized consultants (53.9%).

This picture, however, should be correlated to the lack of obligation to report to stakeholders on their commitment to eco-sustainability, provided only for large societies. Maybe it is not by chance that the majority of the firms surveyed confirm that they do not worry about this need.

Tab. 3 – Stakeholder engagement perception (%)

	North	Middle	South
Customer requests stimulate the adoption of EIs			
Totally disagree	18.3	28.6	13.0
…	29.6	14.3	26.1
…	18.3	17.1	21.7
…	14.1	22.9	17.4
Totally agree	19.7	17.1	21.7
Suppliers proposals encourage the adoption of EIs			
Totally disagree	25.4	20.0	15.2
…	26.8	20.0	30.4
…	29.6	31.4	32.6
…	12.7	20.0	15.2
Totally agree	5.6	8.6	6.5
Financial intermediaries are more likely to fund environmentally friendly investments			
Totally disagree	29.6	25.7	26.1
…	28.2	42.9	30.4
…	29.6	17.1	23.9
…	9.9	8.6	19.6
Totally agree	2.8	5.7	0.0
Venture capitalists are more likely to fund environmentally friendly firms			
Totally disagree	21.1	17.1	13.0
…	31.0	28.6	30.4
…	22.5	20.0	30.4
…	21.1	31.4	19.6
Totally agree	4.2	2.9	6.5
Also other actors of the local economic context induce to adopt EIs			
Totally disagree	15.5	11.4	6.5
…	21.1	37.1	50.0
…	42.3	40.0	28.3
…	14.1	8.6	15.2
Totally agree	7.0	2.9	0.0

With particular reference to the pressures of the PAs, the majority of respondents believe that there are inadequate fiscal and monetary benefits to stimulate the adoption of EIs, while they consider the bureaucratic procedure to receive them particularly complex. Businesses also consider the

regulatory framework to be inadequate (Table 4). Although globally weak, these findings appear to be entirely consistent with the very low percentage (14%) of companies that requested the incentives provided by the regulations in favor of the EIs (only 8% received them), while more than 51% did not feel able to request them, and 34% declared that they were not aware of them.

Tab. 4 – Perception of PAs interventions effectiveness

PAs provides…	Commerce	Manufacturers	Services
adequate tax benefits for eco-innovations of my interest			
Totally disagree	33,3	22,9	28,7
…	33,3	42,9	38,9
…	11,1	22,9	25,0
…	22,2	8,6	5,6
Totally agree	0,0	2,9	1,9
appropriate monetary incentives for EIs of my interest			
Totally disagree	44,4	28,6	32,4
…	44,4	40,0	38,0
…	11,1	22,9	21,3
…	0,0	5,7	6,5
Totally agree	0,0	2,9	1,9
a more streamlined bureaucratic procedure			
Totally disagree	33,3	34,3	49,1
…	66,7	45,7	28,7
…	0,0	11,4	17,6
…	0,0	2,9	4,6
Totally agree	0,0	5,7	0,0
a regulatory framework that supports EIs			
Totally disagree	44,4	20,0	35,2
…	44,4	40,0	35,2
…	11,1	31,4	23,1
…	0,0	2,9	6,5
Totally agree	0,0	5,7	0,0

However, these findings do not reflect the high environmental awareness that emerges on the whole; particularly in the southern regions, where more than half of the companies expresses attention to the EIs. It could even be assumed that southern Italy firms think of the EI as a way of reduc-

ing comparative disadvantages compared to companies in other regions, but also of a reaction to the known criticality of business climate that characterizes many southern areas.

Another reason for the gap between sensitivity and concrete actions of respondents is related to the size of the firm. Enterprises that are mainly small and poorly structured may not have adequate economic resources to invest in the environmental purpose. This also explains the pressures to eco-innovate delegated to their employees.

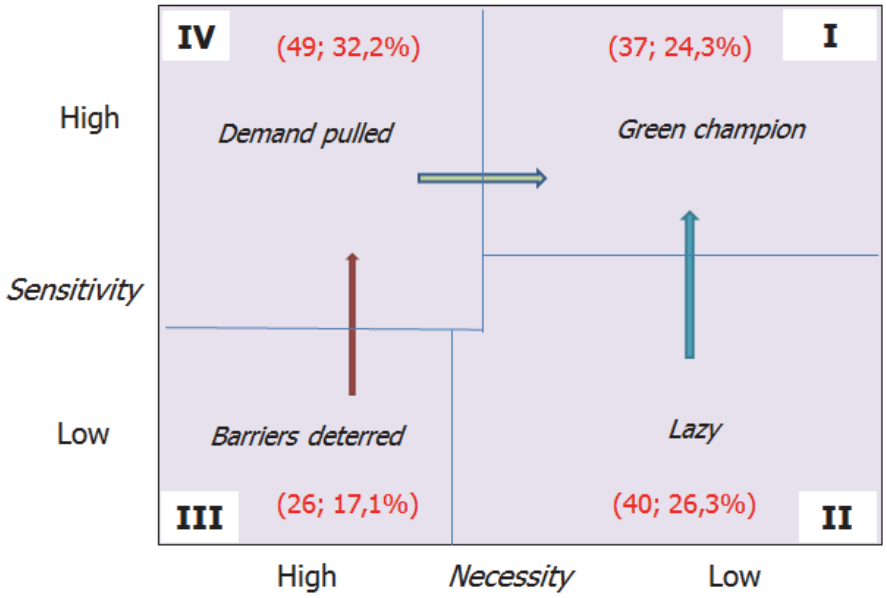
5. The cluster analysis

In order to highpoint possible similarities between the companies investigated in relation to EI drivers, we carried out a cluster analysis. This statistical technique permits to identify possible common structures among the variables that allow to group the firms Due to the considerable number of firms investigated, it would be difficult to interpret the output obtained from the classic hierarchical analysis based on aggregative algorithms. So we have preferred to use a two-step procedure (Hair *et al*., 2009). To identify the number of clusters, first of all a hierarchical agglomerative algorithm was monitored. Next, the firms were assigned to one of the groups obtained through ta non-hierarchical clustering algorithm of the k-means.

The distribution of the companies to the individual clusters identified allows to recognize the characteristics shared by the ventures based on their proclivity towards EIs. Each identified clusters is described by some items included in the analysis that allows to describe the characteristics of the group, and subsequently the features to which each of them is most sensitive.

The analysis carried out according to two latent features, and *necessity*, displayed the presence of four homogeneous clusters of firms. *Sensitivity* concerns the declared proclivity of firms to eco-innovation and environmental sustainability. A high *sensitivity* indicates that enterprises are aware of the problems related to sustainability. The *necessity* explains how much the choice to adopt EIs depends on stakeholders' pressures, on the endogenous stimuli linked to the need to adapt to competitors or to satisfy customers' requests, but also on the possibility to obtain funding by PAs (Berrone *et al.*, 2013). A high *necessity*, therefore, distinguishes among ventures that adopt EIs because somehow obliged to do so and those that, on the contrary, are driven by the desire of management to anticipate competitors, to obtain greater legitimacy among stakeholders, to create an image of a sustainable development towards the community, or to answer at entrepreneurs' subjective desires of environmental protection.

Fig. 5 – A representation of the characteristics of individuated clusters



The cluster I includes companies that show, at the same time, a high *sensitivity* towards EIs and the environmental sustainability in general, but a low *necessity* to adopt them. This cluster fundamentally includes firms that know the normative references and that have the suitable competences to adopt innovations independently from the exogenous supports. While not particularly feeling the *necessity* to adopt EIs, they prove to be particularly attentive to environmental problems, and to energy efficiency. It is no coincidence that in their organization chart it is common to find the figure of the energy manager, whose role is precisely to work to reduce the environmental footprint of the firm. The sensitivity of these companies is also found with reference to the degree of attention paid to requests from stakeholders. This group therefore contains companies whose managers see the EIs as an opportunity for their development.

It should also be noted that this group is the one with the highest incidence of manufacturing companies, notoriously the most aware of their environmental impact and of the consequent influence of the EIs on their financial and economic dynamics. In addition, usually these firms are larger, more capitalized and internationalized which make them more sensitive and open to EIs compared to other sectors (Hojnik and Ruzzier, 2016; Hojnik *et al*., 2018). Manufacturing firms are also more attentive to regulatory aspects and the provision of skills; positively influenced by the feedback and

stimuli of the PA. These assumptions also justify the greater propensity to invest in EIs. So, consistently with the findings of the cluster analysis by Marin *et al.* (2015), the firms of this group have been defined *green champion*, «since these firms seem to recognize the opportunities linked to intense eco-innovation engagement» (p. 683). That is these enterprises tend to anticipate the needs or to adapt themselves more rapidly to the changing context.

In the clusters II and III are included those companies that show a low *sensitivity* to corporate sustainability issues. In general, they are firms whose investments in EIs are modest or non-existent. The firms of the second group, in particular, even though are beginning to show a certain *sensitivity* towards environmental issues, at the moment they do not appear interested in sustaining substantial investments due to the absence of adequate requests from stakeholders or of a future vision of management. For these reasons, they can be defined as *lazy*, as they lack adequate stimuli that could perhaps lead them towards a path of more convinced environmental sustainability.

The ventures included in cluster III, the least numerous (26 units equal to 17.1% of the sample) represent those with low levels of sensitivity, but high levels of necessity to be ecologically innovative. Nevertheless, they are the ones that, in absolute terms, are less attentive to the aspects of environmental protection and of the consequent EIs. Probably this weak interest reflects a precise managerial and organizational gap to implement EIs. These firms, in fact, are normally aware of having to adapt to requests and solicitations from outside, which are also able to discern, but they do not have enough competencies, tangible internal resources, or managerial propensity to deal with it.

It is interesting to note that, in keeping with the above, manufacturing companies are almost absent in this group. In light of this, and following the definition of Marin *et al.* (2015), it is considered appropriate to call the firms belonging to this cluster as *deterred barriers*, since they are locked by their own intrinsic limits. By virtue of this, they are dangerously exposed to the risks associated with requests for adaptation of customers, as they are unable to satisfy in the short term.

Finally, in the cluster IV there are firms that are simultaneously characterized by a high *sensitivity* and the *necessity* to adopt innovations. This cluster is the most numerous (49 units, corresponding to 32.2% of the sample), and includes almost all the few commercial enterprises. Companies linked to the commercial sector are those that most complain about the bureaucratic delays and the limited resources made available by the PA. This feedback can be ascribed to the fact that this type of venture is often ex-

cluded from the regulations encouraging the adoption of EIs which, as mentioned, tend to favor the manufacturing sector (Cainelli and Mazzanti, 2013).

The firms included in this cluster are also characterized by being dependent on the stimuli or regulations issued by the PA. However, this relationship is not perceived as constructive as companies complain about the inadequacy of the funds provided and bureaucratic difficulties that discourage the request. This is a significant problem because at certain stages of the development process or for certain types of ventures with low capitalization and low levels of turnover, the ability to self-regenerate resources is rather limited (Paolone, 2007; Catturi, 2009), with obvious negative consequences on investment decisions. In essence, the investments of these companies rather than a deliberate choice are a consequence of external contingencies to avoid slipping out of the market. For these reasons, the firms in this cluster can be called *demand-pulled*.

As the clusters I e IV which exhibit the higher sensitivity, *green champion* e *demand-pulled*, are the most numerous (56.6%), this allows to judge with a certain optimism the approach towards the EIs by the population of investigated firms. Nevertheless, considering the intrinsic innovative nature of this population, it would have been reasonable to expect an even greater propensity overall.

As explained, the reason could be the limited incidence of manufacturing companies with respect to services. These category presents the highest incidence to the environmental pollution, but it also is the most heavily regulated and the most inclined to introduce innovative responses to environmental issues (Caianelli and Mazzanti, 2013).

Against this landscape, certainly not generalizable in light of the specificities of the population investigated, it is clear that the goal of policy makers should be to favor the transition of firms towards the best cluster of *green champions*. This objective could be achieved, with regard to firms defined as *lazy* localized in the II quadrant, first of all supporting them into strengthening the relationships with the actors of the context. The aim is to help them to improve their ability to grasp external stimulus and therefore to adopt virtuous investment behavior in EIs. The aim is to assist them to improve their ability to grasp external stimulus and therefore to adopt virtuous investment behavior in EIs. It would therefore be advisable to encourage the development of *networking abilities* (Mazzanti and Zoboli, 2009).

For companies in the III quadrant, the *deterred barriers*, an essential first step would seem to be a closer contact with public institutions; universities and research centers included. They should, on the one hand, spread a

cultural model geared to environmental sustainability, and on the other hand help these enterprises to overcome the skills and knowledge gaps that prevent them from investing adequately in EIs. The risk is that the inability to read or respond to requests and external needs for adaptation to green economy could undermine the same survival conditions of these firms; that would end up cut off from customers and suppliers.

In addition, firms belonging to clusters II and III need to be made aware of the advantages associated with the adoption of EIs; especially long term ones. Increasing the level of awareness regardless of stakeholder demands or PA pressures would allow for future performance and competitiveness gains. Furthermore, due to the cooperation and collaboration among enterprises, specific EIs markets could arise, as well as EIs diffusion by imitation would be accelerated. Also in this case a closer relationship with universities and research laboratories could be functional to this purpose (Tumelero *et al*., 2019).

Finally, for the *demand-pulled* companies of cluster IV, that is enterprises that have the necessity to eco-innovate to keep up or to stay ahead to the competitors, the objective is first of all to improve both the quality of the PAs interventions and their relationship with other firms. From this point of view, it would be advisable a more specific legislation which reflects the sectorial or dimensional differences among ventures, as well as able to identify new paths and procedures stimulating investments in EIs. If PAs will unfit this requests, even with monetary supports, there is an obvious risk of penalizing the competitiveness of these enterprises.

6. Final remarks

To accelerate the transition of economies towards *green economy* and *sustainable development*, managerial and economic scientific literature believes more and more important to become able to understand the drivers affecting the eco-innovative processes within the firms. To adopt ecoinnovations (EIs) probably is also the better manner to answer at the increasing request for environmental sustainability showed by stakeholders, by virtue of their increasing influences over firms' strategies and behaviors.

With this in mind, this paper aimed to identify the level of diffusion of EIs and the main factors that support their adoption within a specific population of Italian firms. Up to now just few papers investigate this issue.

The overall impression we get is that the problem of eco-sustainability is sufficiently felt, first and foremost thanks to the push of customers. Nevertheless, this sensitivity does not translate into real investments due to a

series of constraints connected both to the structural peculiarities of the companies, and to the national reference context.

With specific reference to the investigated population, many firms seem not adequately structured to systematically approach the problems of environmental sustainability (Hojnik and Ruzzier 2016; Cai and Li, 2018); e.g. adopting an *environmental management system*. Indeed, investments to support EIs appear to find a serious obstacles related to the limited size and low capitalization typical of Italian enterprises. Not by chance, even if firms declare the possession of adequate endogenous skills, they suffer the scarcity of financial resources.

This low propensity to eco-innovate reflects negatively on its suppliers, which in turn are not encouraged to invest in EIs. Even the feeble international openness of companies further slows down the push towards EIs (Zhu *et al.*, 2012; Hojnik *et al.*, 2018). However, the mentioned strong push of customers towards EIs also represents a risk, since customers, especially foreign ones, could decide to interrupt relations with investigated firms that had difficulty following them on this path (Yalabik and Fairchild, 2011; Guoyou *et al.*, 2013).

A second set of constraints and barriers is linked to the action of public administrations (PA). First of all, the regulatory framework is perceived as still incomplete, scarcely widespread and complex to face; also as regards the offer of incentives and stimulus for eco-innovators. Furthermore, even if the potential environmental and economic benefits connected with the adoption of the EIs are very clear in the minds of entrepreneurs, as well as their positive effect on competitive dynamics, there seems to be missing of a concrete response to the firms' needs from the PAs. Similarly, there is a lack of accompanying actions by public institutions towards companies that wish to adopt EIs, but are conditioned by objective limits.

Implications

The picture thus outlined recalls a key role and a greater responsibility for the PAs. In fact, PAs are responsible for the creation of a business climate coherent with the specific needs of environmental innovations and of the difficulties currently perceived and expressed by ventures (Horbach, 2014; Xavier *et al.*, 2017). by virtue of the showed findings, policies should act in several directions with strategies and methods of public intervention that are correlated to the specific evolutionary stage in which the interested companies are located (Halila and Rundquist, 2011; Kesidou and Demirel, 2012; Cafferata, 2018).

A first direction concerns the guarantee of certainty to firms both in terms of application of the regulations, and in the granting of any financial or tax benefits (Gangi *et al*., 2018). An aspect that is considered critical by many respondents.

A second direction concerns the support to the creation of partnerships and collaborations with other companies. The aim is to facilitate the dissemination of technological skills that promote the adoption of the EIs, to share the costs of adoption or learning of their use, but also the costs of R&D for societies which aspire not to be simple followers of the environmental innovations (Tumelero *et al*., 2019).

A third direction concerns a wider supply of tangible and intangible resources. They concern both organizational and managerial skills through ex-ante training and ongoing assistance for the more complex EIs to be implemented, as well as ad hoc incentives aimed also at new plants, as well as for the conversion of existing ones (De Marchi, 2012; Parente and Feola, 2015). From this perspective, investments supporting firms adopting EI are among the most profitable, because they reduce negative externalities, increase the competitiveness of the country and improve the welfare of the community (Horbach *et al*., 2012).

Particularly, according to the findings of the cluster analysis, the existence of differentiate paths correlated to the positioning of companies in the four quadrants that have emerged is conceivable. That is because companies have different needs, depending both on availability of resources of the single firms, and on the needs of the stakeholders with whom they have to deal.

On the whole, anyway, universities and research centers should continue to carry out their key tasks by providing training, the diffusion of an entrepreneurial culture of innovation, and technology transfer actions (Calvelli and Cannavale, 2013; Saviano *et al.*, 2018; Fageberg, 2018). Nonetheless, the duties of institutional bodies supporting the internationalization processes of firms and the search for venture capitalists and other investors should be strengthened; without with it replacing the role of private subjects (Mele *et al*., 2008; Xavier *et al*., 2017).

Limitations

As any empirical research, the paper has some limitations.

First of all, due to the specificities of the investigated population, the showed landscape is not generalizable. Even if these firms show, at the same time, a distinct perception of the environmental issues but a modest willingness to invest in EIs, they present specificities not common at the

majority of other national firms. Indeed, they should represent the share presumably more open to change. That is to say that the picture outlined here could be better overall than that obtained by other populations of firms. It should be acknowledged, however, that some of the structural characteristics of companies linked to the possibility of being included in the specific investigated database (e.g. dimension and sector) may be related to a lower propensity to eco-innovate.

Moreover, it is probable that the findings are conditioned by the high percentage of firms operating in the service sector, such as ICT. The latter have greater difficulty in improving their already limited ecological footprint. However, as the service economy is now predominant in the advanced economies, the results seem to realistically photograph the national situation. But they could have been different by considering a sample composed mainly of manufacturing companies. It is not by chance that it has been noted that these firms are the most attentive to environmental sustainability. Probably the latter are more aware of their own environmental impact and also more subject to compulsory laws and possible controls; as well as more beneficiaries of incentive regulations (Wagner and Llerena, 2011).

Similarly, we can image that the results have been influenced by the reduced small average size of the investigated population, whereas the larger and more capitalized societies are more likely to eco-innovate (Horbach, 2014; He *et al*., 2018) due to the above mentioned reasons.

Secondly, like in other similar surveys, just some variables have been investigated. So far no researcher has been able to simultaneously analyze all the variables treated in the scientific literature, as analogous variables can be considered at the same time as positive drivers or barriers (Marin *et al*., 2015), and they can influence each other (de Jesus Pacheco *et al*., 2017).

Thirdly, as reminded by Kiefer *et al*. (2019), each drivers could affect differently according to the type of innovation, while in this paper, such as in the majority of the empirical surveys, EIs are considered as homogeneous, without distinguish among their different types. Of course each type of EI differently impacts on the firms' productive processes and strategies.

Fourthly, usually investigations consider the answers of the firms to the external stimulus or internal pressures as whole; that is by considering their governance as a unitary body. This approach, however, tends to lose meaning in smaller enterprises where most decisions are concentrated in a few people of the entrepreneurial team (Fortuna and Paoloni, 2010; Bonti and Cori 2016). Consequently, the investment decisions are no more the result of a complex choice of exhaustive and all-inclusive evaluation, but may depend on the reading and interpretation of the economic reality of even just a person, in turn strictly dependent on his/her skills and abilities.

In the light of the above statements, due to the real risk of having a panorama of companies not very inclined towards the EIs, it seems more necessary than ever to propose extensions of this survey or new investigations to other populations or contexts, according to different approach and methodologies. Only in this way it will be possible to confirm or to refute the showed picture, as well as to shed light on the limits highlighted. It is crucial to improve the understanding of the EIs adoption processes, delivering to policy makers and other institutional actors the indispensable knowledge to successful support eco-innovative firms to positively modify a possible unfavorable industrial scenario.

References

Berrone P., Fosfuri A., Gelabert L., Gomez-Mejia L.R. (2013). Necessity as the mother of 'green' inventions: institutional pressures and environmental innovations. *Strategic Management Journal*, 34, 891-909.

Berthon P., Ewing M., Lian H.L. (2005). Captivating company: dimensions of attractiveness in employer branding. *International Journal of Advertising*, 24, 2, 151-172.

Bonti M., Cori E. (2016). Assetti di governance e forme organizzative nelle PMI familiari. In: Anselmi L. e Lattanzi N. (Eds.), *Il Family Business Made in Tuscany*. Milano: FrancoAngeli.

Cafferata R. (2018). *Management in adattamento. Tra razionalità economica, evoluzione e imperfezione dei sistemi*. Bologna: Il Mulino.

Cai W., Li G. (2018). The drivers of eco-innovation and its impact on performance: Evidence from China. *Journal of Cleaner Production*, 176, 110-118.

Cainelli G., Mazzanti M. (2013). Environmental innovations in services: manufacturing-services integration and policy transmissions, *Research Policy*, 42, 9, 1595-1604.

Calvelli A., Cannavale C. (2013). *Competenze culturali e internazionalizzazione delle imprese*. Torino: Giappichelli.

Carrillo-Hermosilla J., Del Río P., Konnola T. (2010). Diversity of eco-innovations: reflections from selected case studies. *Journal of Cleaner Production*, 18, 1073-1083.

Catturi G. (2009) Crescita e sviluppo aziendale: il quadro di riferimento. In: Ibidem (Eds.), *L'armonia della complessità. Dalla crescita allo sviluppo aziendale*. Padova: Cedam.

Cheng W., Appolloni A., D'Amato A., Zhu Q. (2018). Green Public Procurement, Missing Concepts and Future Trends – A Critical Review, *Journal of Cleaner Production*, 176, 8, 770-784.

Cucari N. (2018). *Lo shareholder engagement negli studi di corporate governance. Un'analisi empirica mediante la Qualitative Comparative Analysis*. Milano: FrancoAngeli.

del Río P., Peñasco C., Romero-Jordán D. (2016). What drives eco-innovators? A critical review of the empirical literature based on econometric Methods. *Journal of Cleaner Production*, 112, 2158-2170.
del Río P., Peñasco C., Romero-Jordán D. (2017). Analysing firm-specific and type-specific determinants of eco-innovation. *Technological and Economic Development of Economy*, 23, 2, 270-295.
de Jesus Pacheco D.A., Caten C.S.T., Jung C.F., Ribeiro J.L.D., Navas H.V.G., Cruz-Machado V.A. (2017). Eco-innovation determinants in manufacturing SMEs: Systematic review and research directions. *Journal of Cleaner Production*, 142, 4, 2277-2287.
De Marchi V. (2012). Environmental innovation and R&D cooperation: empirical evidence from Spanish manufacturing firms. *Research Policy*, 41, 614-623.
EIO (Eco-Innovation Observatory) (2012). Methodological Report. Eco-Innovation Observatory. Funded by the EC, DG, Environment, Brussels.
Fagerberg J. (2018). Mobilizing innovation for sustainability transitions: A comment on transformative innovation policy. *Research Policy*, 47, 9, 1568-1576.
Fortuna F., Paoloni P. (2010). La corporate governance nelle Pmi: situazione attuale e tendenze evolutive. In: Fortuna F. (Ed.), *La corporate governance nell'esperienza nazionale e internazionale*, Bologna: Il Mulino.
Freeman R.E. (1984). *Strategic Managemen. A Stakeholder Approach*, Boston: Pitman.
Gangi F., Meles A., D'Angelo E., Daniele L.M. (2018). Sustainable development and corporate governance in the financial system: Are environmentally friendly banks less risky? *Corporate Social responsibility and Environmental Management*, 26, 3, 529-547.
Genco P., Penco L. (2017). *La gestione strategica dell'impresa. Le strategie di corporate.* Torino: Giappichelli.
Golinelli M.G. (2000). *L'approccio sistemico al governo dell'impresa*. Padova: Cedam.
Guoyou Q., Saixing Z., Chiming T., Haitao Y., Hailiang Z. (2013). Stakeholders' influences on corporate green innovation strategy: A case study of manufacturing firms in china. *Corporate Social Responsibility and Environmental Management*, 20, 1, 1-14.
Hair J.F., Black, W.C., Babin, B.J., Anderson R.E. (2009). *Multivariate Data Analysis*, Prentice Hall Higher Education.
Halila F., Rundquist, J. (2011). The development and market success of Eco-innovations: A comparative study of Eco-innovations and "other" innovations in Sweden. *European Journal of Innovation Management*, 14, 278-302.
He F., Miao X., Wong C.W.Y., Lee S. (2018). Contemporary corporate eco-innovation research: A systematic review. *Journal of Cleaner Production*, 174, 502-526.
Hojnik J., Ruzzier M. (2016). What drives eco-innovation? A review of an emerging literature. *Environmental Innovation and Societal Transitions*, 19, 31-41.
Hojnik J., Ruzzier M., Manolova T.S. (2018). Internationalization and economic performance: The mediating role of eco-innovation. *Journal of Cleaner Production*, 171, 1312-1323.

Horbach J. (2014). Do Eco-innovations need specific regional characteristics? An econometric analysis for Germany. *Review of Regional Research*, 34, 23-38.
Horbach J., Rammer C., Rennings K. (2012). Determinants of eco-innovations by type of environmental impact – the role of regulatory push/pull, technology push and market pull. *Ecological Economy*, 78, 112-122.
Horbach J., Oltra V., Belin J. (2013). Determinants and specificities of Eco-innovations compared to other innovations – an econometric analysis for the French and German industry based on the community innovation survey. *Industrial Innovation*, 20, 6, 523-543.
Kesidou E., Demirel P. (2012). On the drivers of Eco-innovations: Empirical evidence from the UK. *Research Policy*, 41, 862-870.
Kiefer C.P., Del Río González P., Carrillo-Hermosilla J. (2019). Drivers and barriers of eco-innovation types for sustainable transitions: A quantitative perspective. *Business Strategy and the Environment*, 28, 155-172.
Lombardi R. (2012). *Corporate governance e governo della complessità: un approccio integrato*, Vol. 9, Napoli: Edizioni Scientifiche Italiane.
Marin G., Marzucchi A., Zoboli R. (2015). SMEs and barriers to Eco-innovation in the EU: Exploring different firm profiles. *Journal of Evolutionary Economics*, 25, 3, 671-705.
Mazzanti M., Zoboli R. (2009). Embedding environmental innovation in local production systems: SME strategies, networking and industrial relations. *International Review of Applied Economy*, 23, 2, 169-195.
Mele R., Parente R., Petrone M. (2008). La governance pubblica dei distretti tecnologici. *Sinergie*, 77, 81-100.
Paolone G. (2007). *L'economia aziendale e la ragioneria*. Milano: Maggioli.
Parente R., Feola R. (2015). The renewable energy industry: Competitive landscapes and entrepreneurial roles. In: Kyro P. (Ed.), *Handbook of Entrepreneurship and Sustainable Development Research*, 299-320, Cheltenham: Elgar.
Porter M.E., van der Linde C. (1995). Toward a New Conception of the Environment-Competitiveness Relationship. *The Journal of Economic Perspectives*, 9, 4, 97-118.
Porter M.E., Kramer M.R. (2006). The link between competitive advantage and corporate social responsibility. *Harvard Business Review*, 84, 78-92.
Prahalad M.S., Krishnan (2008). *The new age of innovation*. New York: McGrawHill.
Qu Y., Yu Y., Appolloni A., Li M. and Yue Liu Y. (2017). Measuring Green Growth Efficiency for Chinese Manufacturing Industries. *Sustainability*, 9, 4, 637.
Saviano M., Caputo F., Belyaeva Z., Mueller J. (2018). Competing through consonance: a stakeholder engagement view of corporate relational environment. *Sinergie*, 36, 105, 61-80.
Schilling M. (2009). *Strategic Management of Technological Innovation.* New York: McGraw Hill.
Sciarelli S. (2007). *Etica e responsabilità sociale nell'impresa*, Milano: Giuffrè.
Sorci C., Paternostro S. (Eds.) (2017). *Lo sviluppo integrale e la centralità della persona.* Roma: Aracne.

Triguero A., Moreno-Mondéjar L., Davia M.A. (2013). Drivers of different types of Ecoinnovation in European SMEs. *Ecological Economics*, 92, 25-33.
Tumelero C., Sbragia R., Evans S. (2019). Cooperation in R&D and eco-innovations: the role on the companies' socioeconomic performance. *Journal of Cleaner Production*, 207, 1138-1149.
Wagner M., Llerena P. (2011). Eco-innovation through integration, regulation and cooperation: Comparative insights from case studies in three manufacturing sectors. *Industry and Innovation*, 18, 747-764.
Yalabik B., Fairchild R.J. (2011). Customer, regulatory, and competitive pressure as drivers of environmental innovation. *International Journal of Production Economics*, 131, 519-527.
Xavier A.F., Naveiro R.M., Aoussat A., Reyes T. (2017). Systematic literature review of eco-innovation models: Opportunities and recommendations for future research. *Journal of Cleaner Production*, 149, 15, 1278-1302.
Zanin F., Bagnoli C. (2016). *Lo strategizing in contesti complessi*, Ca' Foscari.
Zhu Q., Cordeiro J., Sarkis J. (2012). International and domestic pressures and responses of Chinese firms to greening. *Ecological Economy*, 1, 83, 144-153.