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The use of Eco-efficiency Indicators by Environmental Frontrunner Companies

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Abstract

Eco-efficiency is considered as a relevant practice for corporate sustainability as this concept addresses both environmental and economic issues. Similarly, eco-efficient indicators are seen as useful instrument for corporate environmental management. The literature has studied the use of eco-efficient indicators by companies from different sectors of activity but the analysis of the use of eco-efficient indicators by environmental frontrunner companies from diverse sectors of activity has been overlooked. Therefore, the aim of this paper is to contribute to the literature analysing the use of eco-efficient indicators by environmental frontrunner companies. For that purpose the case of companies registered against the Eco-Management and Audit Scheme (EMAS) is analysed, as the adoption of this scheme is associated to environmental frontrunner companies in both practitioner and scholarly literatures. Based on a content analysis of third-party verified environmental statements of 387 EMAS-registered Spanish organizations, a general lack of use of eco-efficient indicators was found. More specifically, the results show that only close to 39% of the 10,337 analysed indicators were calculated with minimum eco-efficiency criteria to measure corporate environmental performance. Implications for managers, public policy makers as well as other stakeholders are discussed.

Key words: Eco-efficiency, Indicators, Corporate Environmental Management, Eco-Management and Audit Scheme, EMAS, Environmental Reporting.

Classification: Research paper

1. Introduction

According to Long et al. (2015), eco-efficiency is defined as the ability of companies to produce goods or services either by saving energy and resources, and/or by reducing waste and emissions. Eco-efficiency, understood as a productivity improvement through the minimization of resource consumption, waste and pollution, 'appears to be a strategic priority for improving both competitiveness and environmental performance' (Kabongo and Boiral, 2017, p. 956). Eco-efficient indicators (EEIs) are seen as useful instrument for sustainability analysis (Zhou et al., 2018) at different levels such as the corporation level. In the literature, eco-efficiency at the corporation or firm level tends to be calculated as the ratio of the value of a product to its environmental impact (e.g., Huppes and Ishikawa, 2005; Chen, 2009; Picazo-Tadeo et al., 2011).

The literature has analysed the use of EEIs for different sectors of activity such as the food and beverage industry (Maxime et al., 2006; Ingaramo et al., 2009), the forestry sector (Koskela and Vehmas, 2012), the urban transport (Moriarty and Wang, 2015), and the building sector (Ruschi et al., 2014). Nevertheless, the analysis of the use of EEIs by environmental frontrunner or leader companies from diverse sectors of activity has been overlooked in the literature, with the notable exception of the work of Erkko et al. (2005) published fifteen years ago with data from 1999 to 2001 (see the next section for an analysis of the main outcomes of this study).

The analysis of the use of EEIs by environmental leader companies is relevant for at least two reasons. First, as underlined by Christmann (2000), a growing body of scholarly research on corporate environmental management focuses on identifying best practices aimed at reducing the negative impact of companies on the natural environment and at contributing to their competitive advantage. According to Matthews (2003), comparing environmental practices 'to find leaders and laggers in environmental performance is essential to moving businesses closer to effective practices' (Matthews, 2003; p. 95). Similarly, in the scholarly literature (e.g. Alves and Medeiros, 2015; Passetti and Tenucci, 2016) eco-efficiency is considered as an important best practice for corporate sustainability in various studies, as this concept addresses both environmental and economic issues, which is essential for most companies. From this perspective, the focus on the use of EEIs by frontrunner companies might contribute to this body of literature. Second, from a more practical perspective, the focus on frontrunner companies, as it is also the case for best environmental practices or best-in-class cases, might serve as a guide to corporate sustainability benchmarking. In the literature, environmental benchmarking has been pointed out as a key aspect to raise awareness and avenues for improvement for corporate environmental management from both the theoretical (e.g., Christmann, 2000; Sarkis, 2003) and practical perspectives (e.g., Taylor et al., 2003; Siwar and Harizan, 2009; Verrier et al., 2014; Tuokuu et al., 2019).

Taking the gap evidenced in the literature into account, the aim of this work is to shed light on the use of EEIs by environmental frontrunner companies. For that purpose, the analysis will focused on the Eco-Management and Audit Scheme (EMAS)-registered companies. Both in the practitioner (e.g., Hillary, 2017) and scholarly literatures (e.g., Bonilla-Priego and Avilés-Palacios, 2008), standards and schemes such as EMAS have been associated to environmental frontrunner companies. These companies are supposed to implement organisational environmental management practices aimed at the continuous improvement of their environmental performance (Petrosillo et al., 2012).

The remainder of this paper is organized as follows: first, the literature review is carried out and the research question is defined. Second, the analysis methods are presented. Third, the results of the content analysis of EMAS-registered companies' statements are described. Finally, the conclusions are presented and the contributions made by this research are identified.

2. Literature review and research question

The eco-efficiency concept for companies was developed by the World Business Council for Sustainable Development (WBCSD) in the early 1990s (Maxime et al., 2006). Erkko et al. (2005) defined it as a combination of economic and environmental efficiencies, expressed by the following ratio from the company's perspective:

$$\text{Eco} - \text{efficiency} = \frac{\text{economic value (added)}}{\text{environmental impact (added)}}$$

As underlined by Erkko et al. (2005), apart from the proposal made by the WBCSD, different measurement alternatives for EEIs have been proposed by different organizations, such as the International Organization for Standardization (ISO), the United Nations Environment Programme (UNEP), and the United Nations Conference on Trade and Development (UNCTAD). For example, the key aspect of the ISO 14031 standard is to describe and discuss in detail the type of indicators aimed at measuring the environmental performance of companies (Chang and Tsai, 2015). As underlined by Erkko et al. (2005), despite EEIs being seen as a corporate internal management tool, the WBCSD suggests to report these indicators as part of a company's environmental report.

The scholarly literature has analysed the use of EEIs for different sectors of activity (e.g., Maxime et al., 2006; Ingaramo et al., 2009; Koskela and Vehmas, 2012; Wang and Moriarty, 2015; Ruschi et al., 2014). For example, Rönnlund (2016) developed a framework for EEIs as an environmental sustainability benchmarking tool for products from the metallurgical industry. Similarly, Maxime et al. (2006) analysed EEIs to build a framework for the Canadian food and beverage industry and Ingaramo et al. (2009) studied the EEIs of a set of corporations in Argentina and Mexico from the sugar cane processing industry. Similarly, it could be also mentioned that Wang et al. (2016) analysed the applications of these indicators for the Chinese cement-based materials industry.

Surprisingly, as stated previously, only the work of Erkko et al. (2005) has focused on environmental frontrunners, more specifically EMAS-registered companies. The EMAS scheme is the most demanding reference system to adopt Environmental Management Systems (EMSs) in companies. The EMAS scheme was launched in 1993 as a tool for self-regulation in addition to compulsory public regulations (Testa et al., 2014; Daddi et al., 2018). As underlined by Montobbio and Solito (2018), according to the prevailing scholarly literature, several advantages are associated with the adoption of EMSs, including the positive impact on environmental performance, energy efficiency, self-reported technical and organizational innovations, regulatory compliance, human capital, market performance, and the firm's image performance.

Generally speaking, the EMAS scheme is associated to frontrunner companies, as it is seen as the stricter existing system for least to two reasons (Daddi et al., 2011; Chiarini, 2017; Heras-Saizarbitoria et al., 2016, 2020). First, EMAS requires a clear compliance to environmental laws and regulations in a continuous environmental improvement perspective, which has not been the case for other EMS schemes or standards (e.g. ISO 14001) as underlined in the literature (e.g. Morrow and Rondinelli, 2002; Blackman, 2012; Heras-Saizarbitoria et al., 2016). Second, the EMAS-registered companies must publish annually an environmental statement including their detailed corporate environmental indicators verified and validated by an independent third-party (Daddi et al., 2011; Testa et al., 2018). The relationship between environmental reporting practices and sustainability performance improvement has been widely debated in the literature. According to the voluntary disclosure theory, 'companies with better environmental performance due to an unobservable proactive environmental strategy have an incentive to use disclosure to signal this strategy to investors and other relevant stakeholders' (Cho et al. 2012, p. 489-90). The disclosures included in the EMAS statement makes it possible for a registered company to inform their stakeholders. Companies can be driven by the need to distinguish themselves

from poor-performing competitors and to improve their reputation by showing publicly hard-to-imitate sustainability strategies. Due to the abovementioned and other similar aspects, EMAS-registered companies are seen as environmental frontrunners (e.g., Nawrocka and Parker, 2009; Galvez-Martos et al., 2013; Montobbio and Solito, 2018). Indeed, regulatory authorities at various levels are offering possible control relief for environmental frontrunners (Nawrocka and Parker, 2009; Testa et al., 2016).

As underlined by Erkko et al. (2005), despite eco-efficiency being not mentioned among the objectives of EMAS, it could be assumed that this rather simple notion might be included in the environmental practices of EMAS-registered firms for at least three reasons. First, most of the EMAS-registered companies receive the help of external consultants specialized in the implementation of EMSs (Ammenberg, 2003). Second, environmental statements are validated by an external verifier (Heras-Saizarbitoria et al., 2020) and this type of activity is aimed at providing reliability and legitimation in the eyes of the different stakeholders (Boiral and Gendron 2011; Heras-Saizarbitoria et al., 2013). Third, the EMAS requirements on environmental indicators lead to a better tracking of costs and benefits related to environmental practices, which leads to a better control and measurement of eco-efficiency (Henri et al., 2014; Heras-Saizarbitoria et al., 2011).

In their analysis of the environmental statements of 40 Finnish companies mostly from the pulp and paper industry, Erkko et al. (2005) reported a very weak use of EEIs by EMAS-registered organizations. Nevertheless, this analysis was carried out in the early years of the EMAS scheme dissemination (the analysed statements were issued between 1999 and 2001). Furthermore, the development of the EMAS certification towards a more detailed and perhaps more demanding scheme has to be considered. For example, the latest version of this scheme—EMAS III, which came into force in 2010—included some relevant changes, one of the most noteworthy being the inclusion of Sectoral Reference Documents (SRDs) (Heras-Saizarbitoria et al., 2020). These SRDs propose benchmarks and best practices for environmental management, including specific guides to implement EEIs. Therefore, as justified before, trying to contribute to fill the gap found in the literature, this study aims to respond to the following research question: *Are EEIs used in environmental frontrunner companies such as the EMAS-registered companies?*

3. Methods

In order to answer the research question, an exploratory empirical study was planned. The study focused on Spain, one of the European Union member states where EMAS has been most widely disseminated in both absolute and relative terms (Heras-Saizarbitoria et al., 2015). The data for 387 EMAS-registered companies was obtained from the EU EMAS Helpdesk service of the European Commission. The EMAS statements were obtained from the websites of these registered companies.

In order to give a broad and rich picture of the use of EEIs by the EMAS-registered companies, the analysis was carried out in two stages. As underlined by Müller and Sturm, EEIs 'are most useful and meaningful if they are disclosed over time' (Müller and Sturm, 2001, p. 15). The first stage was performed in 2013 and the second one six years later, in 2019. In the first stage, 160 statements from the same amount of companies were analysed. In the second stage, 227 statements/companies were analysed. Table 1 summarizes the number of companies and indicators analysed as well as their sectoral breakdown. Overall, the environmental statements of 387 companies from six sectors of activity and 10,337 indicators disclosed by these companies were analysed. These six sectors of activity were chosen due to their high environmental impact and their high number of EMAS registration (Heras-Saizarbitoria et al., 2015). The statements analysed in the first stage ranged from 2007 to 2009, while the statements analysed in the second stage ranged from 2015 to 2018.

According to the EMAS scheme, the environmental statements are public and therefore anyone should have access to them easily and free of charge. Most of the statements were

obtained from the companies' websites. However, some of them were more difficult to obtain, as (surprisingly) the companies did not publish them on their websites. In these cases, we requested them by e-mail or telephone. Of these companies, three were reluctant to provide us with their environmental statements.

All the statements retrieved were published as PDF documents. The documents scanned as images were converted to text through an OCR software. Overall, the final sample of text analysed represents approximately 5,000 single-spaced pages. This information was extracted, categorized and analysed by two researchers using an analysis grid. The qualitative and quantitative information for each EMAS statement was compiled in a set of Excel spreadsheets. The information was then reviewed separately by a third researcher with an assessment protocol, as recommended in specialist literature on the subject, in order to improve the validity and reliability of the analysis (Schreier, 2012). The information was analysed using descriptive statistical techniques together with content analysis method, a process of systematically classifying the collected data (Stemler, 2001; Schreier, 2012). The main findings of this analysis are summarized in the next section.

Table 1. Sectoral breakdown of analysed organizations and indicators by fieldwork stage

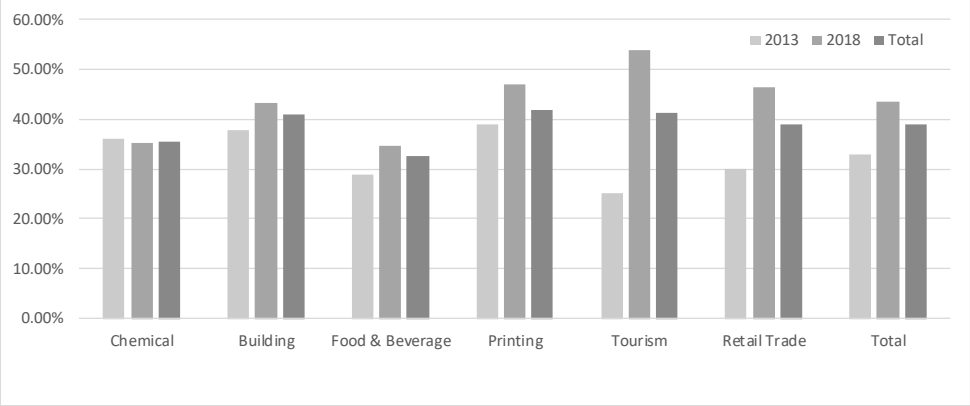
	2013		2018		Total	
Sector	No. Firms	No. Indicators	No. Firms	No. Indicators	No. Firms	No. Indicators
Chemical	24	743	24	1,118	48	1,861
Building	37	658	39	894	76	1,552
Food & Beverage	14	507	28	995	42	1,502
Printing	11	402	14	218	25	620
Tourism	64	1,683	112	2,647	176	4,330
Retail Trade	10	220	10	252	20	472
Total	160	4,213	227	6,124	387	10,337

Source: prepared by the authors.

4. Results

Figure 1 and Table 2 summarize some of the main findings of the analysis. With regard to the analysis, it has to be highlighted that the case was eliminated for those indicators of environmental aspects that make it more difficult to use in an eco-efficient perspective. This is the case of the environmental impact produced by the maintenance of specific facilities. For example, the swimming pools in hotels (tourism sector) require a constant consumption of resources for its correct use (e.g., pH values, BOD5 measured as mgO_2/L, suspended solids measured as mg/L), regardless of the number of guests.

Figure 1. Use of EEIs by sector of activity and stage of the analysis



Source: prepared by the authors. Note: 'Total' corresponds to the two stages, with the proportions are calculated related to the total ammount of the indicators and not as an average of the averages two stages.

In Table 2 the z-test (Z_1 and Z_2) for sample proportions were used to identify the statistical differences between the two stages of the analysis (Z_1) —2013 and 2018— and the sectoral breakdown among the six industries(Z_2).

The Z_1-test results for the two stages showed strong support for the hypothesys of different proportion of EEIs related to the 'Total' reference category, for the case of the Tourism and Retail Trade industries ($p < 0.01$), marginal support for the Construction and Food and Beverage industries ($p < 0.05$), and weak support for Printing ($p < 0.1$). The result also showed a significant difference ($p < 0.01$) in the proportion of EEIs between 2013 and 2018 for the whole sample. The Z_2-test analised the sectoral breakdown, comparing the 'Total' referece category againts the analysed sectors. The Z_2-test results indicated that the proportion of EEIs for the reference category was significantly different in three of the six analysed industries($p < 0.01$).

Table 2. Statistical significance analysis of the use of EEIs by sector and stage

	% of EEIs of the total number of indicators analysed				
	2013	2018	Signif. (Z_1-value)	Total (two stages)	Signif. (Z_2-value)
Chemical	36.20%	35.18%	0.45	35.39%	-3.24***
Building	37.84%	43.18%	-2.11**	40.92%	1.79*
Food & Beverage	28.99%	34.65%	-2.21**	32.74%	-5.28***
Printing	39.00%	47.02%	-1.93*	41.82%	1.78*
Tourism	25.25%	53.87%	-18.56***	41.22%	2.80***
Retail Trade	30.00%	46.50%	-3.67***	38.81%	-0.03
Total	32.88%	43.40%	-10.77***	38.87%	Reference Category

Source: prepared by the authors. 'Total' corresponds to the two stages and the proportions are calculated related to the total amount of the indicators and not as an average of the averages two stages. Z-test contrasts whether differences between stages (Z_1) and industries(Z_2) are statistically significant. * , **and *** represent statistical significance at the 10%, 5% and 1% significance levels, respectively

Similarly, an improvement in the use of EEIs between the two periods in which the analysis was performed can be observed. On average, there has been an improvement in the use of EEIs from an average of 32.88% in 2013 to 43.40% in 2018. On a sectoral basis, the improvement experienced by companies from the Tourism sector (with a more than 28

percentage point improvement) should be highlighted. Conversely, the companies of the Chemical sector had experienced a one percentage point worsening and the Food & Beverage sector had experienced a low improvement of 5 percentage points.

However, if the average data of the use of EEIs is analysed, the results are weak, both in 2013 and 2018, considering that the analysed companies are leading companies in terms of environmental awareness and introduction of environmental practices. It should be remembered that these practices have not only been evaluated by the internal staff of the companies analysed, but the environmental objectives and indicators included in the environmental statements that is made public have also been verified by an experienced external party.

Beyond this descriptive analysis, a set of good and bad practices for the use of EEIs has been summarized from the analysis made with the environmental statements (please see Table 3). The 'good practices' refer to the use of minimum eco-efficiency criteria for the definition of indicators, while the bad ones represent a few illustrative examples of the absence of this type of criteria. In other words, the 'good practices' included in Table 3 show the appropriate measurement units that allow to report the data in a comparable and transparent way, which is not the case for the measurement units used in the bad practices.

All the companies in the sample show basic environmental performance indicators in their environmental statements (energy consumption, consumption of materials, water consumption, generation of waste, etc.). As minimum 'good practices' in the definition of indicators, those in which the environmental impact is measured in relation to the production figures should be underlined. This is the case of many companies in the Chemical and the Food and Beverage sectors where the EEIs are defined in relation to their production (in physical units). For example, water consumption defined as the amount of water consumed in m^3 per ton of production (m^3/t production), electricity consumption defined as megawatt hours per ton of production (MW·h/t production), or waste generated measured in kilograms per ton of production (kg/t production). Likewise, it should be pointed out that since the EMAS regulation allows, for confidentiality reasons, the provision of data referring to production as index numbers (assigning the value 100 to a reference year), approximately 30% of the companies analysed in these two sectors used these index numbers. Obviously, the use of this kind of indicators gives very poor information on the evolution of the environmental performance of the companies analysed.

Table 3. Examples of good and bad practices identified in the analysis (selection)

	Tourism		Chemical		Retail Trade	
Scope	Good Practices	Bad Practices	Good Practices	Bad Practices	Good Practices	Bad Practices
Water consumption	L/guest·night	Total m^3	m^3/production	m^3/year	m^3/employee or thousands of customers	Total m^3
Elec. Power consumption	kW·h/stay	Total kW·h	kW·h/production	kW·h	kW·h/employee or opening hours	kW·h
Gas consumption	kg·m^3/stay	Total kg·m^3	GJ/production	GJ	kg/customer	Total kg
Diesel consumption	L/stay	Total kg	kW·h/production	kW·h	L/100km (vehicles)	L
Consumption of batteries, aerosols, etc.	kg or units/stay	Total kg or units	t/production	Total t	kg/employee or customer	Total kg
Paper consumption	kg/stay	Total kg	t/production	Total t	kg/customer	Total kg/centre

GHG emissions	tCO_2eq/stay	tCO_2eq	tCO_2eq/production	t	t/employee	t
Waste	kg/stay	Total kg	t/production	Total t	kg/employee or customer	Total kg

Source: prepared by the authors.

In the Building, Printing and Retail Trade sectors, most of the indicators that incorporate a minimum eco-efficiency criterion are defined in relation to the number of employees: for example CO_2 emissions (CO_2eq/employee) or diesel consumption (GJ/employee) per employee. In the Tourism sector, the EEIs are mainly defined in relation to the number of stays in the accommodations: for example, gas consumption (kW·h/stay) or electricity consumption (kW·h/stay) per stay. As examples of 'good practices,' it should refer to a set of indicators defined in relation to the turnover of the company (e.g., paper consumption in t/million €), the number of customers (e.g., packaging consumption in t/client), and the number of opening hours (e.g., electricity consumption in kW·h/opening hours). Other examples of good practices are as follows: percentage of energy consumption generated by renewable energy sources or indicators such as the weight of a given package per total weight of the product.

It is worth mentioning that none of the companies analysed used the added value as a denominator for calculating the EEIs, despite the fact that the EMAS scheme establishes it as a figure to indicate the overall annual production in the calculation of the indicators (EMAS, 2019). Likewise, some authors such as Müller and Sturm (2001) recommend it, as the 'value added is the most appropriate financial item' (Müller and Sturm, 2001, p.31). Similarly, in the environmental statements analysed, eco-efficiency criteria in the definition of basic environmental performance indicators were frequently completely absent for the most of the statements analysed. As illustrative examples, we can mention the cases in which water consumption is expressed only in m^3, or the amount of waste generated expressed only in tons, or the amount of CO_2 emitted into the atmosphere measured in kg/year or as a concentration (mg/m^3 or ppm).

In two of the environmental statements analysed, it was found that the companies have created their own composite indicators. This is the case of a weighted index that an EMAS-registered company calls the 'Global Emissions Index' in which it considers together some emissions into the atmosphere, some discharges into water, the generation of hazardous and non-hazardous waste, and their recovery. It is interesting to note that the weighting factors used are inversely proportional to those of the thresholds established in the Spanish Register of Emissions and Pollutant Sources (known as PRTR in Spain). The second case is an indicator named by the company as 'IndicA' based on the audit by points. It should be noted that in neither case does the methodology used in the construction of these indicators appear in the environmental statements to provide a clear explanation of the items evaluated. As a result, it is impossible to know whether the eco-efficiency criteria have been used for their calculation.

Finally, in order to better contextualize the poor performance of EMAS-registered companies, it is also interesting to shed light on the use by the analysed companies of the SRDs published in EMAS III to define their indicators. Companies analysed in the first stage of the fieldwork have to be excluded from this analysis, since their environmental statements were published before the implementation of the SRDs. Companies analysed in the second stage should show an improvement in relation to these guidelines. However, in the content analysis carried out, this influence was not detected in the companies analysed in the second stage.

Table 4. Examples of guides to implement EEIs by the SRD for the Tourism sector

Environmental performance indicator	Benchmark of excellence
Water consumption per guest-night (L/guest·night)	Water consumption, and associated energy consumption for water heating, of ≤ 100 L and 3.0 kW·h per guest-night, respectively, for ensuite guest bathrooms
Energy consumption for water heating (kW·h/guest·night)	See above
Flow rates of showers, bathroom taps, urinals, and toilet flushes (L/min or L/flush)	Shower flow rate ≤ 7 L/min, bathroom tap flow rate ≤ 6 L/min (≤ 4 L/min for new taps), average effective toilet flush ≤ 4.5 L, installation of waterless urinals

Source: prepared by the authors based on Styles et al. (2013).

For example, as summarized in Table 4, the SRD for the Tourism sector defined a set of EEIs as a detailed guide and reference benchmark for the adoption of an EMS in a hotel facility. Surprisingly, among the 112 cases analysed, only one company seemed to took advantage of the use of the mentioned SRD as a guide to implement EEIs.

5. Discussion and conclusions

The analysis found a weak use of EEIs in EMAS-registered companies, which in the literature are assumed to be frontrunner companies in terms of their environmental awareness, practices, and performance. It was found that only up to 42% of the analysed 10,337 indicators were calculated using minimum eco-efficiency principles. This figure improved slightly between the two temporal stages of the analysis (from 2013 to 2018), considering the development of the EMAS certification towards a more consistent and detailed scheme to implement environmental practices in companies from an EMS.

In other words, this study shows that, even in the case of organisations considered as leading or frontrunning companies, the concept of eco-efficiency is poorly used in their EMS. The study confirms the previous results obtained by Erkko et al. (2005) for Finnish companies from the pulp and paper industry, for which they reported a very weak use of EEIs. Surprisingly, this analysis carried out in 2013 and 2018 confirms the results of this Finnish study carried out in the early years of the EMAS scheme dissemination two decades ago. The present analysis also shows that an externally-verified EMS is not a guarantee of the capacity of certified companies to contribute to their environmental performance by the use of EEIs.

This article contributes to the literature in several ways. First, it contributes to gather evidence of the limited use of EEIs by companies, even in the case of firms that are supposed to be among the leaders or frontrunners in terms of environmental management behaviours. Second, it also contributes to the critical literature about the real practical impacts of the implementation of certifiable standard-based EMSs (e.g., Boiral, 2007; Heras-Saizarbitoria et al., 2013; Testa et al., 2018; Heras-Saizarbitoria et al., 2020). According to a recent systematic literature review in the field of voluntary certifiable standards for EMSs (Boiral et al., 2018), although the conventional scholarly literature is optimistic with regard to the impacts of these certifiable standards or schemes such as EMAS, there is an increasing body of scholarly literature that questions their effectiveness. This article constitutes another example of these doubts. More specifically, the limited use of EEIs may be indicative of the lack of internalisation of EMSs in organisations that have adopted certifiable standards such as EMAS. Given the critical importance of the economic implications associated with corporate sustainability and the need to find a balance between economic and environmental objectives (Sarkis and Cordeiro, 2009; Beckmann et al., 2014; Van der Byl and Slawinski, 2015), it can be assumed that companies substantially

involved in this area tend to set up EEIs to monitor their performance. Conversely, it seems reasonable to assume that companies that implement mainly symbolic and superficial environmental initiatives have less need to develop specific EEIs. As highlighted by the neo-institutional literature on certifiable environmental standards (e.g. Yin, H., & Schmeidler, 2009; Heras-Saizarbitoria et al., 2013; Iatridis and Kesidou, 2018; Testa et al., 2018), many firms mostly use EMAS and ISO 14001 standards as tools to strengthen the organisation's social legitimacy rather than to improve internal practices and environmental performance. In this context, the establishment of EEIs may appear superfluous, costly, and of little use to these organisations. Third, this article contributes to the scholarly literature on corporate disclosure and the issue of (un)measurability/(un)comparability of environmental performance (e.g. Gray, 2010; Moneva et al., 2006; Rahman and Post, 2012; Boiral and Henri, 2017; Chiba et al., 2018). The heterogeneity of the indicators used by the EMAS-registered companies makes it difficult if not impossible to compare environmental performance from one EMAS company to another. As proposed by Boiral and Henri (2017) the reluctance of organisations to use standardised metrics may be due to mainstream/functionalist reasons (e.g. lack of adaptation of indicators to the specificities of organizations, lack of incentives or requirements from the EMAS standard, etc.), critical reasons (e.g. greenwashing, reluctance of company to disclose transparent and usable information), or post-modernist reasons (e.g. environmental performance is simply not comparable, too complex, etc.).

These findings also have implications for managers and policy makers. Considering the results of this study, managers should go back to the rather basic concepts of corporate environmental management and move away from sophisticated perspectives allegedly intended to enhance the legitimacy and reputation of organizations. For policy makers, taking into account that the adoption of new perspectives for corporate environmental management tends to be prescribed with certain trend to the re-styling of ideas (e.g., the perspectives of industrial ecology, the circular economy), public decision makers should reconsider these policies in the light of the findings of the scholarly literature[2]. They should indeed adjust their expectations taking into account the weak environmental management practices that companies seem to have implemented, as it is exemplified in the present study for the use of EEIs. Even among those that should be, in principle, more aware and with greater degrees of environmental management practices implemented, the generalized lack of use of a key but rather simple approach such as eco-efficiency casts deep doubts. As a result, a general reflection on the real practical implications of the adoption of certified EMSs is needed.

Due to its exploratory nature, this study has a set of limitations. The analysed sample was limited to a set of sectors of activity and to a specific country. The results of this work may therefore not be generalizable to other sectors of activity or countries. The limitations of this work suggest avenues for future research. Beyond the obvious idea of extending the geographical scope of the analysis, it would be interesting to extend the analysis to other alleged leading companies in environmental behaviour and Corporate Social Responsibility. For example, companies that implemented and certified/verified their EMSs against the ISO 14001 standard could be analysed, together with companies that actively use the Global Reporting Initiative's guidelines for sustainability reporting.

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