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Outlook 4

Can environmental process standards enable eco-innovation?

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Key messages



Process standards can be adopted by organizations and may support the development and diffusion of eco-innovations



This policy outlook paper illustrates different aspects related to the process standards, by providing also empirical findings from previous studies



The objective is to provide some insights on how process standards can help to achieve a higher level of environmental sustainability and, at the same time, to achieve sustainable development goals.

1 INTRODUCTION

New regulations and the need to preserve the environment require businesses to implement more environmentally friendly processes. There are several tools companies may use to introduce a proper system of environmental management into their organization, strategies and processes. One of these is represented by voluntary environmental process standards. This policy outlook explores the potential role of environmental process standards in facilitating the development and diffusion of eco-innovations.

Voluntary process standards can have a key role to achieve most of the UN Sustainable Development Goals, as also affirmed by ISO. ISO is the International Organization for Standardization, the body that developed and published one of the most important process standards in the world, the ISO 14001. EMAS, at the EU level, and ISO 14001, at worldwide level, are among the most important process standards due to their diffusion and the number of certified organizations. Moreover, the European Action Plan for the Circular Economy lists improving the uptake of EMAS as one of its key aspects (European Commission, 2015).

This paper aims to illustrate the sustainability challenges and opportunities that environmental process standards may address. The objective is to help different kinds of stakeholders complete the transition towards a higher level of environmental sustainability and achieve sustainable development goals. For this purpose, this policy outlook describes how environmental process standards may influence and encourage eco-innovations, firm competitiveness and ultimately firm environmental performance. Moreover, it offers insights on the interrelationships between environmental process standards and eco-innovations, firm competitiveness and environmental performance also based on empirical evidence.



SUSTAINABILITY CHALLENGE

Paying attention towards environmental sustainability and green growth is becoming increasingly important: Regulations require businesses to make their processes more environmentally friendly. In this sense, the main “sustainability challenge” is to establish more sustainable processes, activities and practices in firms. Taking into account the Sustainable Development Goals (SDGs) –which are part of the United Nations’ new sustainable development agenda- the sustainability challenge is relevant for a number of SDGs. More sustainable processes and activities at the firm level may contribute to a lot of the SDGs, for example to SDG 6 (Clean water and sanitation), SDG 9 (Industry, innovation and infrastructure), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate action).

However, many manufacturing and industrial companies continue to employ processes which are environmentally harmful and inefficient in terms of resource and energy consumption. Thus, they also drive climate change and greenhouse gas emissions (Henriques & Catarino 2016). In other words, adopting environmental sustainability practices and processes is not yet a standard procedure in most companies (Vieira & Amaral, 2016).

The potentially lower environmental performance that arises from current processes and practices adopted at company level can be caused by a number of systemic barriers, for example:

- **Low awareness** at the business level of the benefits that might arise from environmental-friendly activities, practices and processes (Gadenne et al. 2009).
- **Organisational factors**. For example, the lack of managers’ influence, or the top management commitment represent some organisational constraints on the adoption of environmental practices by companies (Lee 2015).
- **Reluctance to behavioural change** is also a factor preventing the implementation of greener processes by companies (Staniškis 2011).

- **Lack of resources** (Henriques & Catarino 2016) – including economic, human, and knowledge resources – but also a lack of competences within firms can limit their environmental efforts (and the consequently better environmental performance).

- **Lack of regulation** promoting actions towards environmental sustainability at the company level.

- **Regulatory uncertainty**, e.g. determined by changes in environmental regulations which can become a constraint to the adoption of green processes by companies (del Río González 2005). Similarly, also the lack of public support of organizations aiming to “become greener” (e.g. incentives or administrative simplifications) is one of the main aspects that limit the adoption of environmental processes and practices at the company level.

- **Market failures**, companies often neglect the importance to act in a pro-environmental way due to the presence of market failures that do not internalize negative environmental externalities caused by industrial pollution.



ECO-INNOVATION PRACTICE

3.1. Eco-innovation opportunity: How can environmental standards contribute to eco-innovation?

Environmental standards: an overview

There are a number of standards companies may introduce to improve environmental management at their organization. These measures differ in several respects. First, standards can focus on **processes** or **products**:

- **Environmental standards applicable to processes** are related to modes of production and delivery of goods and services. These measures improve or modify the existing production processes to achieve better environmental outcomes. Among these instruments, there are for example the environmental management systems (EMSs), such as ISO 14001 and the European Environmental Management and Audit Scheme (EMAS). These standards require companies to formalize and systemize corporate processes within a set of procedures (Tari et al. 2012).

- **Environmental standards affecting products or services** are related to the environmental quality and characteristics of products and services and aim to promote the production and use of products that have a reduced environmental impact. Among environmental product instruments there are product labels, such as the US Energy Star, the Holland Milieukeur label –adopted also in South Africa–, Eco-Rail Mark (launched by the Japanese Ministry), and the European Ecolabel (a voluntary label defined by the European Regulation n. 66/2010).

Second, the environmental standards may be **public** or **private**, depending on organization that promotes the standard:

- **Public standards** are defined by public authorities, as the European Commission, or national or local governments.
- **Private schemes** are promoted by private organizations, as for example business associations, or organisations set up by businesses.

Third, standards may be of a **mandatory** or **voluntary** nature:

- **Mandatory schemes** usually reflect environmental prescriptions of governmental laws that should be adopted obligatory by specific categories of companies. These kind of environmental regulations impose mandatory duties on firms. Example of mandatory environmental instruments are those linked with existing EU Directives on environmental aspects, as for example the Industrial Emission Directive 2010/75/EU or the Waste Framework Directive 2008/98/EC, but also those established by national or local binding environmental laws.

- **Voluntary environmental standards** are discretionary instruments that companies may decide to adopt in an autonomous way, to improve the environmental quality of their processes or products. Examples of voluntary environmental standards are the above-mentioned Ecolabel, EMAS or ISO 14001 standards. This outlook focuses on voluntary environmental process standards (VEPS), such as EMAS and ISO 14001.

How do VEPS relate to eco-innovation?

Implementing VEPS into a firm can be viewed as an eco-innovation in itself: the adoption of an organisation innovation that results in environmental benefits. In addition, there are reasons to suppose that adopting VEPS can also facilitate further eco-innovation among firms. This section sets out those reasons, while a subsequent section explores the empirical evidence behind these claims.

VEPS facilitate identification of opportunities for productivity-enhancing resource- and energy-savings. Environmental management practices are very important today because they may benefit companies and can affect firm performance in a positive way (Moneva & Ortas 2010). EMAS and ISO 14001 standards, for example, set up an Environmental Management System (EMS) aiming to develop, implement and monitor firms' environmental activities. The standards apply to all direct and indirect environmental aspects linked to organi-

zations' activities, products and services, focusing on the performance of key environmental aspects (e.g. emissions to air, water discharges, waste, etc.). Environmental standards give organisations the opportunity to achieve better economic performance, as they require firms to use resources more efficiently, which saves costs. Traditionally economists have viewed firms as rational and optimising players, implying that there are no opportunities for efficiency gains. However, it is clear that firms differ in their capabilities, and that their decision-making processes can be constrained by heuristics, routines and biases. In this context, the adoption of an environmental management system can result in the identification of productivity-enhancing opportunities for eco-innovation that had been previously overlooked.

Furthermore, VEPS provide a systematic tool to assess the environmental performance of a company over time. Beyond the minimum requirements for complying with regulation, EMAS and ISO 14001 have introduced a requirement of continuous improvement thereof, thus driving incremental and also potentially more disruptive environmental objectives. Continuous improvement generates internal drivers for innovation by identifying areas that need special attention. It introduces changes (and innovations) that may affect processes, products, business models and, ultimately, drive change across the whole supply chain.

VEPS build firm-level capabilities for monitoring and improving environmental performance, as well as for managing environmental risks. This can be important in the context of increasing recognition of potential environmental risks to business; it can also help to build knowledge and expertise to spark firms to eco-innovate and benefit from growing markets for greener goods and services.

Wider benefits of VEPS: employee engagement and costs reductions

Adoption of VEPS can have wider benefits for participating firms. Moreover, the adoption of an environmental management system within organizations

can only be achieved if employers and employees alike work towards it. The continuous commitment and involvement of the staff will help to achieve the SDGs and the transition towards a sustainable economy. For example, a study on labour productivity of ISO 14001 French firms found that employees of certified companies were more productive than those of non-certified firms (Delmas & Pekovic 2013). Among the benefits of ISO 14001, the ISO survey¹ found that organisations which implemented the standard improved their environmental performance, but also achieved higher management commitment and employee engagement.

Another study on ISO 14001 companies found that certified organisations were able to improve their resource efficiency after the certification (Heras and Arana 2010). **VEPS can reduce the costs associated with adhering to environmental regulation.** Even if these standards are voluntary, they play a key role in facilitating the achievement of mandatory policies, regulation compliance and objectives. For example, there is empirical evidence that voluntary environmental standards -private or public- can help organizations to achieve a higher level of regulatory compliance: Analysing existing research and surveying Northern Irish businesses, the Northern Ireland Environmental Agency² found ISO 14001 and EMAS organizations comply with legislation. Similarly, a recent EU funded study on EMAS including more than 460 EU EMAS organisations found that the main benefit achieved was the management of legal compliance (European Commission, 2017).

VEPS can have benefits for regulators. Supporting voluntary environmental process standards may also provide advantages for regulators. For example, by using EMAS, regulatory agencies can save time and costs, as they have direct access to environmental data that are available for certified organisations. Moreover, EMAS, ISO 14001 and other standards prescribe administrative simplifications and regulatory reliefs for certified organisations (e.g. less environmental inspections, less environmental reporting obligations, etc.). Thereby they also decrease the workload of government agencies,

thus saving them time and resources and facilitating organisations' compliance with mandatory regulation (European Commission 2015a).

For example, some national laws in EU countries provide that EMAS or ISO 14001 certified organisations benefit from a longer duration of the Industrial Emission Directive authorisation. This example shows clearly how voluntary environmental standards help to facilitate the compliance with mandatory standards and contribute to the transition towards sustainable development: Certified organizations should sustain lower costs to comply with the Directive compared to other organizations, as their authorization has a longer validity. Moreover, VEPS can give certified companies a competitive edge against competitors when bidding and in green public procurement processes. Voluntary standards can help differentiate among competition and may be a crucial part of a company CSR policy.

3.2. Eco-innovation in practice

Characteristics and diffusion of major VEPS

The EMAS Regulation and the ISO 14001 standard represent two of the main reference standards defining the requirements for an Environmental Management System (EMS). An Environmental Management System is a tool that any kind of organization can implement with the objective of improving the environmental management of their businesses (Testa et al. 2014). Both schemes are voluntary environmental policy standards that organisations of any sector can adopt in an autonomous way. They enable organisations that implement an Environmental Management System to achieve a certification attesting that their productive processes comply with the standard. EMAS and ISO 14001 however differ in some aspects; Table 1 includes a summary of their main differences.

Table 1. Main differences between EMAS and ISO 14001 standards

	EMAS	ISO 14001
Nature	Public standard (European Regulation EC N. 1221/2009 and N. 2017/1505)	Private standard of the International Organization for Standardization
Validity	Applicable only in Europe until 2009 and also at the international level since 2010	Applicable at the international level
External communication	The scheme requires that the Environmental Statement should be available to the public. External reporting is thus required	The dialogue with the public is not mandatory. External reporting is not required
Scope	Organisations of all sectors, and experimentally applied in industrial clusters	Organisations of all sectors

Source: our elaborations based on Testa et al., 2014

The nature of the standards is different. EMAS is provided by the European Regulation n. 1221/2009 (recently integrated by the EU Regulation n.2017/1505) and thus has a public nature. It was launched initially in the year 1993 and revised in 2001 (also known as EMAS II) and 2009 (EMAS III). The new Regulation n. 2017/1505 modifies the annexes I, II and III of the EMAS III Regulation. In contrast to it, ISO 14001 is an international private standard, issued by the International Organization for Standardization. ISO 14001 was created in 1996 and was last revised 2015 (ISO 14001:2015). Regarding the validity of the standards, the scope of EMAS was extended to the international level in 2010. Before it was only valid within the EU, whereas ISO 14001 has had international validity since 1996. This explains why a higher number of organisations are certified to ISO 14001 instead of EMAS.

The EMAS Regulation provides more stringent requirements for the external communication compared to ISO 14001. In particular, organizations adopting EMAS have to make the document called "Environmental Statement" public, including data

on the performance of the organisation, indicators of relevant environmental aspects, environmental objectives and targets, other data on the environmental management system of organizations. Due to the fact that information included in the Environmental Statement should be validated by an accredited environmental verifier, EMAS is considered a valid tool to communicate the environmental efforts of organizations to various stakeholders (Testa et al. 2014).

Regarding the number of EMAS and ISO 14001 certifications, ISO 14001 is more diffused than EMAS, as it became valid on an international level much sooner than EMAS. (Table 2 refers to the period 2010-2015). The total number of ISO 14001 certifications issued at the organisation level has continuously increased (in 2015 the total certifications are 319.324), whereas the number of EMAS certifications has decreased. After a slight increase in 2014, the number of EMAS certifications decreased again in 2015.

Table 2. The number of organisations with ISO 14001

	2010	2011	2012	2013	2014	2015
EMAS*	4.542	4.532	4.470	3.721	4.024	3.928
ISO 14001	239.880	243.393	260.852	273.861	296.736	319.324

Source: ISO data (2015), European EMAS Helpdesk.

* Data of each year refer to the month of December, except for year 2014 (data refer to November) and 2015 (data refer to October).

Box 1 includes a few illustrative examples of companies that adopted the EMAS standard in a successful way.

Box 1 EMAS Awards winners in 2015

The EMAS Awards are held every two years and recognise the achievements of EMAS registered organizations that have performed very well from an environmental point of view. Here is the list of the 2015 winners with a brief description of their achievements.

Organisations from the public sector

Regional Centre for Water and Wastewater Management Co. (RCGW S.A.): This is a small Polish organisation, operating in the water and wastewater sector, which produces and provides renewable energy. Its environmental excellence includes, among others, investments in innovative research and engagement with local communities.

Landeskrankenanstalten-Betriebsgesellschaft – KABEG: This is an Austrian organization that manages some of the biggest hospitals in southern Austria. It has achieved good environmental results, including for example a reduction of water use, the use of green energy and more energy efficient processes.

Organisations from the private sector.

Le Page Original: This is a Spanish micro-organisation with only three employees, operating in the graphic design and visual communication studio area. It received an award for considering environmental criteria during all its own projects.

SeehotelWiesler GmbH: This is a small hotel located at Lake Titisee in the southern Black Forest in Germany. The wellness hotel has developed an eco-tourism model that has motivated more than 30 hotels to achieve the EMAS certification.

MetallbauHaskinger GmbH: This is a medium-sized company, operating in steel construction and overhead crane production. It achieved a good energy performance on its way to becoming carbon neutral even though it has very energy-intensive processes. It uses, for example, solar energy and electric vehicles. In addition it has a strong management and the staff shows great commitment.

COMEXI Group Industries S.A.U: This is a large Spanish company that developed a new printing machine that does not use solvent-based inks for printing. The new machine has low energy consumption.

The nominees for the 2015 EMAS Awards included a total of 22 organisations. More details are available at: www.ec.europa.eu/environment/emas

Evidence on the relationship between environmental standards and environmental innovation

One of the first objectives of the EMAS Regulation is to stimulate environmental innovation in companies complying with the standard. As discussed previously, VEPS are expected to stimulate eco-innovations since they help firms to identify previously overlooked opportunities to improve re-

source efficiency make processes greener. There is, however, a debate in literature about the causal relationship between environmental standards and environmental innovation. On the one hand, there are studies that find that EMAS or ISO 14001 positively affect the innovation capabilities of companies. On the other hand, some researchers argue that environmental standards do not lead to innovation and may increase the administrative burden, thus reducing the firm's agility.

Among the studies stating a positive relationship between EMAS or ISO 14001 and eco-innovation is the one of Rennings et al. (2006). They explore the effects of EMAS on technical and product-related environmental innovations of 1277 EMAS registered sites in Germany. The study, exploring a dataset of EMAS-registered sites, finds that the standard positively affected environmental innovations. The EMAS characteristics influencing innovations include the positive impact of the EMS maturity, the high involvement of specific departments in the standard development, and also the learning processes that are part of the EMS.

Focusing on ISO 14001, Demirel & Kesidou (2011) investigate the relationship between the standard and different kind of eco-innovations (end of pipe technologies, integrated cleaner production technologies and environmental R&D). Based on a survey at the firm-level held DEFRA, the authors find that ISO 14001 has positive effects on environmental innovations, green technologies and environmental R&D. The study of Lim and Prakash (2014) based on a country level analysis of 79 countries, stated a positive relationship between ISO 14001 and environmental patents adoption. In particular, author stated that country-level ISO 14001 adoption is a predictor of environmental patent applications at country level. Another interesting study (Scuola Superiore Sant'Anna, 20138), found that in the most of surveyed companies, EMAS certification has been able to stimulate environmental investments and innovation.

Among studies that did not find a relationship between certified Environmental Management Systems and innovation, there is the paper of Frondel et al. (2008). Authors carried out a survey on German organisations, with the purpose to explore if innovation activities of German manufacturing firms were linked with the adoption of an Environmental Management System. They found that environmental innovation activities are not linked with EMS implementation.

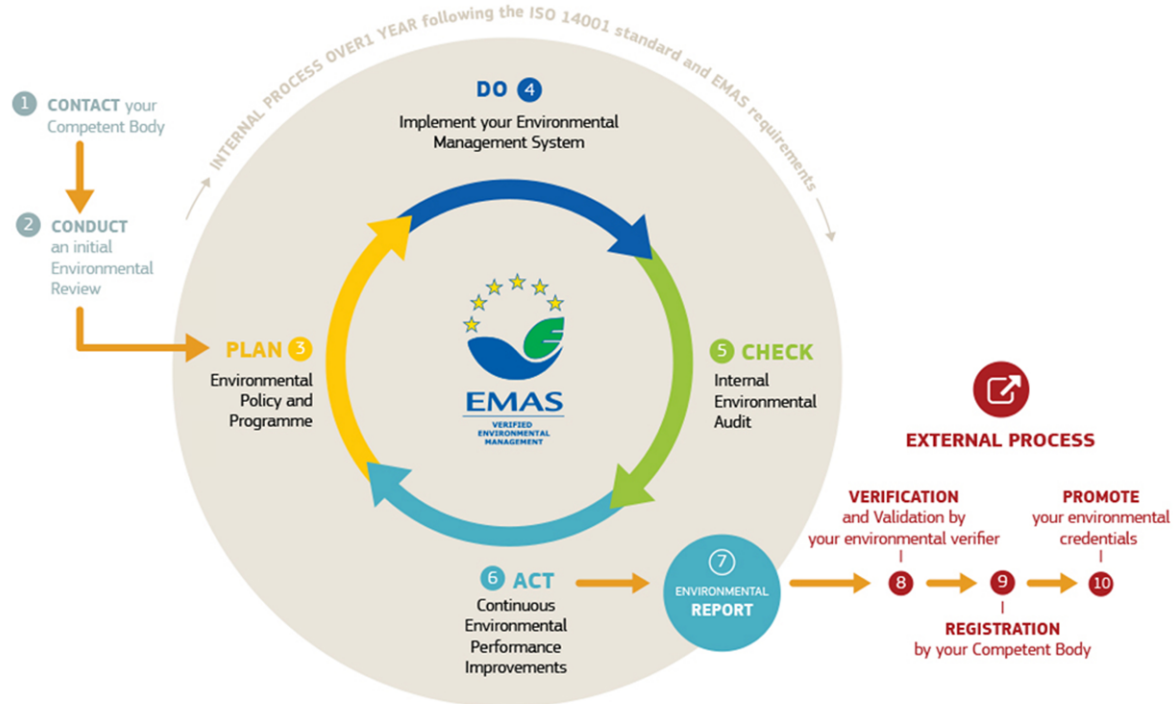
The relationship between the environmental standards and environmental performance

EMAS and ISO 14001 emerge as leading management standards to address environmental pollution. One key aspect of the environmental management system is the orientation toward the continual improvement of environmental performance of organizations. The principle of the continual improvement of the EMSs is based on the Plan-Do-Check-Act (PDCA) cycle, also known as the Deming cycle. Figure 1 illustrates the PDCA cycle for EMAS.

Even if the main objective of environmental management standards is to reduce the environmental burden caused by organizations, there is still limited evidence that EMAS and ISO 14001 decrease natural resource consumption and pollution. Also by taking into account studies on the effects of the EMSs on the environmental performance of organizations, there is still a certain level of uncertainty on whether these systems positively influence the environmental performance of organizations (Iraldo et al. 2009; Comoglio & Botta 2012).

Taking into account the studies stated positive findings between ISO 14001 and environmental performance, a recent study, funded by the European Commission (European Commission, 2017), found cross-industry evidence that firms with EMAS certification improve their environmental performance: as far as environmental statements data are considered, 60% of organisations achieve improvement in environmental aspects as energy, air emissions and CO₂ emissions, while 70% of surveyed firms declare to experience performance improvement in most of environmental indicators.

Figure 1. The EMAS Plan-Do-Check-Act cycle for the continuous improvement



Source: European Commission, 2016, (http://ec.europa.eu/environment/emas/join_emas/how_does_it_work_step0_en.htm)

The paper of Arimura et al. (2008), found that the standard affected positively the environmental performance of Japanese facilities. In particular, authors affirmed that the standard helped facilities to reduce their impacts on natural resources use, solid waste generation and waste water effluent. Similarly, the study carried out by King et al. (2005) -even if did not find a direct evidence that ISO 14001 certification is associated to environmental performance improvements at company level- showed that the Environmental Management System was positively associated with improvements in environmental performance. In his study Russo (2002) found that ISO 14001 standard reduced the air emissions of U.S. electronics facilities.

Similarly, also the study of Prakash and Potoski (2006) found evidence on the positive effects on air pollution emissions in United States. Nguyen and Hens (2015) found that ISO 14001 determined potential to improve the environmental performance of cement companies in Vietnam.

But there are also some studies that do not support a positive relationship between environmental standards as EMAS or ISO 14001 and the environmental performance at a company level (Rondinelli&Vastag 2000). Darnall and Sides for example (2008) and Nawrocka & Parker (2009) found little evidence about the effects of ISO 14001 on environmental performance improvements.

Table 3. Evidence overview of the Effects of VEPS

On Eco-innovation		On Environmental Performance	
Positive	EMAS Rennings et al. 2006 European Commission, 2017	Uncertain	Iraldo et al. 2009 Comoglio&Botta 2012
	ISO 14100Demirel&Kesidou 2011 Lim & Prakash 2014	Positive	European Commission, 2017 Arimura et al. 2008 King et al. 2005 Russo et al. 2002 Prakash & Potoski 2006 Nguyen & Hens 2015
No Effect	Fronzel et al. 2008	No Effect	Rondinelli&Vastag 2000 Nawrocka& Parker 2009 Darnall & Sides 2008

Management standards, such as EMAS and ISO14100, are unlikely to drive eco-innovation on their own. The requirements they create, such as having an environmental policy for the organisation, monitoring and continuous improvement and embedding of environmental principles in each of the organisation's activities, may create adequate

conditions for promoting the inclusion of environmental principles in the design/innovation processes. They may also promote social innovation (through better engagement with stakeholders) and more systemic innovations beyond product or process design through rethinking of business models and vision.



ECO-INNOVATION CHALLENGE

4.1. Drivers and barriers of eco-innovation

Drivers of adoption of environmental standards.

Some factors can encourage the implementation of environmental standards:

- **Social determinants** are important to spur firms to implement eco-innovations or environmental process standards. The willingness to improve the organization's image, and the strengthening of relationship with customers or citizens, are identified as EMAS (Merli et al. 2016) or ISO 14001 drivers (Daddi et al. 2011; Mariotti et al. 2014). Institutional and customers pressures are usually drivers that spur companies to adopt an EMS (Granly&Welo 2014; Darnall et al. 2008) to gain external legitimacy. An interesting study on more than 3700 plants located in different countries showed that the implementation of an EMS responds to pressure from internal stakeholders (Lannelongue & Gonzalez-Benito 2011). Similarly to social pressures motivation, another driver of ISO 14001 is the desire of companies to improve their reputation (Boiral 2007). Another important evidence on this aspect emerged from a survey made within the scope of an EU funded project³. Based on a sample of more than 220 EMAS companies in different European countries, results revealed that pressure from public authorities plays a key role for EMAS implementation.

- Regarding **economic drivers**, we can mention the desire to achieve energy savings and savings in the use of raw materials. But also the proactivity in expectation of future business concerns leads firms toward an environmental certified standard, as found by the study of Gavronski et al. (2008), investigating the drivers of Brazilian companies from different industrial sectors to adopt the ISO 14001.

- **Ecological determinants** are also drivers leading organizations to adopt process standards. The desire to improve the environmental performance is one of the key factors that push company to implement an Environmental Management System

(Heras & Arana 2010; Marazza et al. 2010), as the commitment towards the environmental protection and conservation in the case of ISO 14001 (ISO, 2014).

- **Political drivers** play an important role to spur firms to adopt environmental process standards. An important driver that motives organizations to implement an EMS is the improvement of their legal compliance⁴. In this framework, also Gavronski et al. (2008) found that among motivations leading firms to adopt the ISO 14001 standard, there are legal concerns.

Barriers to adoption of environmental standards

Companies, especially Small and Medium Enterprises (SMEs), face barriers to adoption environmental standards, including:

- Most SMEs face **human capital barriers** due to the fact that personnel has little knowledge and lack of interest in environmental issues, and have difficulties to integrate environmental aspects into their activities (Halila 2007). The lack of qualified personnel, lack of information on markets and on technology, low attitude of personnel and managers towards change have been also highlighted by OECD (2005) as reasons for which companies may resist to adopt eco-innovations.

- Value **system constraints and low consumer awareness and interest** can represent obstacles limiting the adoption of standards (Iraldo et al. 2006). The study of Martín-Peña et al. (2014) found that among main obstacles to ISO 14001 is a low involvement of human resources and unclear definition of workers' environmental responsibilities. Similarly, a study on ISO 14001 companies in Malaysia (Sambasivan & Yun Fei 2008) found that problematic aspects dealing with the ISO standard were social aspects, and management, organisational and technical issues. The lack of commitment of organizations (Bist 2007) and the lack of understanding of the environmental management systems (Tambovceva 2010) are other barriers.

- Similarly, also **organizational issues** within adopter' firms can represent a limit (Martín-Peña et al. 2014; Salomone 2008).

- **Technological problems** encountered by organizations in the adoption of eco-innovations or environmental process standards, include the lack of infrastructure (OECD, 2005), or other technical issues, as found by a study on ISO 14001 Malaysian companies (Sambasivan & Yun Fei 2008).

- **Economic barriers** can also affect eco-innovation and EMAS and ISO 14001 standards. Costs are one of the main constraints. OECD (2005) indicated cost and market factors among main reasons for which companies may not eco-innovate. According to the EU survey⁵, the most relevant barriers to implement eco-innovation are the uncertain demand from the market, lack of funds within the enterprises and the lack of financing. More recently, also the EU Flash Eurobarometer⁶ confirmed as one of the problems that SMEs face when trying to set up resource efficiency actions, the costs of environmental actions. The study of Merli et al. (2016) on EMAS Italian certified companies found that the main factor preventing the EMAS adoption is represented by costs for consultants, for staff trainings and for the updating of processes.

- **Political barriers** also represent a constraint to eco-innovation. Difficulties to adapt environmental legislation to companies¹¹, but also the lack of regulation (OECD, 2005) are some barriers. Regarding the EMAS process standards, Iraldo et al. (2006) found that the lack of recognition and support from public institutions to organizations is a relevant barrier associated to its adoption. Similarly, also the study of Mariotti et al. (2014) on companies of Saudi Arabia found the lack of government support as one of the main barriers hindering the implementation of the ISO 14001 standard.

- Finally, some problems that SMEs face when try to set up resource efficiency actions include **administrative issues and burden**, as the complexity of administrative or legal procedures¹¹.

4.2. Eco-innovation gap

The more pervasive and possible disruptive elements that VEPS can introduce in an organisation are linked to the requirement of having an environmental policy, setting objectives and targets to monitor progress and promoting continuous improvement. How different organisations interpret this and how ambitious these targets are varies considerably among companies. There is still little research into the actual specific mechanisms that may drive eco-innovation under VEPS. Anecdotal evidence seems to point that a company can thrive with these standards while others it would just be another standard procedure they will comply with. Understanding when and why VEPS can drive eco-innovation is an area that requires further research.

There are also limitations to the scope of the more widely adopted VEPS. One key limitation is that it considers the organisation in isolation and overlooks opportunities to engage with neighbouring companies and the external environment to identify further opportunities to increase resource or energy efficiency. Industrial symbiosis solutions, for example, where the waste stream of an organisation becomes a raw material for another organisation, are largely ignored and sometimes even discourage among companies with VEPS as they may challenge some of the conventions of the management system. Extending the scope of the system to consider the organisation as part of the industrial eco-system may bring opportunities of innovative sourcing of raw materials and alternative uses for by-products and other underutilised resources.

Table 4. Overview of Barriers and Drivers

Barriers	Drivers
Human Capital: <ul style="list-style-type: none"> ▪ E.g. low knowledge, low interest 	Social Determinants: <ul style="list-style-type: none"> ▪ E.g. pressures from stakeholders
Value System Constraints: <ul style="list-style-type: none"> ▪ E.g. social aspects 	Economic Drivers: <ul style="list-style-type: none"> ▪ E.g. achievable savings
Organizational Issues: <ul style="list-style-type: none"> ▪ E.g. issues within firms 	Ecological Determinants <ul style="list-style-type: none"> ▪ E.g. better environmental performance
Technological Problems: <ul style="list-style-type: none"> ▪ E.g. technical issues at company level 	Political Drivers <ul style="list-style-type: none"> ▪ E.g. better legal compliance
Economic Barriers: <ul style="list-style-type: none"> ▪ E.g. high costs, low funds 	
Political Barriers: <ul style="list-style-type: none"> ▪ E.g. lack of regulation 	
Administrative Barriers: <ul style="list-style-type: none"> ▪ E.g. procedures 	



WHAT CAN POLICY MAKERS DO?

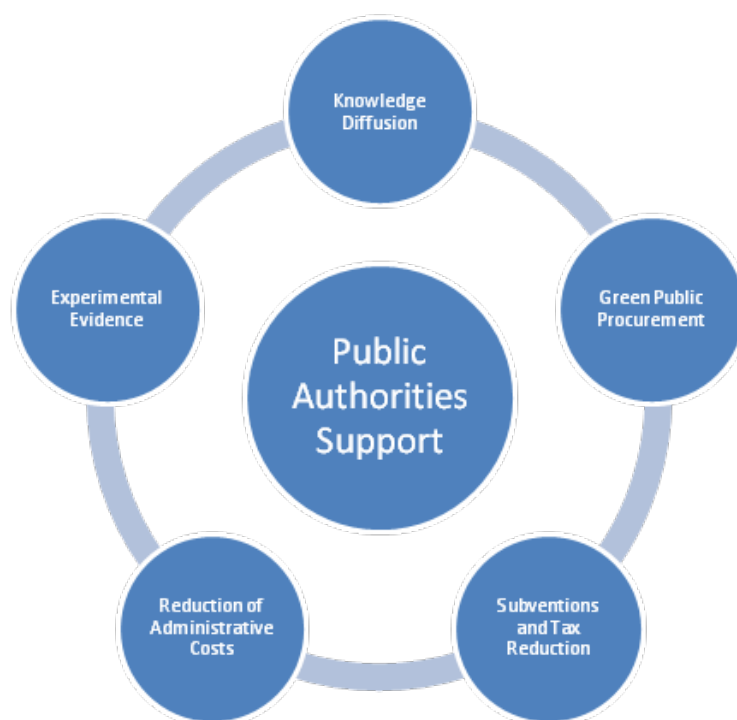
5.1. Success factors

Policy makers can play a key role for the success and the diffusion of environmental process standards supporting eco-innovations and may promote different action actions:

- **Public regulatory reliefs.** Public authorities can support instruments and actions reducing technical barriers to the adoption of environmental process standards, as public programs improving the companies' knowledge on EMAS and ISO 14001. Among

these instruments there are also incentives in public contracts and bids for certified companies (e.g. subsidies and grants that support companies in the EMAS or ISO 14001 adoption). Examples of regulatory reliefs may include an extension of administrative permit duration, the reduction of financial guarantee required to carry out specific activities, tax reduction, inspection frequency reduction, self-declaration for permit renewal, reduction of technical document to obtain an environmental permit, reduction of reporting and monitoring requirements, advantages in public tenders and bids.

Figure 7. Success Factors



Public authorities and policy makers can do a lot to support companies in the adoption of environmental standards. However, there is an ambiguous –or mixed– evidence of the effectiveness of VEPS in driving environmental innovation and environmental benefits. For this reason, some ques-

tions on whether and how support VEPS remain open for policy makers. This suggests that there is a need of "policy learning" about the effectiveness of VEPS to make policymakers able to evaluate if the development of regulatory reliefs and simplifications supporting standards are really recommended.

Box 2 Empirical evidence of the positive effects linked to regulatory reliefs

The study of Morrow and Rondinelli, 2002 found that regulatory reliefs were among the most relevant drivers to adopt EMAS for German organizations. Similarly, another recent study based on Italian regulatory reliefs showed that they have been a driver to increase the EMAS adoptions (Daddi et al. 2014). According to a survey made on a sample of 244 companies located in Germany, Italy, Austria and Spain countries (Testa et al. 2016), there are some public incentives that would be appreciated according to organization's opinions with respect to those already existing. They include further tax reduction, reduction of technical reports, reduction of inspection frequency, permit renewal by self-certification, extension of environmental permit duration, reduction of mandatory internal monitoring.

Policy learning on VEPS may help policy makers to evaluate if fostering VEPS is worthwhile. Indeed, regulatory reliefs and simplifications require a cost. For example, tax breaks provided for EMAS and ISO 14001 organizations can determine a direct cost to public budgets –due to a lost tax revenues–, but can also determine a weakening of regulatory power.

Governments may facilitate other actions, as **experiments with VEPS**. When design policy interventions on supporting VEPS, policymakers may adopt formal experimental design approaches with population of firms. The aim is to determine whether policy interventions cause the expected outcome, i.e. whether they are effective in driving environmental innovation and environmental benefits. Such activity of policy learning is important for policymakers since they may know whether the effort in fostering a wider diffusion of VEPS, also through regulatory reliefs and simplifications for firms adopting VEPS. To realize experimental design with VEPS, governments could invite a small number of firms as attendants of the experiment. Participant firms are randomly placed in a treatment group and in a control group, and the effects of the policy intervention is estimated in the two groups of firms. Experimental design allows for better design of policy scheme.

4.2. Steps towards transformative change

This section aims to include some inputs on what are the potential steps to support the transformative change towards a higher sustainability level of business and towards a higher diffusion of eco-innovations:

- **Review of existing standards by taking into account their sustainability claims**, a new versions of the most known standards are recently released (e.g. ISO 14001 and EMAS),
- **Periodical revision of other standards** to take into account any variation that may be required to ensure these standards are able to promote better processes for the environment;
- **Design new standards** that may be able to face the sustainability challenges is another opportunity. There is also the need to further promote the environmental standards to increase the awareness on them of all actors involved in the transition towards sustainability.
- **Incentives and regulatory reliefs** supporting the adoption of environmental standards. The activity of policy learning is important to define whether the effort in fostering the wider diffusion of such standards is worthwhile.

Box 3 Initiatives related to developing countries.

Mechanisms to facilitate further adoption of VEPS are mainly referred to countries where the environmental legislation is well developed (e.g. Europe, North America and in general in developed economies). With the aim to promote voluntary environmental instruments also in developing countries, policy makers may start to think to a potential integration between existing environmental policies in those countries and environmental processes standards, as ISO 14001 and EMAS, with the objective to achieve a sustainability transitions also there. Here there is the example of The Cleaner Production Program (CPP) of United Nations Industrial Development Organization. The United Nations Industrial Development Organization (UNIDO) and the United Environment Programme (UNEP) defined preventive environmental strategies in some developing countries. These strategies were successful and represented the starting point for the launch of a programme to set National Cleaner Production Centres (NCPCs).

The programme involved a lot of developing countries, where experts have been properly trained and a number of dissemination activities have been carried out among companies, public authorities, and other stakeholders. Positive results have also been achieved in terms of increased awareness of the benefits of cleaner production among different kind of actors and, at the same time, the NCPCs supported policy makers to design policy tools and instruments that encouraged cleaner production in those countries. It is interesting to mention a case study that identified potential contributions of the Cleaner Production Program to the ISO 14001 standard (Cervellini and Souza 2009). The case study revealed that the CPP may contribute to an ISO 14001 certified system because the cleaner production approach can act positively to eco-efficient processes. The study concluded that the complementarity between CPP approach and the Environmental Management System based on ISO 14001 can result in positive outcomes in terms of environmental performance.

¹ See ISO (2014) Continual Improvement Survey 2013. Final Report and analysis, at: www.iso.org/iso/tc207sc1home.

² See Northern Ireland Environment Agency (2009) Measuring the effectiveness of Environmental Management Systems. Final Report, Ireland, at: http://www.doeni.gov.uk/niea/measuring_the_effectiveness_of_ems_phase_2.pdf.

³ ScuolaSuperioreSant'Anna, 2013. EMAS implementation in the EU: level of adoption, benefits, barriers and regulatory relief B.R.A.V.E. Project. Survey on European EMAS organisations, available at: http://www.braveproject.eu/wp-content/uploads/2013/03/Report-survey-europa_-rev-19122013.pdf

⁴ See to this purpose: Milieu and RPA 2009. Study on the Costs and Benefits of EMAS to Registered Organisations. Final Report for the EC. Available at: http://ec.europa.eu/environment/emas/pdf/other/costs_and_benefits_of_emas.pdf

⁵ European Commission (2011). Flash Eurobarometer 315. Attitudes of European entrepreneurs towards eco-innovation. Analytical report. Survey requested by the European Commission, Directorate- General Environment and coordinated by the Directorate- General Communication, available at: <http://ec.europa.eu/COMMFrontOffice/PublicOpinion/index.cfm/Archive/index>

⁶ European Commission (2015). Flash Eurobarometer 426. SMEs, resource efficiency and green markets. Survey requested by the European Commission, Directorate- General for Internal Market, Industry, Entrepreneurship and SMEs and coordinated by the Directorate- General for Communication (report available at: <http://ec.europa.eu/COMMFrontOffice/PublicOpinion/index.cfm/Archive/index>)

ISO 14001

- **General information on ISO 14001:** <http://www.iso.org/iso/iso14000>
- **The annual ISO survey:** <http://www.iso.org/iso/iso-survey>
- **ISO and SDGs:** <https://committee.iso.org/files/live/sites/tc207sc1/files/Final%20UN%20SDG%20and%20ISO%2014001%20071216.pdf>

EMAS

- **The European Commission's EMAS website:** <http://ec.europa.eu/environment/emas/>
- **Data on the number of EMAS organisations:** http://ec.europa.eu/environment/emas/emas_registrations/statistics_graphs_en.htm
- **The EMAS EU Regulation:** <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009R1221>
- **The European Commission 2015 compendium on EMAS:** http://ec.europa.eu/environment/emas/pdf/other/EMAS_Compendium_2015.pdf
- **EMAS Awards:** http://ec.europa.eu/environment/emas/emas_for_you/emas_awards_en.htm

Other European Commission documents

- <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0614>
- <http://ec.europa.eu/COMMFrontOffice/PublicOpinion/index.cfm/Archive/index>

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The Inno4SD Policy Outlooks series focuses on the horizontal policy issues or transversal topics relevant for public policy supporting innovation for sustainable development. The selected topics are based on questions and issues raised by policy makers and stakeholders active in the Innovation for Sustainable Development (Inno4SD) network.

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