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Environmental management control systems: Exploring the economic motivation behind their implementation

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ABSTRACT

Environmental management control systems (EMCSs) effectively integrate environmental objectives into corporate decision-making, yet implementation costs may discourage their adoption. To understand firms' economic motivation for implementing EMCSs, we theorize that internal and external factors drive both their economic performance and the decision to implement EMCSs. We argue that the environmental costs induced by firms' pollution intensity drive the economic benefits of EMCSs as well as their implementation. Additionally, we suggest that this relationship depends on society's environmental awareness. By introducing an archival measure of EMCS implementation, we test these hypotheses on a longitudinal dataset of European and US firms. Our results support the argument that environmental costs drive EMCSs' economic benefits and implementation. We also find that environmental awareness in societies influences the impact of environmental costs. Our study highlights the importance of environmental awareness in society for aligning environmental and economic goals and thus to increase corporate environmentalism.

1. Introduction

As climate change and its consequences are becoming an ever-greater threat, firms should reduce their exploitation of natural resources and give more consideration to their impact on the environment (Cadez, Czerny, & Letmathe, 2019; Ghadge, Wurtmann, & Seuring, 2020). Environmental management control systems (EMCSs)[1] measure and integrate firms' environmental performance to provide a foundation for informed corporate environmental decision-making (Henri & Journeault, 2010). Many scholars have documented the positive effects of EMCS implementation on environmental performance (Henri, Boiral, & Roy, 2014; Henri & Journeault, 2010; Latan, Chiappetta Jabbour, Lopes de Sousa Jabbour, Wamba, & Shahbaz, 2018; Lisi, 2015), while the economic benefits of EMCS implementation are still questionable or seem at least to depend on certain conditions (Guenther, Endrikat, & Guenther, 2016; Henri & Journeault, 2010). Another strand of the literature focuses on the determinants of EMCS implementation (Bansal & Roth, 2000; Lisi, 2015; Pondeville, Swaen, & De Rongé, 2013), but has paid only limited attention to the economic rationale for implementing EMCSs. However, it might be worth understanding whether the two seemingly different goals of environmental and economic performance are in any way reconcilable. Specifically, it might help firms to add to their economic performance and society to understand an effective means by which firms can be moved towards better environmental performance and protecting the environment. Thus, we combine the two literature streams by approaching EMCSs from an economic perspective and investigate *which factors drive the economic benefits of EMCS implementation and whether they motivate its implementation*.

Touching on the economic perspective on EMCS implementation, prior research indicates that the implementation of EMCSs is associated with benefits as well as costs for the implementing firms (Henri & Journeault, 2010; Lisi, 2015). On the one hand, EMCSs enable better control of environmental cost (value) drivers, allowing firms, for example, to benefit from a reduction in pollution costs or to stick to certain pollution thresholds defined by regulations (Henri & Journeault, 2010). On the other hand, EMCS implementation involves substantive administration costs, such as the resources needed to measure and integrate environmental indicators in the reporting systems. Following

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[1] EMCSs are a special form of management control systems (MCSs), which can be defined as "systems, rules, practices, values, and other activities management put in place in order to direct employee behavior" (Malmi & Brown, 2008, p. 290).

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contingency theory, the effectiveness of EMCSs should therefore depend on whether certain contingency factors allow the benefits of implementing an EMCS to exceed its associated costs. Managers rationally striving for enhanced economic performance should therefore decide on implementing EMCSs only under such contingency factors. In this paper, we address two contingencies, one at the firm level and one at the country level.

First, we suggest that the pollution intensity of a firm provides the basis for the benefits that EMCS implementation can potentially deliver. This is because the level of pollution (e.g., emissions, waste, energy, and water use) determines a firm's external environmental costs. While external environmental costs represent societal costs that arise from a firm's impact on the environment, these costs can be internalized and result in financial costs for firms. Such internal environmental costs occur when a firm is held accountable for its impact on the environment.[2] As EMCSs aim for better control of external environmental costs, which may partly become internal (financial) costs, an EMCS can also improve a firm's economic performance by efficiently reducing the firm's internal environmental costs. Pollution intensity should thus not only provide an ecological but also an economic motivation for EMCS implementation.

Second, however, we suggest that the extent to which external environmental costs translate into financial costs is shaped by a firm's institutional environment. Institutions determine the costs of regulatory compliance for environmental outcomes and reflect institutions' environmental awareness (Henri & Journeault, 2010). Institutions' environmental awareness in the form of environmental advocates, such as Green parties, non-governmental organizations (NGOs), and the media, can increase the price tag on environmental costs by, for example, requiring higher charges for pollution or more ambitious standards for certain products. As more environmental awareness of the institutional environment confronts pollution-intensive firms with higher environmental costs, it should also shape the economic motivation to implement EMCSs and, ultimately, reduce environmental costs.

To investigate these two predictions empirically, we focus on a multinational setting, as we expect considerable institutional differences to shape the benefits of EMCS implementation for pollution-intensive firms. We develop a methodology based on data recorded by Asset4 and primary archival data (e.g., published sustainability reports and annual reports) to measure EMCS implementation. We collect data on four distinct elements of EMCS implementation to capture the degree of EMCS implementation.[3] Our approach allows us to comprehensively capture EMCSs for a large longitudinal and multi-country data set. The data set comprises 5,599 firm years for the period between 2005 and 2016. We run several regressions to test our predictions. To investigate the antecedents of EMCS, we employ ordinal logit regressions that address the discontinuous scale of the EMCS variable. We further employ a set of firm-fixed regressions to estimate the economic consequences of EMCS implementation.

Overall, our results provide three important insights: (1) EMCS implementation is associated with higher economic performance for pollution-intensive firms; (2) pollution intensity is a considerable driver of firms' EMCS implementation; and (3) the economic benefits of EMCS implementation for pollution-intensive firms and the motivation behind pollution-intensive firms implementing an EMCS are amplified by institutions' environmental awareness stemming from the power of Green parties, the influence of Greenpeace, and the level of critical media attention toward environmental topics. Paired with insights from additional tests that EMCS implementation improves environmental performance, our results show that doing well and doing good can be complementary goals. Environmentally aware institutions, however, are a prerequisite for aligning these goals and for intensified corporate environmentalism.

Our study contributes to the literature in several ways. First, we contribute to environmental management accounting research (Henri et al., 2014; Henri & Journeault, 2010; Lisi, 2015; Pondeville et al., 2013) by shedding light on the economic-oriented antecedents of EMCS implementation. By following Guenther et al. (2016) and focusing not on whether but rather when it pays to be green, we highlight the contingency roles of environmental costs and institutions' environmental awareness. Second, we add to the understanding of the relevance of the institutional environment by considering the pressure from environmental-related stakeholder groups for firm decisions (Habisch, Patelli, Pedrini, & Schwartz, 2011; Rodrigue, Magnan, & Boulianne, 2013; Zyglidopoulos, Georgiadis, Carroll, & Siegel, 2012). Third, our empirical approach to gather information about the degree of EMCS implementation for a broader dataset enables additional, reconciling evidence in the field. Thereby, we respond to Hristov et al.'s (2021) call for studies across different industries and countries in the investigation of EMCS.

2. Prior literature and hypotheses

Management control systems (MCSs) can be defined as "systems, rules, practices, values, and other activities management put in place in order to direct employee behavior" (Malmi & Brown, 2008, p. 290). MCSs shape organizational practices and behavior (Ahrens & Chapman, 2007), and thus support the strategy (Langfield-Smith, 1997) and achievement of corporate goals (Flamholtz, Das, & Tsui, 1985). However, conventional management accounting and MCSs fail to incorporate environmental issues and the environmental costs that are frequently hidden in general overhead accounts (Henri et al., 2014). Consequently, potential economic benefits may often be downplayed or ignored (Christ & Burritt, 2013).

Well-designed EMCSs, by contrast, specify and communicate environmental objectives and enable the achievement of these objectives through feedback and control. As such EMCS, can motivate the top management team to engage in sustainability projects and practices by rewarding and appraising their sustainability achievements (Albertini, 2019; Ali, Jiang, Rehman, & Khan, 2022; Henri & Journeault, 2010; Lisi, 2015; Schaltegger & Burritt, 2010; Wijethilake, 2017).[4] They further aim to facilitate managerial decision-making that is aligned with environmental objectives by providing information on the environmental performance of projects and decision alternatives (Guenther et al., 2016). For example, EMCSs may set emission targets (e.g., for CO2 or waste emissions) for the organization, measure the emissions of organizational actions and include the achievement of these targets in the firm's rewarding structure (Lisi, 2015; Pondeville et al., 2013). The actual implementation of EMCS may, however, vary among EMCS

[2] This can happen through environmental taxes (e.g., carbon tax) but also via sanctions (e.g., as in the case of the offshore drilling rig Deepwater Horizon for BP) or consumer boycotts (e.g., as in the case of Greenpeace when it called on consumers to boycott sushi restaurants that served bluefin tuna).

[3] The four stages of EMCS implementation are: (1) environmental orientation, (2) environmental metric adoption, (3) target setting, and (4) compensation linking.

[4] More precisely, Albertini (2019) outlines that EMCS can foster environmental capabilities by highlighting priorities and stimulating dialogue via four concrete ways: 1) Stakeholder integration by jointly using belief, boundary, and diagnostic control systems; 2) shared vision by jointly using belief and boundary systems; 3) organizational learning by using interactive control systems; and 4) continuous innovation by using interactive control systems. Relatedly and regarding the economic outcomes of EMCS, Ali et al. (2022) document positive relations between the emerging capabilities (e.g., human capital, structural capital, and relational capital).

adopters as EMCS are not regulated.[5]

A growing body of literature addresses the importance of EMCSs by analyzing the consequences (Henri & Journeault, 2010; Lisi, 2015; Rötzel, Stehle, Pedell, & Hummel, 2019; Velte, Stawinoga, & Lueg, 2020) and antecedents (Bansal & Roth, 2000; Lisi, 2015; Pondeville et al., 2013) of their implementation. Regarding the consequences, researchers have mainly focused on the link between EMCSs and environmental performance (Judge & Douglas, 1998; Latan et al., 2018; Lisi, 2015; Rötzel et al., 2019)[6], while research on the link between EMCSs and economic performance is scarce (e.g., Feng & Wang, 2016; Henri & Journeault, 2010). An exception is the survey study by Henri and Journeault (2010), who found no link between EMCSs and economic performance in general, but they did find a link in several contexts that exhibit a higher awareness of environmental topics. Another survey study by Feng and Wang (2016) sheds light on how EMCSs affect economic performance through increased customer loyalty and satisfaction. Specifically, they argue that EMCSs help firms to better monitor and reduce the environmental impact of their products. Given that customers increasingly value environmental-friendly products, the customers will be more satisfied and develop a positive image of the firm, which in turn makes them more likely to remain loyal. Overall, research provides indications on the link between EMCSs and economic performance under certain conditions, but it lacks longitudinal and large-scale empirical quantitative evidence (Guenther et al., 2016).

Regarding the antecedents of EMCSs, researchers have investigated diverse motivations for implementation (Lisi, 2015; Pondeville et al., 2013). For instance, in her survey of Italian firms, Lisi (2015) considers and finds the expected competitive advantage, perceived stakeholder concerns, and environmental commitment to have an effect on the use of EMCSs. Another example is Pondeville et al. (2013), who conducted a survey among Belgian manufacturing firms and tested the roles of perceived ecological environmental uncertainty, perceived stakeholder pressure, and the degree of corporate environmental proactivity in the development of EMCSs. The results provide partial evidence for the latter two cases. Overall, research on the antecedents of EMCSs is dominated by a socio-economic perspective and has apparently neglected the economic rationale (emerging from the paragraph on the consequences of EMCSs).

In this study, we extend research on EMCS by proposing a contingency framework based on which we explore firms' economic motivation to implement EMCS. Contingency theory is based on the premise that the suitability of an organization's structure depends on conditions, such as the environment (Burns & Stalker, 1961), organizational size (Child, 1975), and strategy (Chandler, 1962). In the pursuit of organizational effectiveness (i.e., higher financial performance), a firm will thus make structural changes to achieve a fit with the situational demands of its environment (Lawrence & Lorsch, 1967; Otley, 1980). MCS research has frequently applied contingency theory in explaining design choices (Chenhall, 2003) and "suggested that particular features of an appropriate accounting system will depend upon the specific circumstances in which an organization finds itself." (Otley, 1980, p. 413) We apply these theoretical insights to the mixed findings of previous studies on EMCS. Specifically, we suggest a firm-level and a country-level contingency affecting the degree to which firms will implement EMCS. As mentioned above, the investigated contingencies arise from the firms' environment, particularly from the increasing pressure on firms to internalize external environmental costs. First, we focus on firms' potential environmental costs arising from their pollution intensity and their contingency role in the relation between EMCSs and economic performance. Second, we add the contingency of institutions' environmental awareness to our framework and investigate how it affects the influence of environmental costs on the relation between EMCSs and economic performance. In this vein, we aim to complement existing research by employing quantitative, panel-based data. Table 1 summarizes the most relevant empirical research on EMCS and categorizes it by type of study, focus, sample, and major findings, as well as highlights how our research contributes to this important stream of research.

2.1. The role of environmental costs for the economic benefits of EMCS implementation

EMCSs aim for environmental and economic benefits by enabling better control of environmental concerns and environmental costs (Ferreira, Moulang, & Hendro, 2010; Pondeville et al., 2013). The benefit of better control of such environmental costs thus primarily constitutes a reduction in environmental costs. Environmental costs refer to the costs that arise as a result of the environmental burden (e.g., emissions, resource usage, or waste) of producing certain products or services. To be more specific, costs that occur from a firm's impact on the environment can be distinguished into external costs that arise for society and internal costs for which the firm is held accountable. Better control of environmental costs is also associated with a number of additional benefits, such as complying with regulative emission standards, capturing green markets with environmentally friendly products, attracting environmentally aware customers, and preventing potential boycotts. However, like all MCSs, EMCS implementation is associated with costs that could outweigh the aforementioned benefits (Henri & Journeault, 2010; Lisi, 2015). EMCS implementation requires the calculation of environmental indicators as well as its integration into the firm's reporting system, both leading to substantial administrative costs.[7] In addition, there can also be more indirect costs, such as the overload of promoted information or reduced motivation due to multiple goals that are inconsistent in the short term (Henri & Journeault, 2010).

Given that EMCS implementation includes the described benefits and costs, we expect that the implementation decision hinges on whether the benefits outweigh the costs.[8] In other words, managers' decision for EMCS implementation will depend on how evident potential contingencies will occur. As the main benefit of EMCS implementation consists of a reduction of environmental costs, we argue that the benefits relate to the pollution intensity of the particular firm. Pollution-intensive firms typically have higher environmental costs and thus a higher potential for a reduction. For example, benefits, such as emission reduction, weigh more when firms incur larger external environmental costs in the form of more intensive pollution. Pollution-intensive firms may thus benefit the most from the proper management of external environmental costs enabled by EMCSs. While pollution firstly results in societal costs and thus external environmental costs for firms, firms are held increasingly responsible for their environmental impact. This may partly relate to consumers that increasingly consider environmental costs in their

[5] To account for this, we decide to measure EMCS with a measure that accounts for varying degrees of EMCS implementation. For example, some firms may espouse to consider their environmental burden, but do not measure the emission of environmental actions, while other may do so but neglect to link environmental impact to their rewarding system.

[6] In line with the literature, we find a positive relation between EMCS implementation and environmental performance in an unreported additional test.

[7] As the calculation of environmental indicators typically lays outside the firm's standard ERP system, firms need to make a great effort to measure environmental-related information. This likely requires substantial human resources that are needed to set up and maintain a system that measure environmentally-related information. The purchasing of software applications (e.g. Watershed, Climatiq or CO2-AI) could help in this process, but would still require substantial investments.

[8] As the benefits are likely to vary much more between firms based on their pollution intensity (Cadez & Czerny, 2016) in contrast to the costs of EMCS implementation, we focus on the heterogeneity in the benefits.

Table 1
Overview of key empirical studies on EMCS.

Study	Focus	Type of study	Sample	Major findlings
Feng and Wang (2016)	Consequences	Survey	214 Chinese firms	EMCSs is positively associated with economic performance through increased customer loyalty and satisfaction.
Ferreira et al. (2010)	Consequences	Survey	40 Australian firms	Environmental Management Accounting (EMA) use has a positive association with process innovation, but not with product innovation.
Henri et al. (2014)	Consequences	Survey	319 Canadian manufacturing firms	Tracking of environmental costs has an indirect influence on economic performance through environmental performance. This indirect effect is influenced by the environmental motivations of the firm.
Henri and Journeault (2010)	Consequences	Survey	303 Canadian manufacturing firms	Eco-control has no direct effect on economic performance, but in certain contexts a mediating effect through environmental performance on economic performance is observed. These contexts are (1) higher environmental exposure, (2) higher public visibility, (3) higher environmental concern, and (4) larger firm size.
Latan et al. (2018)	Antecedents and consequences	Survey	107 Indonesian firms	Corporate environmental strategy, top management commitment, and environmental uncertainty positively influence the use of EMA, which in turn positively influences environmental performance.
Lisi (2015)	Consequences	Survey	91 Italian firms	The use of Environmental Performance Measures (EPM) partially mediates the relationship between firms' business motivations and environmental performance and fully mediates the relationships between perceived stakeholder pressures as well as top management's environmental commitment and environmental performance. The results also show that EPM use positively influences economic performance indirectly through environmental performance.
Pondeville et al. (2013)	Antecedents	Survey	256 Belgian manufacturing firms	Firms that perceive greater ecological environmental uncertainty are less inclined to develop a proactive environmental strategy, environmental information system, or formal environmental management control system. Market, community, and organizational stakeholders motivate environmental proactivity, as well as the development of different environmental management control systems. Regulatory stakeholders only encourage the development of an environmental information system.
Rehman et al. (2021)	Consequences	Survey	373 Malaysian construction firms	EMCS use is positively associated with ecological sustainability, sustainable performance, and environmental strategies. Environmental strategies mediate the relation between EMCS and ecological sustainability as well as sustainable performance.
Rötzel et al. (2019)	Consequences	Survey	218 German firms	EMCSs mediate the relationship between environmental strategy and environmental managerial performance. The level of integration between regular and environmental MCS significantly impacts the relationship between EMCS and environmental managerial performance.
Wijethilake (2017)	Antecedents and consequences	Survey	175 Sri Lankan firms	Sustainability Control Systems (SCSs) were observed to partially mediate the relationship between proactive sustainability strategy and corporate sustainability performance. The study also finds that (1) a proactive sustainability strategy is positively associated with SCS and corporate sustainability performance and (2) SCSs are positively associated with corporate sustainability performance.
Current study	Antecedents and consequences	Archival	Multi-country panel data set (5,588 firm-years of European and US firms)	EMCS implementation is associated with higher economic performance for pollution-intensive firms. Pollution intensity is also a driver of firms' EMCS implementation. The economic benefits of EMCS implementation for pollution-intensive firms and the motivation behind pollution-intensive firms implementing an EMCS are amplified by institutions' environmental awareness stemming from (1) the power of Green parties, (2) the influence of Greenpeace, and (3) the level of critical media attention toward environmental topics.

Notes: In this table, we summarize the most relevant (quantitative) empirical studies on EMCS as well as our own study to demonstrate how we extend prior literature. Given the strong focus on empirical studies on antecedents and consequences of EMCS, we did not consider single case studies that were used to develop conceptual frameworks (e.g., Albertini [2019], Sundin and Brown (2017)).

buying decision for pollution intensive products (Vanclay et al., 2011) but also to the increasing legislative pressure. For instance, Arjaliès and Mundy (2013, p. 285) state that "increasingly stringent environmental legislation means that firms will need to incorporate external costs into their business planning." Similarly, Krueger et al. (2020, pp. 1067–1068) posit that "companies can be negatively affected from policies and regulations implemented to combat climate change. Fossil fuel firms, for instance, can be adversely affected by carbon pricing or limits on carbon emissions […] electric or fuel-cell-powered vehicles could disrupt traditional car manufacturers." Some of the external environment cost related to the pollution of firms may on average also be translated to internal (financial) costs. Pollution-intensive firms may thus more likely financially benefit from the proper management of environmental costs enabled by EMCSs. In line with contingency theory, when considering the implementation of an EMCS, managers should thus take into account the internal contingency of their firm's pollution intensity as a critical driver of organizational effectiveness (Chenhall, 2003). Consequently, we hypothesize:

Hypothesis 1a. Pollution intensity is positively associated with EMCS implementation.

If managers, thus, carefully make their decisions based on cost-

benefit trade-offs, they are likely to steer their firms to a desired state of fit between the organization structure and the environment. According to contingency theory, firms whose organizational structures are effectively shaped by the requirements of their environment perform better and have a higher chance of survival (Donaldson, 2001; Lawrence & Lorsch, 1967). Consequently, in line with contingency theory, we argue that EMCS implementation is not beneficial per se, but that it depends on the specific conditions of the focal firm. Building on the increased benefits for pollution-intensive firms resulting from EMCS implementation, we predict the effect of EMCS implementation on economic performance to be contingent on firms' pollution intensity. Formally:

Hypothesis 1b. EMCS implementation is positively associated with economic performance for pollution-intensive firms.

2.2. Environmental awareness as a driver for internalizing environmental costs

While we argue that external environmental costs are, on average, to some extent internalized, this likely depends on the level of environmental awareness in the institutional environment. For example, there are a number of public debates on how to internalize firms' external environmental costs (e.g., Eidelwein, Collatto, Rodrigues, Lacerda, & Piran, 2018; Georgakellos, 2010; Tarí, Molina-Azorín, López-Gamero, & Pereira-Moliner, 2021). The most prominent debate is probably the one on carbon pricing (Mann & Puko, 2021; Panzone, Ulph, Zizzo, Hilton, & Clear, 2021; The Economist, 2022). While the debate in general illustrates the intention of determining and enforcing the price tag for firms' external environmental costs and thus firms' impact on the environment, the wide range of proposed amounts in different institutional environments reveals great variation in the envisaged price-tags (Bhat, 2021; Black, Parry, & Zhunussova, 2022; Fan, Rehm, & Siccardo, 2021). Similar debates can be observed regarding energy and water use as well as waste production.[9] In this process, different stakeholder groups have suggested different price tags. Stakeholder groups known as environmental advocates typically suggest higher price tags than others and call for strict enforcement (Jones, 2021; Nijhuis, 2021).

Given that different institutional contexts feature environmental advocates with more or less influence, firms will experience varying degrees of environmental awareness depending on their institutional environment. Environmental awareness in the institutional environment is thus likely to pose an additional external contingency affecting firms' adaption towards the internal contingency of their environmental costs. This is because the internalization of environmental costs is not strictly determined but rather varies in different contexts. We argue that external environmental costs are more likely to be internalized in institutional environments with higher environmental awareness. Consequently, firms' economic motivation would not only depend on the internal conditions but also on external contexts describing the institutional influence of environmental advocates, ultimately affecting firms' decision-making processes and the implementation of EMCSs. In the following, we focus on three particular salient environmental advocates affecting the institutional environment: Green parties, Greenpeace, and the media.

2.2.1. Political party

In general, political stakeholders have an increased interest in representing public concerns. Accordingly, in various countries, Green parties have emerged as the environmental advocates from among the political stakeholders (Mourao, 2019). One of the most important goals on the political agenda of Green parties has been a higher quality of life for communities through more effective environmental policies and, consequently, better control of pollution (Close & Delwit, 2016). Political studies highlight the influence of Green parties even if they do not form part of the government (Kayser & Rehmert, 2021; Sartori, 1976). Even by winning a small number of seats in the parliament, the Green party has a stage, which can lead to public debates about environmentalism, which then gain weight and also become more important for other political decision makers (Grant & Tilley, 2019; Kayser & Rehmert, 2021). With their increasing influence, Green parties are playing a greater role in empowering regulations regarding corporate environmentalism (Mourao, 2019). At the same time, Allan et al. (2021) observe a rise of green industrial policies that are transforming climate politics on a national but also on a multilateral level by aiming for a stronger internalization of external environmental costs. Thus, Green parties do not only result in increased levels of environmental awareness in society, but also exert significant influence (Folke, 2014).

Consequently, pollution-intensive firms are likely to experience stronger pressure when Green parties have greater power (i.e., higher vote share for the Green party in the last national parliament elections). In these institutional contexts with greater environmental awareness, pollution-intensive firms could particularly benefit from controlling environmental costs and reducing the highlighted financial impact of environmental costs by implementing EMCSs. At the same time, pollution-intensive firms could take advantage of the high environmental awareness in the institutional context, as using EMCSs could help those firms to develop an image as vanguards of corporate environmentalism. Thereby, firms could benefit from higher consumer acceptance, leading to increased market shares and lower price sensitivity. We argue that in the presence of stronger Green parties managers will become increasingly aware of the society's environmental awareness. Thus, when pondering the implementation of an EMCS, we expect managers of pollution-intensive firms to also consider the influence of Green parties. Hence, we posit the following hypotheses:

Hypothesis 2a. The positive relationship between pollution intensity and EMCS implementation is enhanced by the power of Green parties in the institutional environment.

The greater power of Green parties likely increases the environmental awareness in the society and with it the benefits of EMCS for pollution-intensive firms. Hence, we expect that pollutions-intensive firms' economic performance will increasingly benefit from EMCS implementation when Green parties have greater influence. Formally:

Hypothesis 2b. The positive relationship between EMCS implementation and economic performance for pollution-intensive firms is more pronounced in institutional environments with powerful Green parties.

2.2.2. Non-Governmental organizations

Apart from political parties, NGOs have gained a pivotal role as firms' stakeholders striving to achieve sustainable and responsible business practices (Lorek & Spangenberg, 2014). A particularly active NGO with a very strong focus on environmentalism is Greenpeace (see Friedman and Miles (2002) for a portayal on the particular salient role of Greenpeace). Environmental NGOs in general, and Greenpeace in particular, usually campaign against heavily polluting firms and lobby for stronger internalized environmental costs. Thereby, pollution-intensive firms with greater environmental costs receive more attention and are more likely to become the target of potential boycotts (Buysse & Verbeke, 2003). The consequences of the boycotts should be stronger for firms in countries with a greater influence of Greenpeace. That is, a greater influence of Greenpeace entails a larger number of members potentially supporting such boycotts. Thus, firms with higher pollution intensity should face even higher public pressure in countries with a greater influence of Greenpeace. Again, environmental pioneers

[9] See, for example, the £126m punishment for Southern Water in the United Kingdom due to spills of wastewater into the environment from its sewage plants (Kollewe, 2019) or the European Union's ban on throwaway plastic (Schreuer, 2018).

could strive in these institutional contexts with higher environmental awareness by capitalizing on their image. As, in these contexts, pollution-intensive firms could particularly benefit from implementing EMCSs, we expect that these firms consider the higher benefits and are more likely to favor EMCS implementation. In addition, managers will be more likely to sense the greater environmental awareness of the society given a greater influence of Greenpeace. Thus, we postulate:

Hypothesis 3a. The positive relationship between pollution intensity and EMCS implementation is enhanced by the influence of Greenpeace in the institutional environment.

Following our previous argumentation, we expect the described mechanisms to strengthen the benefits of EMCS implementation for pollution-intensive firms. Specifically, we expect pollution-intensive firms' economic performance to be affected more positively from EMCS implementation when Greenpeace yields greater influence. Formally:

Hypothesis 3b. The positive relationship between EMCS implementation and economic performance for pollution-intensive firms is more pronounced in institutional environments with a greater influence of Greenpeace.

2.2.3. Critical media coverage of environmental topics

Studies have shown that the media has the ability to influence corporate behavior regarding environmental responsibility (Baron, 2005; Zyglidopoulos et al., 2012). This influence is the result of the media being the main legitimate information source for many stakeholders (e.g., customers). For example, Calculli et al. (2021) find that the media is the main source of information on environmental issues for younger and older citizens (37.8% and 58.6%, respectively). Thus, firms heavily depend on what the media reports (Henriques & Sadorsky, 1999). Institutional contexts with higher media foci on environmental topics put firms' environmental behavior more strongly in the spotlight, especially following critical news coverage. As higher environmental awareness is expected to result in more environmentally conscious behavior (Otto, Kaiser, & Arnold, 2014), pollution-intensive firms run an even greater risk of sanctions, boycotts, and reputation damage in countries with a more critical role of the media regarding environmental topics.[10] Typically, these contexts are also likely to feature stronger lobbying for the internalization of external environmental costs (Calculli et al., 2021). Again, firms proactively engaging in corporate environmentalism are likely to gain considerable upsides regarding consumers in contexts of higher environmental awareness. Thus, in countries coined by a more critical role of the media regarding firms' environmental behavior, pollution-intensive firms could particularly benefit from implementing EMCSs and proactively internalizing their environmental costs. Also the heightened environmental awareness indicated by the critical media makes it more likely that managers will consider the potential benefits of EMCSs and therefore prioritize their implementation. Accordingly, we hypothesize:

Hypothesis 4a. The positive relationship between pollution intensity and EMCS implementation is enhanced by the extent of critical media coverage of environmental topics in the institutional environment.

Analogous to the previous set of hypotheses, we argue that for pollution-intensive firms the extent of critical media coverage of environmental topics amplifies the positive relationship between EMCS implementation and firms' economic performance. Formally:

Hypothesis 4b. The positive relationship between EMCS implementation and economic performance for pollution-intensive firms is more pronounced in institutional environments with critical media coverage of environmental topics.

3. Research method

3.1. Sample selection

We focus on a multinational and longitudinal sample consisting of firms with shares listed in the STOXX® Europe Total Market Index (TMI) and the S&P 100 Index in the timespan from 2005 to 2016. The STOXX® Europe comprises approximately 95% of the free float market capitalization of Europe. Based on this index, we select the 500 largest non-financial firms in terms of market capitalization. The S&P 100 consists of 100 major blue-chip firms from the USA, which are among the larger and more stable firms in the S&P 500. We believe that the focus on Europe and the USA is appropriate for this analysis, as the sample consists of countries that traditionally emphasize shareholder value (e.g., the United Kingdom and the USA), as well as countries with a stronger stakeholder orientation (e.g., Austria, France, and Germany). To avoid survivorship bias, the selection is based on the indices' constituents of the starting year (2005), which we follow until the end of the research period (2016). From the potential sample of 6,435 listed firm-year observations, we exclude firm years with missing data on EMCS implementation (279), and firm years with other data restrictions, such as controls and institutional country-level variables (557). The fulfillment of these criteria yields the final sample of 5,599 firm-year observations from 548 firms from 15 countries for our antecedent tests.[11] As we employ forwarded dependent variables in our performance tests, the final sample is slightly smaller. Table 2 summarizes the sample construction.

3.2. Main variables

3.2.1. EMCS implementation

Our aim is to advance the topic of EMCSs by gaining a deeper understanding of why firms are implementing EMCSs extensively and whether firm performance implications can be expected. While prior studies investigating EMCS implementation relied on surveys to capture the construct, we introduce an approach with which to gather large-scale longitudinal data on the degree of EMCS implementation. To distinguish the degree of EMCS implementation, we focus on four essential elements of an MCS. Based on the management control literature, we suggest that an EMCS implementation requires (1) the environmental orientation of the firm, (2) the adoption of environmental metrics, (3) the setting of environmental targets, and (4) the linking of

Table 2
Sample selection.

Sample selection	Observations
Listed firm-years of non-financial firms from the S&P 100 and the Europe STOXX TMI (500 largest) (2005–2016)	6,435
- Firm-years with missing data on EMCS implementation (annual reports or sustainability reports)	279
- Firm-years with other data restrictions	557
Firm-years included in the sample for EMCS antecedents	5,599
- Firm-years with missing forwarded performance data	11
Firm-years included in the sample for EMCS performance	5,588

[10] Caculli et al. (2021, p. 4) find that "considerable environmental awareness is evidenced by the adoption of correct individual behaviors related to recycling, waste and plastic reduction." In line with these findings, it is well conceivable that customers that pay attention to these measures for the sake of environmental protection will also support initiatives counteracting firms that are pollution intensive.

[11] Ireland and Portugal are not included in the analyses as Greenpeace does not keep a separate account for the members in these countries.

these environmental metrics/targets to executive compensation. To gather the data, we collect information on these four elements of EMCS implementation from archival data sources. Specifically, we use manually collected data from annual reports (and sustainability reports), as well as data from the Asset4 database. In the following, we explain the collection of each of the four EMCS elements.[12]

1. *Environmental orientation*: Commitment of the firm to the overall objective of protecting the environment. We classify a firm as environmentally-oriented if the firm reports its environmental activities with the aim of protecting and ensuring its sustainable development. Therefore, we screen the annual reports and check for the availability of a sustainability report. *Environmental orientation* takes the value of one if the firm specifically states its commitment to protecting the environment in the annual report or if the firm has a sustainability report, and zero otherwise.
2. *Environmental metric adoption*: Adopting environment-related metrics, such as carbon dioxide (CO_2) and other emissions, and energy and water consumption, as well as waste production, serves as an essential step in translating the objective of sustainability into practice. We identify environmental metric categories based on several Asset4 data points that account for the adoption of environmental key performance indicators (see Appendix C). *Environmental metric adoption* takes the value of one if the firm adopted at least one of these metrics, and zero otherwise.
3. *Target setting*: Setting targets represents a crucial step in forming the basis for monitoring management decisions. To collect data for target setting, we identify target categories based on three Asset4 metrics (see Appendix C). The element *target setting* equals one if one or more targets are set for a firm's environmental metric, and zero if no targets were provided.
4. *Compensation linking*: In terms of instilling EMCS throughout the whole organization, it is important to link the metrics and targets to the compensation of the top management team. Through archival data collection in annual reports (or sustainability reports), we identify whether executives' compensation is linked to the firms' environmental metrics and/or targets. We searched in the description of the compensation system whether environmental metrics or targets are mentioned as a basis for compensation or whether there is a general statement indicating that environmental targets are linked to the rewarding structure (see Appendix B).[13] Thus, the element *compensation linking* takes the value of one if the environmental metric is integrated into the organizational remuneration system, and zero otherwise.

Based on the four elements, we build a multidimensional measure of the degree of EMCS implementation. Specifically, we calculate the variable *EMCS implementation* by summing up the four binary-coded elements into a single measure. Thus, *EMCS implementation* varies between "0" and "4" in steps of one, from no implementation to the highest extent of implementation.[14]

3.2.2. Pollution intensity

To obtain our variable of firms' pollution intensity, we draw on firms' emissions, energy and water consumption, and waste production. Ideally, we would need annual data on firms' environmental consumption. However, due to data-availability issues for many firm-year observations in the panel, we follow an approach from previous research that dealt with similar missing data challenges (D'Mello, Gao, & Jia, 2017; Firk, Richter, & Wolff, 2021; Lang & Stulz, 1994; Rajan, Servaes, & Zingales, 2000). Specifically, we start by calculating the industry average based on Fama and French (2010) for the pollution intensity of focused firms with available data from Asset4.[15] We then match these industry scores to each firm's business unit and, finally, we calculate the overall pollution intensity by considering the relative sales of each business unit. By doing so, we obtain a measure for *Pollution intensity* that considers the firms' specific business portfolios and reflects a reliable approximation of firms' pollution intensity without losing data points.[16]

3.2.3. Economic performance

In line with contingency theory, we expect that EMCS implementation will only be beneficial for firms with high environmental costs. To test this assumption, we decide to focus on the operating performance and follow the literature on MCSs by using firms' return on assets as the dependent variable (King & Lenox, 2002). Given industries' idiosyncratic return levels, we focus on firms' industry-adjusted return on assets. Specifically, we calculate yearly industry averages and subtract them from firms' return on assets based on the Fama-French 17 categorization. Further, as the effect of EMCS implementation on firm performance is likely to require time to be effective, we measure the mean of firms' industry-adjusted return on assets for the following two years for our variable *Future return on assets* (*ind. adj.*).

3.3. Environmental awareness in the institutional environment

3.3.1. Green party

As part of national parliaments and thus of the representation of the people, national Green parties have the ability to initiate and enforce regulations regarding environmentalism, including charges, sanctions, and regulatory standards. We collect data from websites and press releases on the outcomes of national elections to identify the power of Green parties in the different institutional environments (Asad, Hennig, Oehmichen, Wolff, & Haas, 2023). Specifically, we employ the percentage of overall votes won in the last national election (*Green party*).[17]

3.3.2. Greenpeace

By being a large and internationally active NGO with a strong focus on environmental protection, Greenpeace has gained considerable attention. Greenpeace's frequent and wide-reaching calls for boycotts as well as its attention-grabbing activities can pose an imminent threat to

[12] Exemplary cases for the assessment of the four elements can be found in Appendix B. An overview of the Asset4 codes and descriptions is presented in Appendix C.

[13] While we acknowledge that it is theoretically possible that firms may include environmental targets in their compensation systems and not disclose this information to stakeholders, we believe that this is highly unlikely. Integrating environmental targets in the compensation system demonstrates the consideration of objectives from stakeholders outside of the firm. Disclosing this information is therefore likely seen as positive by these stakeholders. Therefore, we do not see a good reason to integrate environmental indicators in the firm's compensation system and hide it from the public. Similar arguments apply to the previous three EMCS elements.

[14] As, for example, environmental orientation and metric adoption are necessary preconditions for firms' target setting, the existence of environmental target setting automatically implies environmental orientation and metric adoption.

[15] We calculate the industry averages based on single business firms and firms with more than 50% of their net sales in a single business segment to obtain representative data on pollution intensity in the specific industries.

[16] Given that only 461 of the observations in the final sample belong to single-business firms, we obtain a measure that is rather firm-specific taking into account the structure according to the business portfolio.

[17] In unreported tests, we find that our results also hold when we use the number of seats held by the Green party in the national parliament.

firms' operations. We directly contacted Greenpeace to receive data on the number of its members in the different institutional environments. Specifically, we capture the influence of Greenpeace in different countries by using the yearly number of Greenpeace donors per country adjusted by the population (*Greenpeace*).

3.3.3. Media attention

Many firms' stakeholder, especially consumers, rely on the media as their main information source. Consequently, firms heavily depend on what the media reports as it can drive consumers' behavior and thus influence firms' success. To proxy for countries' media attention on environmental topics, we use data from the news database Ravenpack. Specifically, we focus on critical news articles. We identify articles by searching for words from the dictionary by Pencle and Mălăescu (2016) in the headlines of the news articles. While Pencle and Mălăescu (2016) provide word lists for different dimensions within the CSR construct, many words assigned to dimensions outside the environment dimension also appear in environmental contexts, such as, for example, (bio-) *diversity*, *healthy*, *native*, *philanthropic*, etc. This is also an expression of the great similarity of the different dimensions clustered together under the term CSR. As we base our measure on headlines, which are notoriously concise, we consider it to be advantageous for our measure of media attention to apply this broader dictionary. Moreover, we focus on critical articles by selecting articles with a negative sentiment. We calculate *Media attention* as the percentage of identified critical news articles from all articles in a country per year.

3.3.4. Overall environmental awareness

Based on our individual proxies, we additionally create a composite measure that reflects overall environmental awareness (*Overall*). To compute *Overall,* we standardize the individual variables *Green party*, *Greenpeace*, and *Media attention*, and build their sum.

3.4. Control variables

We include a broad set of variables that may confound the hypothesized effects on and of EMCS implementation. At the firm level, we control for firm *Size*, as it has a considerable effect on the adoption of corporate environmental practices and activities (e.g., Cormier, Magnan, & Van Velthoven, 2005; Henri & Journeault, 2010). We control for *Leverage* to account for financial constraints (Cormier & Magnan, 2003). Additionally, we control for *Growth* and *Volatility*, as growth and risk measures, which could prevent firms from implementing management practices more comprehensively (Burkert & Lueg, 2013). For similar reasons, we include the *Market-to-book* ratio, which can also be an indicator of external financial resources. We control for the operating *Margin* as a measure of firm profitability, since the ability to bear costs assignable to EMCSs depends on the firm's profitability and performance (e.g., Haniffa & Cooke, 2005). We include the *R&D ratio* because scholars (e.g., Lev, Petrovits, & Radhakrishnan, 2010) argue that R&D and corporate environmentalism are positively correlated, as certain aspects of corporate environmentalism, such as EMCSs, can enhance innovation. We also control for *Diversification* because firms with greater organizational complexity can benefit from management accounting practices to a larger extent (Firk, Schmidt, & Wolff, 2019b). At the board level, we include *Board size*, *Board independence*, the average *Board tenure*, and the *Board expertise* regarding environmentalism, as previous research has shown that these indicators are relevant for effective board functioning and influence environmental decision-making processes (Walls & Hoffman, 2013). At the ownership level, we control for *Ownership concentration* as firms with concentrated ownership are less prone to external pressure (Firk et al., 2019b). Moreover, we control for *Institutional investors* because they generally do not have business relations with the firms in which they invest and may be less subject to pressure from these firms, and therefore, are better suited to monitoring, disciplining, and imposing controls (Cornett, Marcus, Saunders, & Tehranian, 2007; Steinberg, Hennig, Oehmichen, & Heigermoser, 2022). In our tests of the antecedents of EMCS implementation, where we use an ordered logistic regression, we also include controls at the industry and country level. At the industry level, we include one-digit SIC industry fixed effects. At the country level, we follow the seminal work by La Porta et al. (2006) and include a set of dummy variables to capture the legal origin of the respective country's laws (*English, French, German,* and *Scandinavian legal origin*). Further, we use the measure *CSR law* developed by Dhaliwal et al. (2012) to control for country-based disclosure laws regarding sustainability topics. Lastly, in all our regressions, we include dummy variables for each year within the sample time frame.

3.5. Empirical methods

3.5.1. Antecedents of EMCS implementation

For the tests on the antecedents of EMCS implementation, we follow previous studies investigating dependent variables that only take a small range of positive values and use ordinal logit regressions that address the discontinuous scale of the variable (Demirkan & Zhou, 2015; Firk et al., 2019b; Sandino, 2007). To account for time-series dependence at the firm level, we cluster standard errors by firms (Petersen, 2009). We also include industry-fixed effects to account for cross-sectional correlations. Specifically, we test Hypothesis 1a using the following model:

$$EMCS_{it+1} = Constant + \beta_1 Pollutionintensity_{it} + \sum Controls_{it} + INDUSTRY_i + YEAR_t + \varepsilon_{it} \quad (1)$$

where the items beside the dependent variable ($EMCS_{it+1}$), independent variable (*Pollution intensity*$_{it}$), and control variables (*Controls*$_{it}$), comprise industry and year dummies as well as the error term ε_{it}. To test our Hypotheses 2a to 4a on the influence of environmental awareness in the institutional environment on the proposed effect in Hypothesis 1a, we introduce interaction terms between *Pollution intensity* and our proxies for environmental awareness in the institutional environment (*Green party*, *Greenpeace*, *Media attention*, and *Overall*). Additionally, we include the respective moderator (i.e., the proxy for environmental awareness) in the regressions.

3.5.2. Consequences of EMCS implementation

To test our hypotheses regarding the effect of EMCS implementation on firm performance, we use a firm fixed-effects model to cover the within-effects. The implementation of new management practices, such as EMCSs, might be an endogenous choice by firms. Firm fixed-effects models help us to capture unobservable time-invariant firm-specific characteristics and thereby to attenuate a common source for endogeneity. Overall, the inclusion of firm- and time-specific fixed effects aims to reduce causality issues, such as unobserved heterogeneity. Moreover, the implement a time lag to counteract reversed causality. Using the subscript *i* for firms and *t* for time, the following model represents Hypothesis 1b:

$$Future\ return\ on\ assets(ind.adj.)_{it} = Constant + \beta_1 EMCS_{it} + \beta_2 Pollutionintensity_{it} + \beta_3 EMCS_{it}xPollutionintensity_{it} + \sum Controls_{it} + FIRM_i + YEAR_t + \varepsilon_{it} \quad (2)$$

where our dependent variable is *Future return on assets* (*ind. adj.*), our independent variables are *EMCS*, *Pollution intensity,* and the interaction term *EMCS* × *Pollution intensity,*[18] *Controls* is a vector that includes the control variables, $FIRM_i$ represents firm-fixed effects, $YEAR_t$ time-fixed effects, and ε_{it} is an error term. To test our Hypotheses 2b to 4b regarding the influence of environmental awareness in the institutional environment on the postulated effect in Hypothesis 1b, we split our sample along the four proxies (*Green party*, *Greenpeace*, *Media attention*, and *Overall*). Specifically, we compute the median of the environmental awareness proxies per country and then categorize countries as above or below the median across all countries. This results in four sample splits in which we test our hypotheses. Lastly, we conduct Wald tests to test for significance of the coefficient differences between subgroups.

4. Results

4.1. Descriptive results

Table 3 highlights the development of the distribution of our four EMCS implementation elements throughout our research period (2005–2016). The development describes a substantial increase over time in the degree of EMCS implementation, including all elements. On average, 94.5% of the firms publish information about corporate environmentalism, while only 12% link their environmental targets to top executive compensation. Table 4 Panel A shows the average, minimum, and maximum values of EMCS implementation for the different countries. While the minimum and maximum values display coverage of the entire range of EMCS implementation elements in each of the countries, the average values differ significantly across countries. This variation provides an initial indication that EMCS implementation is affected by country-level characteristics. Table 4 Panel B exhibits the same set of values for the various industries. Again, the minimum and maximum values reveal great heterogeneity across all industries. Moreover, firms in industries, such as mining or manufacturing exhibit higher levels of EMCS implementation, as we would expect in line with the economic motivation based on pollution intensity. Table 5 provides the means, standard deviations, and pairwise correlations of the variables. Notably, we find correlations between our variables *Green party*, *Greenpeace*, and *Media attention*, providing an indication for a common underlying construct (i.e., environmental awareness).[19]

4.2. Multivariate results

4.2.1. Effect of pollution intensity on EMCS implementation

Table 6 reports the results of the regression analyses investigating the effect of pollution intensity on one-year-ahead EMCS implementation and further considering the influence of environmental awareness in the institutional environment. Model 1 examines Hypothesis 1a, which postulates a positive relationship between pollution intensity and EMCS implementation. The positive and significant coefficient on *Pollution intensity* (p value < 0.001) supports the hypothesis. In terms of the marginal effect of *Pollution intensity*, we calculate the predicted probability of achieving the highest level of *EMCS implementation*. The results suggest that a one standard-deviation increase from the mean in *Pollution intensity* leads to a 33% percent increase in the predicted probability for the highest level of *EMCS implementation*. Hence, the results are consistent with Hypothesis 1a and provide evidence for the claim that firms see EMCS implementation as an adequate response to high environmental costs in pollution-intensive firms to achieve higher performance.

Model 2 tests Hypothesis 2a, which states a more pronounced relationship between pollution intensity and EMCS implementation for firms in institutional environments with more influential Green parties. We continue to find a positive and significant effect of *Pollution intensity* on *EMCS implementation*. In addition, we find a positive and significant coefficient on the interaction term between *Pollution intensity* and *Green party* (p value $= 0.029$), which is in line with our expectation.

Model 3 investigates Hypothesis 3a, which stipulates a stronger relationship between pollution intensity and EMCS implementation in institutional environments with a greater influence of Greenpeace. Besides the positive and significant coefficient on *Pollution intensity*, we also find a positive and significant coefficient on the interaction term between *Pollution intensity* and *Greenpeace* on *EMCS implementation* (p value < 0.01), supporting the prediction.

Model 4 analyzes Hypothesis 4a, which posits that the relationship between pollution intensity and EMCS implementation is stronger in institutional environments with more critical media coverage of environmental topics. Again, we find a positive and significant coefficient on *Pollution intensity*. Moreover, we find a positive and significant coefficient on the interaction term between *Pollution intensity* and *Media attention* (p value < 0.01), supporting the hypothesis.

Finally, we scrutinize the relationship of the interaction term between *Pollution intensity* and our composite measure of environmental awareness in the institutional environment (*Overall*) with *EMCS implementation* and find a positive and significant coefficient (p value $<$ 0.001). In terms of the marginal effect, we now consider the predicted probability to achieve the highest level of *EMCS implementation* in institutional environments with high environmental awareness (one standard deviation above the mean). The results suggest that a one standard-deviation increase from the mean in *Pollution intensity* leads to a 55.3% increase in the predicted probability for the highest level of *ECMS implementation*. Overall, these results indicate that firms adapt their organizational structure to their institutional environment in their pursuit of higher financial performance (Lawrence & Lorsch, 1967).

4.2.2. Effect of EMCS implementation on economic performance

Table 7 reveals the results of regression analyses examining the interaction effects of EMCS implementation and pollution intensity on future economic performance (measured as the mean of one- and two-year-ahead industry-adjusted return on assets). Model 1 is created to test Hypothesis 1b, which proposes that EMCS implementation increases economic performance for pollution-intensive firms. In line with our expectation, the coefficient on the interaction term between *EMCS implementation* and *Pollution intensity* is positive and marginally significant (p value < 0.1). To put this result into perspective, we assess the economic significance of pollution-intensive firms (one standard deviation above the mean) and find that the future return on assets increases by 17.6 basis points as a result of a one-step increase in *EMCS implementation* (e.g., from environmental metric adoption to target setting).

[18] To avoid potential problems of multicollinearity, and to improve the interpretation of the results, we center all interaction terms on their means (Aiken & West, 1991).

[19] Due to the correlations, we decided to test the interaction terms, including the three variables, in separate regressions in our main tests. In these additional tests (untabulated), we obtained similar results when we included all three interaction terms in the same model.

Table 3
Distribution of firms that exhibit the different EMCS implementation elements.

Year	Environmental orientation	Environmental metric adoption	Target setting	Compensation linking	EMCS (mean)
2005	83.7%	59.0%	34.5%	3.1%	1.80
2006	85.2%	60.0%	36.6%	3.6%	1.85
2007	87.0%	65.7%	53.1%	5.6%	2.11
2008	89.9%	67.7%	57.6%	6.5%	2.22
2009	93.1%	71.5%	62.1%	9.0%	2.36
2010	93.4%	73.2%	61.9%	13.4%	2.42
2011	94.5%	72.5%	62.3%	13.4%	2.43
2012	96.4%	72.4%	63.7%	15.9%	2.48
2013	98.2%	73.7%	63.5%	15.3%	2.51
2014	97.8%	74.7%	63.6%	16.0%	2.52
2015	97.9%	74.6%	64.7%	17.6%	2.55
2016	98.2%	94.0%	76.5%	23.0%	2.92
Average	94.5%	72.6%	59.3%	12.0%	2.34

Table 4
Average EMCS implementation by country and industry.

Panel A: Average EMCS implementation by country					
Country	Mean	Min	Max	Obs.	Obs. %
Austria	2.07	0	4	74	1.32
Belgium	2.17	0	4	130	2.32
Denmark	2.25	0	4	166	2.96
Finland	2.47	0	4	191	3.41
France	2.35	0	4	715	12.77
Germany	2.23	0	4	532	9.50
Greece	1.98	0	4	48	0.86
Italy	1.71	0	4	312	5.57
Netherlands	2.16	0	4	258	4.61
Norway	2.14	0	4	117	2.09
Spain	2.11	0	4	260	4.64
Sweden	2.18	0	4	302	5.39
Switzerland	1.91	0	4	361	6.45
United States	2.76	0	4	1,016	18.15
United Kingdom	2.53	0	4	1,117	19.95
Total / Average	2.34	0	4	5,599	100
Panel B: Average EMCS implementation by industry					
Industry	Mean	Min	Max	Obs.	Obs. %
Mining	2.54	0	4	229	4.09
Construction	2.40	0	4	202	3.61
Manufacturing	2.46	0	4	2,737	48.88
Transportation & Public utilities	2.22	0	4	1,153	20.59
Wholesale trade	2.05	0	4	78	1.39
Retail trade	2.50	0	4	383	6.84
Insurance & Real estate	2.28	0	4	175	3.13
Services	1.96	0	4	642	11.47
Total / Average	2.34	0	4	5,599	100

Moreover, we find a negative and significant effect of *Pollution intensity* and a positive but non-significant effect of *EMCS implementation* on future economic performance. This result is in line with previous research (Henri & Journeault, 2010) that could not find a direct relationship between EMCSs and firm performance.

Models 2 and 3 test Hypothesis 2b, which predicts that the positive relationship between EMCS implementation and performance for pollution-intensive firms will be stronger in institutional environments with powerful Green parties. To this end, Model 2 uses a sample of countries where Green parties have greater influence, and Model 3 uses a sample of countries with a lower influence from Green parties. The interaction term between *EMCS implementation* and *Pollution intensity* yields a positive and significant coefficient (p value = 0.012) for the "high Green party" sample in Model 2 and a negative and insignificant coefficient in the "low Green party" sample in Model 3. We further conduct a Wald test to test whether the coefficients are significantly different from each other. The test confirms that the interaction term in the "high Green party" sample in Model 2 is significantly larger than the one in the "low Green party" sample in Model 3. Thus, the results show that the relationship only holds true in institutional environments with higher environmental awareness.

Models 4 and 5 follow the same procedure for Hypothesis 3b, where we focus on environmental awareness in the form of Greenpeace. Again, the results confirm our expectations as we find a positive and significant coefficient on the interaction term between *EMCS implementation* and *Pollution intensity* (p value < 0.01) in countries with a greater influence from Greenpeace and a significantly smaller (negative and insignificant) coefficient in countries with a lesser influence from Greenpeace.

Models 6 and 7 apply the same procedure for Hypothesis 4b and environmental awareness, expressed in the form of critical media coverage of environmental topics. While the results in Model 6 show a positive and significant coefficient on the interaction term between *EMCS implementation* and *Pollution intensity* (coeff. = 0.003; p value = 0.059), Model 7 reveals a smaller, but still positive and less significant coefficient (coeff. = 0.002; p value = 0.09). The coefficient difference test indicates that the coefficient of the interaction term between Model 6 and 7 are not significantly different. Thus, this time, the positive relationship between EMCS implementation and performance for pollution-intensive firms holds in both samples.

Lastly, we combine our variables *Green party*, *Greenpeace*, *Media attention* into a composite measure of environmental awareness (*Overall)* and apply the same procedure as before in Models 8 and 9. Our results confirm the previous results, as we find a positive and significant coefficient on the interaction term between *EMCS implementation* and *Pollution intensity* (p value = 0.012) in the "high Overall" sample and a significantly smaller (negative and insignificant) coefficient in the "low Overall" sample. In terms of economic significance, we find that the effect of a one-step increase in EMCS implementation (e.g., from environmental metric adoption to target setting) for pollution-intensive firms (one standard deviation above the mean) on the future return on assets is 19.3 basis points in the "high Overall" sample and thus higher than in the average institutional environment.

4.3. Robustness and additional tests

To validate the results of the preceding analyses, we provide several robustness and additional tests. First, we test an alternative specification of *EMCS implementation* in our antecedents and consequences hypotheses by specifying a dummy variable indicating whether the EMCS includes the advanced stages of target setting or compensation linking. Second, as an alternative specification of firms' economic performance we now apply *Tobin's Q* and thus a market-based performance measure instead of an accounting-based performance measure. Third, we consider an ordinary least squares (OLS) regression to test our antecedent hypotheses. In all three robustness tests we find corroborating evidence. In an additional, we test an underlying assumption of our study and investigate the relationship between EMCS implementation and firms' environmental performance. In line with prior studies, we find that EMCS implementation is positively related to environmental

Table 5
Correlation matrix of all regression variables.

No.	Variables	*Mean*	*SD*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	*EMCS implementation*	2.34	1.15	1											
(2)	*Pollution intensity*	0.53	0.58	0.008	1										
(3)	*Future return on assets (ind. adj.)*	0.01	0.06	0.012	−0.038	1									
(4)	*Green party*	3.36	3.67	−0.053	−0.072	−0.021	1								
(5)	*Greenpeace*	0.52	0.73	−0.087	−0.055	0.025	0.547	1							
(6)	*Media attention*	0.14	0.04	0.074	−0.013	0.010	0.081	0.073	1						
(7)	*Overall*	0.09	1.36	−0.107	−0.119	0.037	0.693	0.833	0.092	1					
(8)	*Size*	10.13	1.43	0.345	−0.325	−0.053	−0.084	−0.073	0.051	−0.064	1				
(9)	*Leverage*	0.21	0.14	−0.032	0.177	−0.180	−0.142	−0.107	0.026	−0.160	−0.073	1			
(10)	*Growth*	0.36	0.71	−0.148	0.142	0.052	0.035	0.042	−0.011	0.070	−0.147	−0.052	1		
(11)	*Margin*	10.67	11.76	−0.005	0.084	0.554	−0.080	−0.036	−0.003	−0.031	−0.106	−0.044	0.180	1	
(12)	*Market-to-book*	1.39	1.03	−0.090	−0.099	0.636	0.019	0.063	−0.080	0.095	−0.188	−0.110	0.147	0.426	1
(13)	*Volatility*	0.03	0.03	−0.144	0.210	−0.026	−0.033	−0.013	0.013	−0.042	−0.367	0.120	0.041	0.131	0.010
(14)	*R&D ratio*	0.02	0.03	0.069	−0.238	0.089	0.125	0.095	0.044	0.171	0.102	−0.233	−0.027	0.114	0.246
(15)	*Diversification*	0.87	0.50	0.127	−0.071	−0.066	0.050	0.004	−0.011	0.024	0.262	−0.031	−0.067	−0.090	−0.148
(16)	*Board size*	2.25	0.30	0.200	−0.062	−0.068	−0.167	−0.201	0.046	−0.222	0.441	0.014	−0.119	0.033	−0.168
(17)	*Board independence*	0.76	0.16	0.057	0.002	0.019	−0.157	−0.104	0.000	−0.115	0.135	0.030	−0.063	0.064	−0.017
(18)	*Board tenure*	6.33	3.01	0.017	−0.145	0.091	0.059	0.026	0.068	0.057	0.129	−0.083	−0.012	0.083	0.119
(19)	*Board expertise*	0.10	0.14	0.189	0.178	−0.021	−0.119	−0.092	0.025	−0.120	0.139	0.083	−0.040	−0.001	−0.081
(20)	*Ownership concentration*	0.37	0.20	−0.251	0.110	−0.022	0.113	0.004	−0.006	−0.016	−0.283	0.017	0.088	0.004	−0.008
(21)	*Institutional investors*	0.41	0.25	0.169	−0.096	0.051	−0.380	−0.211	0.134	−0.261	0.160	0.087	−0.102	0.011	0.023
(22)	*English legal origin*	0.38	0.49	0.204	−0.042	0.102	−0.602	−0.404	0.159	−0.446	0.188	0.114	−0.083	0.094	0.054
(23)	*French legal origin*	0.31	0.46	−0.114	0.095	−0.103	−0.094	0.065	−0.148	−0.133	−0.100	0.029	0.052	−0.038	−0.134
(24)	*German legal origin*	0.17	0.38	−0.096	−0.063	−0.035	0.615	0.423	0.114	0.681	0.035	−0.139	0.071	−0.044	0.038
(25)	*Scandinavian legal origin*	0.14	0.35	−0.030	0.000	0.033	0.300	0.018	−0.151	0.060	−0.169	−0.047	−0.031	−0.032	0.060
(26)	*CSR law*	1.10	0.87	−0.015	0.020	−0.021	0.073	−0.109	−0.140	−0.081	−0.149	0.030	0.058	−0.043	−0.042

No.	Variables	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
(13)	*Volatility*	1													
(14)	*R&D ratio*	−0.024	1												
(15)	*Diversification*	−0.158	0.005	1											
(16)	*Board size*	−0.060	0.053	0.095	1										
(17)	*Board independence*	0.023	0.048	0.026	0.209	1									
(18)	*Board tenure*	−0.091	0.050	−0.005	0.162	−0.160	1								
(19)	*Board expertise*	0.023	−0.048	0.086	0.073	0.042	−0.073	1							
(20)	*Ownership concentration*	0.084	−0.164	−0.045	−0.056	−0.038	−0.021	−0.130	1						
(21)	*Institutional investors*	−0.020	0.056	0.007	−0.056	0.074	−0.058	0.169	−0.441	1					
(22)	*English legal origin*	−0.007	−0.004	−0.043	0.014	0.122	−0.029	0.234	−0.343	0.745	1				
(23)	*French legal origin*	0.043	−0.144	−0.028	0.237	−0.047	0.055	−0.145	0.328	−0.464	−0.523	1			
(24)	*German legal origin*	−0.070	0.158	0.052	−0.106	−0.024	0.048	−0.071	0.053	−0.255	−0.358	−0.305	1		
(25)	*Scandinavian legal origin*	0.030	0.025	0.041	−0.220	−0.084	−0.085	−0.057	−0.014	−0.149	−0.315	−0.267	−0.183	1	
(26)	*CSR law*	−0.021	−0.121	−0.067	−0.240	−0.223	−0.138	−0.009	0.091	−0.010	−0.046	0.163	−0.248	0.119	1

Notes: N = 5,599. This table presents the correlation coefficients for the variables used in our hypotheses. The superscript asterisk a means that the variable is winsorized at the 1st and 99th percentile levels. Appendix A outlines definitions and data sources for all variables. All correlations with an absolute value greater than or equal to 0.027 are significant at the 5 percent level.

Table 6
Antecedents of EMCS implementation.

Model	1	2	3	4	5
Dependent variable	*EMCS implementation*	*EMCS implementation*	*EMCS implementation*	*EMCS implementation*	*EMCS implementation*
Pollution intensity	0.630***	0.645***	0.634***	0.673***	0.715***
	(4.451)	(4.651)	(4.566)	(4.533)	(5.198)
Green party		0.025			
		(0.928)			
Pollution intensity × Green party		0.062**			
		(1.903)			
Greenpeace			0.004		
			(0.034)		
Pollution intensity × Greenpeace			0.444***		
			(2.395)		
Media attention				−0.867	
				(−0.617)	
Pollution intensity × Media attention				5.007***	
				(2.666)	
Overall					0.022
					(0.272)
Pollution intensity × Overall					0.238***
					(3.269)
Size	0.423***	0.426***	0.423***	0.425***	0.428***
	(6.246)	(6.293)	(6.249)	(6.271)	(6.300)
Leverage	−0.737*	−0.706	−0.699	−0.691	−0.663
	(−1.672)	(−1.593)	(−1.571)	(−1.559)	(−1.489)
Growth	−0.152**	−0.155**	−0.156**	−0.151**	−0.160**
	(−2.274)	(−2.292)	(−2.282)	(−2.243)	(−2.339)
Margin	0.010**	0.010**	0.010**	0.009**	0.010**
	(2.030)	(2.084)	(2.094)	(1.963)	(2.139)
Market-to-book	−0.044	−0.040	−0.042	−0.040	−0.042
	(−0.565)	(−0.523)	(−0.534)	(−0.516)	(−0.537)
Volatility	−3.872**	−3.920**	−3.693*	−3.966**	−3.666*
	(−1.976)	(−2.033)	(−1.904)	(−2.028)	(−1.913)
R&D ratio	1.496	1.528	1.693	1.612	1.809
	(0.678)	(0.702)	(0.784)	(0.737)	(0.834)
Diversification	0.194*	0.187*	0.190*	0.189*	0.185*
	(1.725)	(1.664)	(1.698)	(1.676)	(1.650)
Board size	0.403	0.393	0.350	0.398	0.346
	(1.528)	(1.488)	(1.337)	(1.510)	(1.310)
Board independence	0.038	0.054	0.013	0.049	0.034
	(0.105)	(0.147)	(0.035)	(0.135)	(0.092)
Board tenure	−0.026	−0.030	−0.028	−0.027	−0.030
	(−1.200)	(−1.354)	(−1.302)	(−1.217)	(−1.393)
Board expertise	0.991	1.009*	1.016*	0.954	1.011*
	(1.642)	(1.658)	(1.675)	(1.580)	(1.660)
Ownership concentration	−1.676***	−1.699***	−1.766***	−1.680***	−1.761***
	(−5.019)	(−5.144)	(−5.196)	(−5.057)	(−5.128)
Institutional investors	−0.677**	−0.665*	−0.685**	−0.686**	−0.702**
	(−1.982)	(−1.946)	(−1.984)	(−1.994)	(−2.044)
English legal origin	0.706***	0.798***	0.687***	0.727***	0.677**
	(2.895)	(2.840)	(2.705)	(2.939)	(2.552)
French legal origin	−0.187	−0.107	−0.152	−0.186	−0.155
	(−0.826)	(−0.443)	(−0.675)	(−0.820)	(−0.680)
German legal origin	−0.449*	−0.521**	−0.441*	−0.437*	−0.505*
	(−1.757)	(−1.973)	(−1.675)	(−1.690)	(−1.715)
CSR law	0.128	0.109	0.118	0.120	0.109
	(1.484)	(1.222)	(1.359)	(1.386)	(1.253)
Industry effects	yes	yes	yes	yes	yes
Year effects	yes	yes	yes	yes	yes
Model chi-square	687.90***	691.94***	687.89***	691.60***	688.09***
Pseudo r-squared	0.125	0.126	0.127	0.126	0.128
N	5,599	5,599	5,599	5,599	5,599

Notes: Models in Table are ordinal logit models. ***, **, and * indicate significance at the 1%, 5%, and 10% level. One-tailed for hypothesized effects, two-tailed for control variables. Z-statistics are provided in parentheses. Standard errors are clustered at the firm level. Detailed information on all regression variables is provided in Appendix A.

performance. Finally, we also used the EMCS dummy specification to apply an entropy balancing approach. Entropy balancing adjusts the control group (i.e., observation with no or weak EMCS) to reduce systematic differences in observable characteristics between the treatment (i.e., observation with strong EMCS) and the control group. This likely also reduces systematic differences in unobservable characteristics between the two groups (Hainmueller & Xu, 2013; Shipman, Swanquist, & Whited, 2017). When estimating the consequences of EMCS implementation on the entropy balanced sample, our results are similar to our main results. The results of all these tests are available from the authors upon request.

5. Discussion and conclusion

This study is motivated by calls to improve our understanding of the antecedents and consequences of EMCSs (Gond, Grubnic, Herzig, &

Table 7
The performance consequences of EMCS implementation.

Model	1	2	3	4	5	6	7	8	9
Dependent variable	*Future return on assets (ind. adj.)*								
Sample	*All*	*high Green party*	*low Green party*	*high Greenpeace*	*low Greenpeace*	*high Media attention*	*low Media attention*	*high Overall*	*low Overall*
EMCS implementation	0.000	−0.001	0.002	−0.001	0.002*	0.001	0.000	−0.001	0.002
	(0.459)	(−0.599)	(1.226)	(−0.624)	(1.329)	(0.487)	(0.045)	(−0.713)	(1.259)
Pollution intensity	−0.011***	−0.011**	−0.012*	−0.017***	−0.006	−0.019***	−0.006	−0.011**	−0.012**
	(−2.553)	(−2.316)	(−1.649)	(−3.537)	(−1.030)	(−3.801)	(−0.972)	(-2.203)	(-1.655)
EMCS implementation × Pollution intensity	0.002*	0.005**	−0.001	0.006***	0.000	0.003*	0.002*	0.005**	−0.001
	(1.642)	(2.263)	(−0.747)	(2.358)	(−0.093)	(1.568)	(1.342)	(2.259)	(-0.784)
Size	−0.004	−0.004	−0.004	−0.001	−0.009	−0.004	−0.005	−0.003	−0.004
	(−1.464)	(−1.316)	(−0.846)	(−0.543)	(−1.664)	(−1.677)	(−0.892)	(-1.262)	(-0.792)
Leverage	−0.041***	−0.036***	−0.054***	−0.040***	−0.048***	−0.049***	−0.032**	−0.037***	−0.056***
	(−4.009)	(−2.835)	(−3.559)	(−3.057)	(−3.270)	(−3.558)	(−2.073)	(-2.826)	(-3.869)
Growth	−0.003**	−0.004**	0.000	−0.005***	0.000	−0.003*	−0.002	−0.004**	0.000
	(−2.034)	(−2.088)	(−0.157)	(−2.815)	(0.145)	(−1.699)	(−1.191)	(-2.385)	(0.209)
Margin	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.003***	0.002***	0.002***
	(13.351)	(10.399)	(9.664)	(11.337)	(8.152)	(11.743)	(8.434)	(9.763)	(10.884)
Market-to-book	0.024***	0.023***	0.025***	0.023***	0.024***	0.022***	0.026***	0.024***	0.024***
	(11.842)	(9.607)	(6.758)	(9.023)	(7.706)	(8.289)	(8.785)	(9.728)	(6.906)
Volatility	−0.053	−0.065	−0.042	−0.030	−0.086*	−0.040	−0.069	−0.052	−0.058
	(−1.487)	(−1.356)	(−0.792)	(−0.634)	(−1.732)	(−0.779)	(−1.445)	(-1.055)	(-1.140)
R&D ratio	0.033	0.058	−0.038	0.051	−0.040	0.033	0.034	0.024	0.025
	(0.470)	(0.678)	(−0.302)	(0.513)	(−0.395)	(0.358)	(0.320)	(0.265)	(0.226)
Diversification	−0.004*	−0.003	−0.005	−0.003	−0.003	−0.004	−0.003	−0.002	−0.007*
	(−1.658)	(−1.224)	(−1.206)	(−1.318)	(−0.960)	(−1.547)	(−0.818)	(-0.911)	(-1.713)
Board size	−0.004	0.001	−0.015**	−0.004	−0.003	−0.005	0.001	0.001	−0.014*
	(−0.672)	(0.158)	(−2.010)	(−0.579)	(−0.363)	(−0.800)	(0.134)	(0.110)	(-1.879)
Board independence	0.001	0.002	−0.005	0.002	0.002	−0.013	0.009	0.005	−0.006
	(0.095)	(0.286)	(−0.393)	(0.191)	(0.207)	(−1.471)	(0.996)	(0.621)	(-0.498)
Board tenure	0.000	0.000	0.000	0.000	−0.001	0.000	0.000	0.000	−0.001
	(−0.058)	(−0.122)	(−0.159)	(0.729)	(−0.919)	(−0.297)	(0.600)	(0.675)	(-0.985)
Board expertise	−0.004	0.001	−0.011	0.006	−0.017	−0.004	−0.003	0.003	−0.012
	(−0.583)	(0.092)	(−0.839)	(0.679)	(−1.479)	(−0.393)	(−0.237)	(0.394)	(−0.915)
Ownership concentration	−0.003	−0.008	0.016	−0.013	0.020	−0.013	0.002	−0.007	0.012
	(−0.416)	(−0.946)	(0.894)	(−1.377)	(1.551)	(−1.121)	(0.244)	(−0.817)	(0.688)
Institutional investors	−0.009	−0.004	−0.016	−0.001	−0.022**	−0.017**	0.007	−0.002	−0.022**
	(−1.434)	(−0.591)	(−1.366)	(−0.111)	(−2.331)	(−2.533)	(0.643)	(−0.251)	(−2.022)
Constant	0.005	−0.009	0.046	−0.025	0.062	0.040	−0.021	−0.016	0.050
	(0.184)	(−0.323)	(0.843)	(−0.952)	(1.193)	(1.313)	(−0.459)	(−0.611)	(0.915)
Firm effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
adj. r-squared	0.371	0.365	0.402	0.378	0.379	0.355	0.399	0.362	0.409
N	5,588	3,888	1,700	3,363	2,225	2,942	2,646	3,789	1,799
Wald-test coefficient, difference of *EMCS implementation x Pollution intensity change* for high versus low sample		$\chi^2(1) = 5.35$**		$\chi^2(1) = 4.67$**		$\chi^2(1) = 0.12$		$\chi^2(1) = 5.47$***	

Notes: Models in Table are firm-fixed effects models. ***, **, and * indicate significance at the 1%, 5%, and 10% level. One-tailed for hypothesized effects, two-tailed for control variables. T-statistics are provided in parentheses. Standard errors are clustered at the firm level. Detailed information on all regression variables is provided in Appendix A.

Moon, 2012; Guenther et al., 2016; Lisi, 2015). EMCSs measure and control firms' environmental performance and thereby they provide a foundation for informed corporate environmentalism decision-making. We approach EMCSs from an economic perspective and theorize internal and external contingency factors that drive both the economic performance and the decision to implement EMCSs. We argue that the level of environmental costs induced by a firm's pollution intensity drives the economic benefits and thus the firm's economic motivation behind implementing an EMCS. We further expect that this relationship between environmental costs and the economic benefits (motivation) of implementing EMCSs is contingent on the level of environmental awareness in the institutional environment. Specifically, we argue that the environmental awareness of the institutional environment determines the degree to which environmental costs translate into financial costs. Hence, the institutional environment is critical for the potential of EMCSs to reduce financial costs and thus translate into economic benefits. We investigate our predictions by introducing a new (archival) measure of EMCS implementation. This measure allows us to run tests based on a large longitudinal data set consisting of more than 5,000 firm-year observations between 2005 and 2016. Our results and several robustness tests support our predictions.

5.1. Contribution to the literature

Our study contributes to the literature in several ways. First, we contribute to environmental management accounting research (Henri et al., 2014; Henri & Journeault, 2010; Lisi, 2015; Pondeville et al., 2013; Rötzel et al., 2019) by shedding light on the economic-oriented antecedents of EMCS implementation. By following Guenther et al. (2016) and focusing not on whether but rather when it pays to be green, we highlight the contingency roles of environmental costs and institutions' environmental awareness. Specifically, this study indicates that institutional awareness can shape the economic motivation of pollution-intensive firms to implement EMCSs. Thereby, we increase the empirical evidence on EMCSs and its performance consequences by pointing to the interplay between internal and external factors

determining the economic benefits of environmentally friendly firm decisions. This calls for a cautious interpretation of single-country findings on the performance consequences of environmentally friendly firm decisions.

Second, we add to the understanding of the relevance of the institutional environment in form of stakeholder groups for environmental-related firm decisions (Habisch et al., 2011; Rodrigue et al., 2013; Zyglidopoulos et al., 2012). In this vein, our work is related to the study by Aragón-Correa et al. (2020), who emphasize that often non-mandatory pressure is not enough to improve firms' environmental outcomes. We extent this stream of research by highlighting the influence of relevant stakeholder groups exemplified by their pressure on firms to internalize environmental costs. Given the context of pollution-intensive firms, we find that stakeholder pressure can beacon firms to improved environmental performance via economic incentives. Thus, our results also demonstrate the effectiveness of the institutional environment in improving environmental outcomes (Ali et al., 2022; Frías-Aceituno, Rodríguez-Ariza, & García-Sánchez, 2013; Garcia-Sanchez, Cuadrado-Ballesteros, & Frias-Aceituno, 2016) and also point to the power of regulatory pressure (Ali et al., 2019).

Third, our empirical approach to gather information about the degree of EMCS implementation for a broader dataset enables additional, reconciling evidence in the field. Based on Asset4 and publicly available data we open up the possibility of running a longitudinal analysis across multiple industries and countries in this stream of research. Thus, we respond to Hristov et al.'s (2021) call for studies going beyond the manufacturing industry and across different countries in the investigation of EMCS. Further, we reconcile indications from surveys and case studies on either the antecedents or the outcomes of EMCS by jointly examining the relation between the economic motivations arising from environmental costs and their consequences for implementation decisions of EMCS.

5.2. Practical implications

Our study provides implications for firms, policy makers, and society at large. For firms, our findings suggest that the cost–benefit evaluation and thus the decision to implement EMCSs hinges on the environmental costs, which are determined by the firm's pollution intensity and the level of environmental awareness in the institutional environment. Given these conditions, EMCSs can significantly increase firm performance. However, considering the rapidly increasing environmental awareness around the globe put forward by, for example, the Fridays for Future movement, the potential economic benefits of EMCS implementation should be considered by an increasing number of firms across different institutional environments. In this vein, our study offers a more nuanced perspective by demonstrating that EMCS implementation can actually attenuate the real effects behind common claims, such as corporate environmentalism "hurting businesses" or "killing jobs." For policy makers and society, our study exemplifies an effective means for motivating firms to act proactively with regard to environmental topics. In particular, we show that when society shows heightened awareness toward environmental issues, firms aim to comply with this environmentally friendly attitude, while firms tend to be more reserved regarding environmentally friendly decisions in less aware societies. Increasing environmental awareness in the broader society thus clearly helps to increase corporate environmentalism.

5.3. Limitations and future research

Additionally, some caveats of our study are worth noting. First, we rely on secondary data derived from firms' disclosure (from Asset4 and self-collected data). Regarding the disclosure of information about EMCSs, we expect firms to report such information voluntarily because they should perceive the disclosure as potentially beneficial in terms of their stakeholder management. Nevertheless, we cannot rule out that firms may decide to overemphasize or underemphasize their EMCSs. Second, we use industry averages of single-business firms' actual pollution and assign them to the firms' business units to calculate a business-portfolio specific pollution intensity. We follow previous researchers in considering the industry averages of single-business firms as a potential proxy (D'Mello et al., 2017; Lang & Stulz, 1994; Rajan et al., 2000) for a focal firm's business units when there is a huge number of missing data points. The industry averages might, however, differ from the firms' actual pollution intensity. Third, we focus on Green parties, Greenpeace, and the media to capture environmental awareness in the institutional environment. We acknowledge that other political parties may also have ambitious environmental goals, that many more environmentally-oriented NGOs than just Greenpeace call for corporate environmentalism, and that media pressure may stem from sources such as social media that are not comprehensively captured by our proxy. Nonetheless, we believe that even if there are other players in specific countries, the proposed proxies are still likely to capture a valid tendency of environmental awareness in these countries. Finally, as with any other study that lacks a strictly exogenous shock, we face the question of whether we are facing causality or correlation. Time lags between our dependent and independent variables, as well as the inclusion of firm fixed effects, help us to alleviate some endogeneity concerns. However, we acknowledge that we cannot establish causality, which is why our findings should be interpreted with caution.

This study also opens up fruitful avenues for future research. First, additional interesting contextual factors may drive firms to implement EMCSs. In particular, it may be worthwhile studying the determinants of EMCSs from a more sociological perspective. For example, fashion motives for EMCSs and, in particular, for rather symbolic EMCS implementation could be an interesting path to explore. Second, beyond the applicability of our EMCS measure for future research, other archival sources could be used to capture complementary elements of EMCSs or to refine the construction of the EMCS elements. For example, conference calls may represent another interesting source of capital market information and communication of environmental concerns (Firk, Hennig, & Wolff, 2020; Kimbrough & Louis, 2011). Third, it may be interesting to approach EMCSs from an upper-echelon perspective and to explore the role of the top management team in EMCS implementation. The CEO, as the most powerful executive, would be an obvious choice, but also CFOs having great influence over management control system design (Firk, Schmidt, & Wolff, 2019a; Naranjo-Gil, Maas, & Hartmann, 2009), or Chief Sustainability Officers who are increasingly present in the C-suite of firms (Peters, Romi, & Sanchez, 2019), could advocate for EMCS implementation.

5.4. Conclusion

This study highlights how economic and environmental performance can be complementary goals. However, environmental awareness in the institutional environment is a prerequisite for aligning these goals and thus also for higher levels of corporate environmentalism. Our findings enrich the rather limited large-scale empirical evidence on EMCS implementation. By outlining an approach to measure EMCS implementation based on archival datasets, we hope to encourage future research to further explore the drivers and consequences of EMCSs. Such research can further broaden the understanding of why some firms decide to act in an environmentally responsible way and implement EMCSs, while others do not.

CRediT authorship contribution statement

Jan C. Hennig: Writing – review & editing, Writing – original draft, Software, Methodology, Investigation, Data curation, Conceptualization. **Sebastian Firk:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Michael Wolff:** Writing – original draft, Resources, Conceptualization. **Hülgen Coskun:** Writing – original draft, Investigation, Data curation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A:. Variable descriptions and data sources

Variable	Description	Source
Main variables		
EMCS implementation	Index variable that consists of four elements representing distinctive EMCS design choices: (1) environmental orientation, (2) environmental metric adoption, (3) target setting, and (4) compensation linking. EMCS implementation is calculated by summing up the binary-coded elements into a single measure. The value ranges from 0 (no EMCS implementation at all) to 4 (highest extent of EMCS implementation) in steps of one.	Hand-collected from annual reports and Asset4
Pollution intensity	Pollution intensity based on firms' ecological footprint adjusted by firm size. First, industry averages for emissions, energy and water consumption, and waste production are calculated for single-business firms and firms with more than 50% of their net sales in the business segments. Second, the scores are matched to all firms in the industry. Winsorized at the 1st and 99th percentiles.	Own calculations based on Asset4 and Datastream
Future return on assets (ind. adj.)	Net income before preferred dividends divided by total assets. Winsorized at the 1st and 99th percentiles. Adjusted by yearly industry averages based on the Fama-French 17 industry categorization.	Datastream
Green party	The percentage of votes won in the last national election.	Hand-collected
Greenpeace	The number of donators scaled by the country's population.	Hand-collected
Media attention	Percentage of critical news articles on environmental topics in a country per year. Environmental topics are identified by searching for words from the word list by Pencle & Mălăescu (2016) in the headline of the news articles.	Own calculations based on Ravenpack
Overall	Composite measure of overall environmental awareness computed as the sum of the standardized variables Green party, Greenpeace, and Media attention.	Own calculations
Control variables		
Size	Natural logarithm of firms' number of employees.	Datastream
Leverage	Ratio of total debt to total assets. Winsorized at the 1 st and 99th percentiles.	Datastream
Growth	Five-year percentage growth of firms' total net sales, winsorized at the 1st and 99th percentiles.	
Margin	Operating margin. Winsorized at the 1 st and 99th percentiles.	
Market-to-book	Measured as market capitalization divided by common equity. Winsorized at the 1st and 99th percentiles.	Datastream
Volatility	Standard deviation of cash-flows divided by net sales over five years. Winsorized at the 1st and 99th percentiles.	Datastream
R&D ratio	Ratio of research and development expenses to total assets. Winsorized at the 1st and 99th percentiles.	Datastream
Diversification	Entropy measure using segmental sales data, calculated as $\sum P_{ij} ln^1/P_{ij}$, where P_{ij} is the fraction of firm i's sales in business segment j. Winsorized at the 1st and 99th percentiles.	Datastream
Board size	Natural logarithm of the number of directors serving on the board.	BoardEx
Board independence	Percentage of independent directors serving on the board.	BoardEx
Board tenure	Average tenure of directors serving on the board.	BoardEx
Board expertise	Percentage of board members with environmental expertise, based on the approach by Walls & Hoffman (2013) that considers directors' employment history, board and other positions held, awards and honors received, and other activities.	Own calculations based on BoardEx
Ownership concentration	The sum of fractional holdings of the five largest shareholders.	Thomson One Banker
Institutional investors	The sum of fractional holdings by institutional investor	Thomson One Banker
Legal origin	Dummy variables for English, French, German, and Scandinavian legal origin following the classification by La Porta et al. (2006).	La Porta et al. (2006)
CSR law	The measure CSR law takes a value of 1, if the country only requires mandatory CSR-related disclosure for either commercial firms or pension funds, 2 if the country requires mandatory disclosure requirements for both commercial firms and pension funds and 0 otherwise (Dhaliwal et al., 2012).	Dhaliwal et al. (2012)

Appendix B:. Examples for the assessment of the four elements of EMCS implementation

EMCS elements	Data collection criterion	Example
Environmental orientation	Specific commitment expressed to protect the environment	"It is precisely in these circumstances that our responsibility towards our stakeholders (shareholders, employees, suppliers, customers, institutions, communities) becomes even stronger: the expectation that the Group will continue to create value and distribute it throughout the local area, keeping its care for the environment, the quality of its services and social demands at high levels, can be tangibly felt." *A2A Group [IT], CSR Report 2012, p.5*
Environmental metric adoption	Internal CER metrics as key financial performance figures	Asset4 codes for CO2 emission metrics: ENERDP023, ENERDP024, ENERDP025, ENERDP027, ENERDP096. Asset4 codes for other emission metrics: ENERDP034, ENERDP035, ENERDP040. Asset4 codes for energy metrics: ENPIDP041, ENRRDP033, ENRRDP0341, ENRRDP0342, ENRRDP0351, ENRRDP0352, ENRRDP0361, ENRRDP0362, ENRRDP0371, ENRRDP0372, ENRRDP0381, ENRRDP0382, ENRRDP039, ENRRDP0401, ENRRDP0402, ENRRDP044, ENRRDP0451, ENRRDP0452, ENRRDP0453. Asset4 codes for water metrics: ENERDP057, ENERDP058, ENERDP059, ENERDP060, ENERDP061,

(*continued on next page*)

(*continued*)

EMCS elements	Data collection criterion	Example
		ENRRDP054, ENRRDP055, ENRRDP056. Asset4 codes for waste metrics: ENERDP045, ENERDP049, ENERDP052, ENERDP056, ENERDP098.
Target setting	Specific target defined for adopted CER metric	Asset4 codes for target settings: ENERDP0161, ENRRDP0191, ENRRDP0192.
Compensation linking	Adopted CER metric part of firm's remuneration system	"Emissions management: prioritising maximum carbon efficiency and energy savings across the entire value chain, linked to executive compensation" *Statoil [NOR], Sustainability Report 2015, p. 10*

The annual report (or sustainability report) examples illustrate our methodology to assess the different elements of EMCS implementation. Each statement is identified by the firm name, its home country, the year of the corresponding annual (or sustainability) report as well as the page where the quote is mentioned.

Appendix C:. Descriptions for EMCS elements 'environmental metric adoption' and 'target setting' based on Asset4

EMCS element	Asset4 Code	Description
Environmental metric adoption		
CO_2 emissions	ENERDP023	Total CO2 and CO2 equivalents emission in tons.
	ENERDP024	Direct CO2 and CO2 equivalents emission in tons.
	ENERDP025	Indirect of CO2 and CO2 equivalents emission in tons.
	ENERDP027	Total CO2 and CO2 equivalents emission in tons per ton of cement produced.
	ENERDP096	Total CO2 and CO2 Scope Three equivalent emission in tons.
Other emissions	ENERDP034	Total amount of NOx emissions emitted in tons.
	ENERDP035	Total amount of SOx emissions emitted in tons.
	ENERDP040	Total amount of volatile organic compounds (VOC) emissions in tons.
Energy	ENPIDP041	Percentage of total energy production from nuclear energy.
	ENRRDP033	Total direct and indirect energy consumption in gigajoules.
	ENRRDP0341	Direct energy purchased in gigajoules.
	ENRRDP0342	Direct energy produced in gigajoules.
	ENRRDP0351	Coal energy purchased in gigajoules.
	ENRRDP0352	Coal energy produced in gigajoules.
	ENRRDP0361	Natural gas energy purchased in gigajoules.
	ENRRDP0362	Natural gas energy produced in gigajoules.
	ENRRDP0371	Oil energy purchased in gigajoules.
	ENRRDP0372	Oil energy produced in gigajoules.
	ENRRDP0381	Nuclear energy purchased in gigajoules.
	ENRRDP0382	Nuclear energy produced in gigajoules.
	ENRRDP039	Indirect energy consumption in gigajoules.
	ENRRDP0401	Electricity purchased in gigajoules.
	ENRRDP0402	Electricity produced in gigajoules.
	ENRRDP044	Total energy use in gigajoules per ton of clinker produced.
	ENRRDP0451	Total primary renewable energy purchased in gigajoules.
	ENRRDP0452	Total energy produced from primary renewable energy sources in gigajoules.
	ENRRDP0453	Total primary renewable energy sold in gigajoules.
Water	ENRRDP054	Total water withdrawal in cubic meters.
	ENRRDP055	Total fresh water withdrawal in cubic meters.
	ENRRDP056	Amount of water recycled or reused in cubic meters.
	ENERDP057	Total volume of water discharged in cubic meters.
	ENERDP058	Total weight of water pollutant emissions in tons.
	ENERDP060	Total weight of Chemical Oxygen Demand (COD) in the water discharged in tons.
	ENERDP061	Total weight of total suspended solids (TSS) in the water discharged in tons.
	ENERDP098	The waste recycling ratio as reported by the company.
Waste	ENERDP045	Total amount of waste produced in tons.
	ENERDP049	Total amount of non-hazardous waste produced in tons.
	ENERDP052	Total recycled and reused waste produced in tons.
	ENERDP056	Total amount of hazardous waste produced in tons.
	ENERDP059	Total weight of Biological Oxygen Demand (BOD) in the water discharged in tons.
Target setting		
	ENERDP0161	Has the company set targets or objectives to be achieved on emission reduction?
	ENRRDP0191	Has the company set targets or objectives to be achieved on water efficiency?
	ENRRDP0192	Has the company set targets or objectives to be achieved on energy efficiency?

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