

Rotterdam School of Management
Erasmus University

Erasmus Platform for Sustainable Value Creation

Sustainable finance: Insights from research

Volume 2

Gianfranco Gianfrate
Joep Houf



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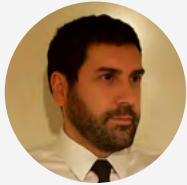
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1 Research on sustainable finance

This is the second edition of a booklet that discusses key sustainable finance research. Five leading papers have been selected and their findings are discussed. All five are academic papers of high scholarly quality with relevant managerial implications. The papers are all positioned at the nexus of sustainability challenges, finance and business strategy.

Last year's edition of this booklet focused on the risks and opportunities posed by climate change on areas such as banking, institutional investing, portfolio returns, real estate and corporate finance. This year's selection covers supply chain sustainability and networks, coordinated engagements, assessing sustainable development goal (SDG) contribution and corporate governance. The review of each article highlights the increasingly prominent role of sustainability challenges in economies and societies.

2 Introduction

The world has changed greatly over the course of 2020. The COVID-19 pandemic has a big negative impact, and it is yet uncertain how this crisis will affect our lives in the long run. The IMF speaks of the 'Great Lockdown' and the worst recession since the Great Depression. There are great social concerns: job losses, health insecurities, growing inequalities throughout global supply chains. At the same time however, we see a bittersweet development: our negative impact on the environment is decreasing.

This crisis is immediate, imminent and unique. Imagining what might happen when severe weather disasters occur or what the effects of climate change will be in the long run, is however not only a matter of reading tea leaves anymore. Ironically, we are now not only dealing with the uncertainties of the next decades to come, we are also dealing with the crude reality of today.

What truly lies at the heart of our public interest and how resilient and adaptive our global system is, will thus be the most important questions for 2020 and for the years to come. The sustainability challenges are an indispensable part of that.

This year's publication showcases some of the most sophisticated (global) sustainability research and explains the relevance for the business world. We present a concise overview of the sustainable finance topics that help to quantify risks, look for effective (new) governance mechanisms and a change of mindset. The topics cover: supply chain sustainability, active ownership, sustainable development goal contribution and corporate governance and sustainability.

The themes highlighted in this book all resonate within the Erasmus Platform for Sustainable Value Creation. Our purpose is to create a place where business and academia can help each other in formulating practical knowledge of sustainable finance. It is a place for generating meaningful insights and a forum for critical dialogues. Part of its mission is to translate scientific information into practical and actionable knowledge for businesses.

I would like to thank our fellow, Professor Gianfranco Gianfrate of EDHEC Business School, for leading this year's overview.



Dieuwertje Bosma

Project Manager of the Erasmus Platform for Sustainable Value Creation
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3 Relevance for business

This year's publication dives deeper into supply chain sustainability, effective engagement mechanisms, corporate governance and the SDGs.

Supply chain sustainability

While the demand for monitoring suppliers for unethical or irresponsible behaviour has grown, complexity in organisations and supply chains make it increasingly more difficult to do so. Supply chain monitoring poses a huge challenge. Enforcement of regulation, collective action and additional public interest could encourage supply chain sustainability. Although climate change is a widely researched topic, the effects of it in global supply chain networks have not been studied before. Research shows that even companies located in 'climate-safe' zones will be exposed to risks of climate change via their suppliers. Suppliers' revenue and income are both negatively affected by heatwaves and floods, which in turn causes effects further down the supply chain. It is expected that more managers will switch to suppliers with significant lower exposure to climate threads. As it appears, climate change can be force to drive the formation of global supply chain networks.

Effective engagement

In the institutional investment world there is currently a surge in coordinated engagements on environmental and social (E&S) issues. Leadership (where there is a lead investor who initiates, monitors and regulates the engagement) appears to be a critical factor in such engagements as success rates are elevated by up to a quarter and subsequent target company performance is significantly improved. In particular, the success rate is high when the lead investor is located in the same country as the target company. The influence of the support investors is also vital for success. When investors have greater assets under management, larger holdings in the targets and high corporate values, success rates are also boosted, particularly when the support investors are foreign. For the maximum effect, coordinated engagements on E&S issues would preferably have a lead investor based in the same country as the target and the lead investor would be supported by influential foreign investors.

Corporate governance

Furthermore, research shows that well-established corporate governance mechanisms are prerequisite for the effective monitoring, control and engagement of companies by outside investors (e.g. institutional investors). In particular, contemporary corporate governance mechanisms that focus on changing a company board's mindset by renewing its members seem to be effective and hold a strong relation with the particular company's environmental performance. Renewing board members with female directors in particular appears to drive environmental performance.

The UN SDGs

Sustainability rating and ranking agencies often use different definitions and methodologies in their scores which leads to discrepancies and incomparability. The United Nations Sustainable Development Goals (SDGs) potentially offer a solution to these problems by functioning as superordinate guidelines. Building on the premise that companies need to combine improvement on sustainability issues with financial returns, companies need to pick and choose which material SDGs to work towards rather than just selecting them at random. It is preferable for companies to score high in an area that also has a high scope of impact in order to progress towards SDG fulfilment.

4 Sustainability challenges and finance – useful knowledge

Economists, finance experts, academics and students in all parts of the world are exploring the impact of sustainability challenges on the financial sector, and vice versa. Enormous amounts of information are released on a daily basis. To keep abreast of all the latest developments and to find a practical use for this research stream, five noteworthy papers have been selected and they are explored and discussed in this research outlet. The aim is to help investors, finance professionals, corporate executives and students to better understand the relationship between sustainability challenges and finance.

Themes and papers

1 Supply chain sustainability

Kim, Y.H., & Davis, G.F. (2016). Challenges for Global Supply Chain Sustainability: Evidence from Conflict Minerals Reports. *Academy of Management Journal*, 59(6), 1896-1916.

Pankratz, N.M., & Schiller, C.M. (2019, October 25). Climate Change and Adaptation in Global Supply-Chain Networks. Available at SSRN: <https://ssrn.com/abstract=3475416>.

2 Active ownership

Dimson, E., Karakaş, O., & Li, X. (2019, October 29). Coordinated Engagements. Available at SSRN: <https://ssrn.com/abstract=3209072>.

3 Sustainable development goal contribution

Consolandi, C., Phadke, H., Hawley, J., & Eccles, R.G. (2018, November 2). Material ESG Outcomes and SDG Externalities: Evaluating the Health Care Sector's Contribution to the SDGs. Available at SSRN: <https://ssrn.com/abstract=3277421>.

4 Corporate governance and sustainability

Dyck, I.A., Lins, K.V., Roth, L. Towner, M., & Wagner, H.F. (2019, September 18). Renewable Governance: Good for the Environment?

5 Supply chain sustainability

Challenges for global supply chain sustainability: evidence from conflict minerals reports

Y.H. Kim & G.F. Davis

Relevance for businesses and business schools

The disintegration of supply chains in recent decades has reduced a company's ability to monitor and control its suppliers. Yet the demand for monitoring suppliers for unethical or irresponsible behaviour has grown due to regulations and stakeholder pressure. The extent to which companies actually investigate their complete supply chain can be driven by both their ability and their motivation to retrieve information. When considering whether SEC (U.S. Securities and Exchange Commission) filing companies consume conflict minerals, it is found that about 80% of the companies in the sample admitted that they were unable to determine their products' origins and only 1% of the companies were able to state with reasonable certainty that their products were conflict-free. Organisational complexity (in terms of international diversification) and supply chain complexity (in terms of number of suppliers) both make supply chain investigation significantly more difficult. Hence, it seems that supply chain monitoring poses a huge challenge. Enforcement of regulation, collective action and additional public interest could help to encourage supply chain sustainability.

Global supply chains and the responsibility paradox

In the 20th century corporations were mainly vertically integrated. The production and sales processes were largely performed in-house and relatively close by. Companies often acquired suppliers and distribution channels and carried most of the responsibility for the products they sold. In recent decades, however, vertical integration has been replaced by disaggregated global supply chains across many industries (e.g. Nike shoes, Apple phones and Hewlett-Packard laptops). Low-cost shipping, improved information and communication technology, and trade liberalisation have enabled this transition allowing companies to reduce production costs and boost profits. However, this has also meant that companies have lost their ability to monitor and control critical processes, including labour practices and the sourcing of supplies. Dispersed supply chains can complicate the identification of who made what and make implementing sustainability policies problematic. For example, over 50% of an average company's carbon emissions comes from its supply chain rather than from within its own boundaries.

While on the one hand these companies are becoming more disaggregated, they are at the same time being called upon to be more accountable for the practices of their suppliers, and even the actions of the states/countries in which these suppliers operate. The increasing demand for corporate social responsibility and accountability combined with the shrinking ability to deliver and control good practices reflects a responsibility paradox for corporate supply chains.

Legal mandates, conflict minerals and the Dodd-Frank Act

Voluntary social reporting without regulatory oversight and enforcement can become a ritualistic practice that often fails to meaningfully change a company's behaviour and this makes it difficult to determine which factors impact a company's ability to monitor and control its supply chain and vouch for it (e.g. state with confidence that it is conflict-free). Therefore, a growing body of research has taken advantage of regulatory interventions, rather than voluntary actions, to see which factors are associated with achieving sustainability and accountability. Legal mandates should, in principle, provide a surer path to supply chain accountability. One such regulatory intervention was the implementation of Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act, a ruling that required new disclosure and reporting by companies for 'conflict minerals' (3TG minerals - tantalum, tin, tungsten and gold) which originated in the Democratic Republic of Congo (DRC) and its adjoining countries. There were concerns that the use of conflict minerals might be financing armed groups in the DRC region. The act ensures that every SEC filing company which deems such minerals to be (1) necessary to the functionality or production of a product manufactured or (2) contracted to be manufactured by the company, must conduct a reasonable investigation into whether the company's products are clear of the use of conflict minerals.

If companies know that the minerals originated in the countries covered by the act or are from scrap or recycled sources, or if they have no reason to believe the opposite, they must disclose this information on a special disclosure form. Otherwise, they must conduct due diligence on the source and chain of custody of their conflict minerals and share the results. Companies were given the option to declare their lack of determinative knowledge for a temporary two-year period (four years for smaller reporting companies) if they were unable to determine whether their products contained conflict minerals during this period. Hence, there is a clear distinction between companies that were able to vouch for their supply chain during this two-year period and companies that were unable to declare whether their products were clean or not. This distinction is exploited to find out what drives a company's ability to monitor its supply chain.

Organisational factors behind supply chain visibility

Supply chain visibility is required in order to be able to vouch for suppliers. Higher visibility comes with a company's ability and motivation to survey the right people at the right organisation. Several factors may influence a company's ability to retrieve trustworthy and useful information.

Organisational complexity is one such factor. Large companies often have diversified revenue streams and operate throughout multiple divisions. Having several divisions frequently complicates supply chain visibility as many decisions are taken at divisional level, for instance who the supplier is. Different types of diversification are recognised (related, unrelated and international) and they each have different effects. Unrelated (i.e. different industries) and international diversification, in particular, should lead to less supply chain visibility.

Supply chain complexity is related to the amount of operational load in terms of monitoring and managing supply chain networks. It is a function of the number of suppliers, differentiation among suppliers and the level of interrelationship between suppliers. Having a large number of suppliers increases monitoring costs and complicates a company's ability to investigate the complete supply chain. Complex supply chains also have a higher change of loss, omission or corruption of information and tend to show obscure buyer-supplier relations. Hence, companies with complex supply chains could be less effective in investigating their supply chain.

Power over suppliers refers to the importance of the buyer to the supplier in terms of revenue share or switching costs. With more power comes more favourable terms and more control over the supplier's decision-making. Moreover, the supplier may put in additional effort in order to conform to their buyer's requests, including sharing of information. Therefore, having more power over suppliers gives a company leverage to escalate inquiries, leading to higher efficiency in determining supply chain sustainability.

Company visibility is also able to influence the level of supply chain opacity. Companies with high visibility receive higher levels of public attention and are, thus, subject to greater levels of external pressures and demands. Not meeting such demands can lead to detrimental results and bad publicity. Hence, companies with higher visibility are expected to put more effort into investigating their supply chain and determining the level of responsible behaviour.

Corporate reputation is another factor. Public recognition and social approval of an organisation, as well as perceptions about its quality, may function similarly to company visibility in that highly reputed companies put in more effort to meet their stakeholder's expectations. While corporate reputation can also function as a buffer and help companies receive the benefit of the doubt, companies are expected to be more concerned with upholding or building a good and strong reputation. Hence, companies that have or seek a good reputation are more effective in determining whether their products are clean.

Voluntary corporate social responsibility (CSR) participation is the final factor expected to positively influence a company's ability and motivation to investigate their supply chain. Although there are several reasons why companies may engage in voluntary sustainability programs (e.g. to improve brand image, to reach socially concerned customers, intrinsic motivation), these programs often have lasting effects on the way in which the company operates and makes decisions. Besides, if a company's positive image is tarnished, they are penalised more harshly than had they not had such a reputation. This should motivate companies active in CSR programs to also look into their supply chain to avoid being involved in scandals. Hence, companies that are voluntarily participating in sustainability-related programs are more effective in determining the level of sustainability in their supply chain.

Lessons from conflict minerals

These six factors are explored by Kim and Davis (2016) in the conflict minerals setting following the introduction of the Dodd-Frank Act. These results may give insights into the general supply chain dynamics of different industry groups.

Perhaps the most striking finding by Kim and Davis (2016) is that nearly eight out of ten of the companies studied were unable to determine the country of origin of the 3TG minerals in 2014 and 2015. The lion's share of the remaining companies stated that they had no reason to believe that their products included 3TG minerals from the Congo area. However, only 1% of all form submitters declared their products to be conflict-free with certainty beyond reasonable doubt. In some industries this percentage was higher. For example, in the primary metals industry a larger share of submitters were able to declare conflict-free minerals, arguably as a result of having direct access and complete control over smelters and refineries. However, even in such 'direct' industries the number of companies that were able to vouch for their supply chain remained low. There were also geographical differences between US companies and foreign companies. To elaborate, EU and other non-US companies were 22% less likely to admit they were unable to verify the origins of their products compared to US-based companies. This difference may stem from a company's regulatory environment. European companies, for instance, already have to remove toxic minerals from electronic products so they should be better at eradicating conflict minerals as well.

To find out which factors determined whether companies were able to declare that their products were conflict-free or whether they were unable to trace back their supplies, Kim and Davis (2016) ran an empirical test. The six hypothesised factors basically fall into two categories: ability (i.e. a company's ability to verify whether products are conflict-free) and motivation (i.e. a company's incentive to trace back its supplies). A company's ability is determined by the complexity of its organisational structure, the complexity of the supply chain and the power it has over its suppliers. A company's motivation is influenced, among other things, by the level of visibility, the company's reputation and whether it engages in voluntary sustainability programs. Organisational complexity is divided into three groups: related, unrelated and international diversification. Neither related nor unrelated diversification seems to have a significant impact on a company's ability to vouch for its supply chain. International diversification, on the other hand, seems to make verifying the origins of the company's product/s significantly harder. Companies with more foreign subsidiaries (+1 standard deviation; circa 18 countries) were 29% less likely to believe that their products were conflict-free when compared to companies with an average country scope (circa five countries).

Two measures of supply chain complexity are investigated: the number of suppliers and the differentiation among suppliers. However, only the former is found to have significant influence. Compared to companies with an average number of suppliers (circa 10 suppliers), companies with a high number of suppliers (+1 standard deviation; circa 49 suppliers) were about 19% less likely to declare that their products were conflict-free. Large supply chains thus seem to complicate product origin verification.

Power over suppliers is found to have no effect on supply chain investigation. One possible reason for the lack of support for this theory pertains to where the biggest challenge of visualising the entire supply chain already lies: not with first-tier suppliers, but with indirect ones. When companies are multiple tiers removed from the origin of materials, supply chain investigation potentially has little to do with whether the company has the control and ability to monitor direct suppliers.

With regards to the motivation hypotheses, there is no support that company visibility, as measured by the level of media attention, has a significant impact. A company's reputation, however, has a positive and significant effect, but only when the main effect of supply chain complexity is accounted for. This indicates that for companies with the same level of supply chain complexity, highly reputed companies are more likely to be able to verify product origins. Nevertheless, reputation can also be viewed as a burden since highly reputed companies experience more pressure to look into their supply chain. There also seems to be a lack of support for the positive link between voluntary sustainability programs and vouching for the supply chain.

Table 1: The effects of organisational factors on supply chain visibility

	Factor	Comment	Effect
Ability	Organisational complexity	International diversification	-
	Supply chain complexity	Number of suppliers	-
	Power over suppliers	No significant effect	+/-
Motivation	Visibility	No significant effect	+/-
	Reputation	Only when accounting for supply chain complexity	+
	Voluntary CSR programs	No significant effect	+/-

Improvement of supply chain sustainability

The research shows that companies that have a complex structure, both internally and externally, often do not have the ability to investigate and verify where their raw materials originate. Even large and visible companies, as well as those that engage voluntarily in sustainability programs, have been no better at determining whether their products involve the use of conflict minerals. The most imminent challenges regarding conflict minerals is the lack of ability to gather information, rather than the enforcement or negotiation of changes in supply chain networks. Three suggestions may help to solve the problem of supply chain opacity.

Enforcement of regulations can help overcome problematic supply chain investigations. Currently, most sustainability programs are voluntary or do not entail any sanctions. For instance, the Dodd-Frank Act does not prohibit the use of 3TG minerals; it calls for the tracing of the minerals. Such lack of enforcement leads to a failure to make meaningful changes within companies.

Collective efforts can reduce the costs of supply chain investigation. The investigation of complete supply chains requires substantial resources and commitment. Collectively, companies spend USD 709 million and six million staff hours preparing conflict mineral reports. Cooperation among companies can help reduce costs and improve material verification. Open source methods (i.e. sharing methods for verifying whether a product contains conflict minerals) and industry-certified sources can save huge amounts of money and lower the barrier

to thorough supply chain investigation. One example of a collective effort is the collaboration between ASML, Thermo Fisher Scientific and Philips to determine an effective and unequivocal approach to 3TG mineral investigation.

Public interest is the third pillar that may improve supply chain analysis. If there is more public interest in a company's supply chain, the pressure on the company will grow. Moreover, investors should also be concerned about the company's supply chain considering the significant downside risk should any scandal or calamity occur. Hence, Kim and Davis (2016) expect that as supply chain investigation draws more attention, the ability to vouch for the supply chain will lead to more material benefits in the future.

Climate change and adaptation in global supply chain networks

N.M. Pankratz & C.M Schiller

Relevance for businesses and business schools

The effects of climate change (proxied with climate shocks) have been researched in many different settings, for instance company profitability, housing prices, stock returns, financial markets and capital structure. Remarkably, the effects of climate change on global supply chain networks have not been studied before, even though this channel exposes companies located in 'climate-safe' zones to the risks of climate change via their suppliers. Suppliers' revenue and income are both negatively affected by heatwaves and floods, and these effects are propagated down the supply chain causing the financial performance of buyer companies to also be negatively affected by the climate risk exposure of their suppliers. Managers seem to recognise this risk and are 3.7 percentage points more likely to terminate a supplier relationship if the realised number of floods exceeds the expected number. For heatwaves the corresponding figure is 1.0. If the relationship is indeed terminated, managers then switch to a supplier that has a significantly lower exposure to such climate threats. On average, replacement suppliers experience 0.83 fewer heatwaves and 0.03 fewer floods than terminated suppliers over the duration of the relationship with the buyer. Hence, climate change is able to drive the formation of global supply chain networks.

Climate change adaptation

In an age in which the detrimental effects of climate change are becoming more and more apparent - take, for instance, heatwaves, forest fires and catastrophic floods - academic literature has broadly documented the adverse effects to society and economic activity. Managers and investors are increasingly looking for ways to reduce their exposure to climate change by adapting their operations and investments. However, much less is known about the effects of climate change on supply chain networks even though modern supply chains often move through those parts of the world that are most vulnerable to climate impact. Companies might thus be indirectly exposed to climate change via their suppliers or even their customers. Hence, adapting to climate change seems like a complex task. This risk has not gone unnoticed: over 50% of CEOs acknowledged climate risks in their global supply chain as a primary concern

in a survey by PwC (2015). So, the question remains as to the extent to which companies are exposed to climate change via their supply chain, and also as to how supply chain organisations should respond to this potential threat.

Heatwaves and floods

Pankratz and Schiller (2019) investigate the performance effects on companies related to the effects of climate change (i.e. extreme weather events) on supplier companies around the world. They compile a data set consisting of global supply chain relations (limited to US-based buyer companies), company financial performance and data from local climate exposure. The latter focuses on two types of climate change related shock: extreme heatwaves and flooding incidents. The main reason for focusing on these is that heatwaves and floods are regionally concentrated events, allowing for exploitation of climate data and the resulting geographic variation in climate exposure. Moreover, there is agreement in scientific research that heatwaves and floods are expected to become significantly more frequent and severe in the coming years, making these events a particularly important subject of study for assessing the future economic costs of climate change.

Heatwaves are collected by company location and follow the definition of the US National Weather Service: "spells of three or more days with daily maximum temperatures over 30 degrees Celsius". In general, it is found that buyer companies (i.e. companies that buy from suppliers and sell to customers) have a 29.8% chance of being affected by a heatwave quarterly. For supplier companies this percentage lies at 36.0%. On average, heatwaves last 24.2 days for buyer companies and 23.8 days for supplier companies. Temperatures, however, seem relatively comparable with an average temperature of 18.6 degrees Celsius for buyer companies and 18.5 degrees Celsius for supplier companies. Flood data are collected on a quarterly basis via the Dartmouth Flood Observatory. On average, buyer companies experience floods in 6.1% of all company-quarters, while supplier companies experience floods 6.0% of that time. The average number of casualties is 30.8 for buyers and 26.7 for suppliers, given a flood event of a substantial magnitude.

Suppliers' direct exposure to climate shocks

To determine the effects of supply chain exposure to climate change (shocks), first a relation between climate shocks and supplier companies needs to be established. As such, Pankratz and Schiller (2019) estimate the medium-term effects of heatwaves and floods on a supplier's turnover and profitability. A reduction in turnover of 3.9% and a reduction in operating income of 9.7% relative to the sample median is documented, conditional on the occurrence of a heatwave during one of the three previous company-quarters. Flooding incidents lead to decreases of 3.9% in turnover and 10.2% in operating income. However, these effects only become apparent when considering more than only the contemporaneous quarter (i.e. there are lagged effects of climate shocks). This complicates the investor's understanding of the link between climate shocks and company performance, possibly explaining the underreaction to a company's exposure to extreme weather events.

Supply chain exposure to climate shocks

It is important to know whether large companies which are not necessarily themselves based in climate-vulnerable geographical areas can still be impacted by climate risk exposure via their supplier network. Given the significant impact of extreme weather events on a supplier's financial performance, a downstream propagation along supply chain links is possible. However, the implications of climate shocks to buyer companies do not necessarily need to be the same as they are for suppliers. On the one hand, buyer companies could be unaffected by shocks because suppliers cannot pass their incurred costs downstream. On the other hand, buyers could include climate factors in their contingency management, enabling them to switch suppliers without incurring large costs if a specific supplier is hit by a heatwave or flood. In both scenarios, the shock would not propagate down the supply chain and buyer companies would not be negatively affected by such climate shocks.

Alternatively, climate shocks could cause supply chain glitches and lower production output at the supplier and, consequently, the buyer company level, particularly if the supplies have a high level of customisation. If climate shocks to suppliers cause distortions they can be costly and a negative relation between buyer financial performance and supplier exposure to climate risk would be a reasonable expectation.

To ensure accuracy in the analysis, suppliers and buyers located in a radius of 500 kilometres from one another are excluded. As such, buyer and supplier companies are not hit by the same climate shock. The results indicate that following the occurrence of a heatwave in a given quarter at a single (top 10) supplier, the buyer company's revenue decreases by 0.2% relative to the sample median. The consequences of floods to buyers are economically larger with a reduction in revenue and operating income of 1.8% and 2.2% respectively. These effects last for up to four quarters after the disaster. Such numbers indicate that climate change related shocks can propagate down the supply chain. Companies located in 'climate-safe' parts of the world can still be affected by climate change if their supply chains span the world.

Supply chain adaptation

Supplier climate shocks are found to negatively affect a supplier's own performance which is, consequently, propagated downstream along the supply chain eventually impacting the buyer's financial performance. This could provide a reason for managers to actively monitor the climate change related risks of their suppliers and to act if threatening levels are reached. For instance, managers could terminate supplier relations and choose alternative suppliers.

In general, it has been found that if realised climate risk exceeds expected (or anticipated) climate exposure, there is an increased chance of the supplier-buyer relationship being terminated. These results suggest that increases in flood exposure increase the probability of a supply chain relationship being ended by 3.7 percentage points on average. Heatwaves have a similar impact but on a smaller economical scale (1.0 percentage points). To put this in perspective, the unconditional expectation of a terminated supply chain relationship is 15.1% in

any given year. Another interesting finding is that when Pankratz and Schiller (2019) consider only the occurrence of climate shocks, rather than measuring whether realised climate shocks exceeded expected climate shocks, a much smaller and statistically insignificant impact on the likelihood of supply chain relation termination is documented. This shows that managers are indeed taking climate risk into consideration when entering into supply chain relations.

Managers terminating supplier relationships do not necessarily have to understand the link between climate risk exposure and financial performance as the reason for terminating a relationship. Possibly, these managers only observe the adverse financial effects of direct or indirect climate shocks without considering climate risk as an underlying driver of financial performance effects. If managers are aware, however, it is reasonable to assume that the new supplier would have a significantly lower climate risk exposure than its old counterpart. Research shows that replacement suppliers have, on average, 0.83 fewer heatwaves and 0.03 fewer floods than terminated suppliers, measured over the duration of the relationship with the terminated supplier. This suggests that managers do indeed respond to climate change exposure in their supply chain network by switching from high-risk to low-risk suppliers. Hence, climate change can drive the formation of global production networks.

6 Active ownership

Coordinated engagements

E. Dimson, O. Karakaş & X. Li

Relevance for businesses and business schools

In the institutional investment world there is currently a surge in coordinated engagements on environmental and social (E&S) issues. Leadership (where there is a lead investor who initiates, monitors and regulates the engagement while sacrificing significant costs and resources) appears to be a critical factor in such engagements as success rates are elevated by up to a quarter and subsequent target company performance is significantly improved. In particular, the success rate is high when the lead investor is located in the same country as the target company. The influence of the support investors is also vital for success. When investors have greater assets under management, larger holdings in the targets and high corporate values, success rates are also boosted, particularly when the support investors are foreign. Hence, for maximum effect, coordinated engagements on E&S issues would preferably have a lead investor based in the same country as the target and the lead investor would be supported by influential foreign investors. Investors are most likely to lead when their stakes in the target are high and the target is located domestically. If engagements lead to success, this may also lead to increased stock returns (if the engagement has a lead investor) and improved sales and profitability in the medium to long term. Organising such engagements through a third-party platform (such as the PRI Collaboration Platform) can significantly reduce the costs associated with engagement. Moreover, it can alleviate the free-rider problem which poses a huge barrier to active ownership.

Collaborative and coordinated engagements

Shareholders can influence management through various channels, for instance at annual general meetings or other direct meetings. If shareholders engage with companies on a certain topic, they exercise their 'voice'. Large shareholders usually have a louder voice as they have more power to steer company direction. Although the results of engagement by one shareholder with limited voice may be negligible, collectively shareholders can be quite intimidating for company management.

There are several benefits to collaborative engagements as opposed to single shareholder engagements. First and foremost, resources and influence are pooled; active investors can achieve greater success via greater voting power and an amplified voice. Secondly, efficiency is improved by borrowing expertise from group members who are more knowledgeable about an issue or target company, and by sharing research costs. This is especially advantageous for smaller investors who are too resource-constrained to afford an in-house engagement team. Thirdly, collaborative engagements facilitate risk-sharing among active owners. For instance, an active owner may be reluctant to engage a target company on a solo basis due to the risk of impairing existing business relations. Engaging as part of a larger coalition may enable active owners to share this risk.

Collaborative engagements also face some challenges. The first challenge is the free-rider problem: the costs may be borne by a small group of committed and resourceful investors while the benefits are shared by all coalition partners. A second challenge arises when considering the difficult and time-consuming nature of collaborative engagements. Investors may have different objectives and interests making it harder to reach agreement and the resulting delay may reduce the effectiveness of the engagement for time-sensitive issues. Finally, potential regulatory barriers in certain markets could dissuade investors from behaving as a concerted party.

There are several collaboration platforms that help to exploit the benefits and overcome the challenges of collaborative engagements, the most well-known being the PRI Collaboration Platform. Collaboration platforms act as a third party for initiating and coordinating engagements. Close cooperation between the platform and its signatories and local authorities may clarify ambiguity concerning regulatory barriers. Moreover, some platforms employ in-house experts for specific issues and their knowledge can be used to proactively identify issues and find solutions. The PRI Collaboration Platform also found it helpful to identify one or more lead investors to drive the initiative forward, accompanied by a larger number of supporting investors who provide more limited resources. This engagement structure alleviates the coordination problems and eases decision-making. Further, the free-rider problem in engagements through a collaboration platform would be reduced as the major costs of coordination and research are borne by the collaboration platform (PRI for example), which is funded through a fee paid by all signatories. Hence, a collaborative engagement through a platform will naturally find itself to be better structured and more coordinated.

Shareholder activism on sustainability

Responsible investing has become a noteworthy feature in the financial world. According to the Global Sustainable Investing Alliance approximately \$23 trillion is invested following the responsible investment criteria. As a result of growing international pressure, environmental and social (E&S) issues have become especially important in the institutional investment world. One way to configure responsible investing is to actively monitor and engage with portfolio companies on E&S topics.

However, it is often argued that the CSR activities of companies lack a conclusive business case. Possibly this is at the heart of the opacity of the effects of sustainability on financial performance (or vice versa) and hence it is difficult to determine whether E&S engagements improve financial performance. Two different types of E&S engagement are recognised among academics: shareholder activism and social activism. Shareholder activism refers to the conflict between managers and shareholders, and it seeks to create value for the latter. Social activism, on the other hand, refers to personal investor (i.e. portfolio manager) decisions of pursuing their own moral values or political interests at the expense of the shareholder.

Given the increased attention to responsible investing and the surge in E&S engagements, it is interesting to see who the actual probable targets for engagement are, how likely success is and what the financial outcomes for the coalition partners are. To answer these questions

Dimson et al. (2019) study a set of coordinated engagements which originated via the PRI Collaboration Platform.

Target companies

In the search for which companies are likely to be targeted, Dimson et al. (2019) study 31 PRI-coordinated engagement projects. These projects encompass many different engagements on either environmental, social and governance (ESG) issues or SDG-related issues. In total these projects consist of 1,671 unique engagement sequences (i.e. a dialogue with a target company in relation to a particular project). The number of target companies in each project ranges from seven to 163.

The target companies are geographically dispersed across a total of 63 different countries, and yet companies in some countries are more likely to be targeted than others. To elaborate, in the US there have been a total of 163 targets, in the UK 67, in Japan 62 and in France 61. Although the intensity (i.e. number of engagement sequences) differs, in general the targets are most likely to come from one of these four countries. In the Netherlands only 13 companies have been targeted. Apart from geographical dispersion, target companies are also active in different industries, the most being active in manufacturing (462), infrastructure and utilities (142), wholesale or retail (97) and mining (96).

By comparing target financials with peers from the same country and industry in the year before the engagement, it can be seen that it is predominantly large companies with a lower sales growth rate and a higher percentage of foreign sales that are targeted. This implies that both domestic and international reputation concerns play an important role in targeting companies. In addition, when compared to their peers, target companies are found to have a lower stock return volatility, lower insider ownership (i.e. management-owned shares), higher long-term institutional ownership and higher equity holdings from the engaging group. The higher equity holdings from the engaging group reflects the investors' preference to engage with companies in which they have enough voice and 'skin in the game'. The lower level of insider ownership may lead to less resistance to proposed advancements in responsible behaviour. Target companies are also found to have higher overall ESG ratings, consistent with PRI's proactive approach of targeting bellwether companies to set example, rather than reactively fixing ESG problems as they arise.

Engaging companies

Characteristics of engaging companies

On a similar note, the general characteristics of the investor (engagement) side are analysed by Dimson et al. (2019). Over half of the investors are located in just four countries: the UK, the US, the Netherlands and Canada. Likewise, lead investors are typically from the same four countries; lead investors from these four countries were responsible for leading over half of all engagements that had lead investors. Surprisingly, in the full list of PRI collaborative engagements, it seems that Japan has never had an asset owner participating in such an initiative, possibly because activism is not positively received in Japan and is generally resisted

in Japanese public companies. With regards to investor type, the authors differentiate between asset owners, investment managers and service providers. Asset managers seem to be the largest category of engagers through PRI and are also most often the lead investor. The three largest active asset managers in the Netherlands are APG AM, AEGON AM and PGGM investments. The top three investors with the most engagements are the UK-based asset manager Aviva Investors (1,018 engagements, 13 as lead), the US-based Boston Common Asset Management (978 engagements, 141 as lead) and the Netherlands-based asset manager Robeco (908 engagements, 86 as lead). Surprisingly, the world's biggest asset managers (BlackRock, Vanguard and State Street) refrain from any PRI collaborative engagements. Perhaps, with their substantial in-house resources, these organisations prefer to engage alone. In the tables below investors are ranked by the number of engagements and the number of leads (acting as lead investor). One possible explanation for the different levels of engagement and active ownership is corporate culture. Companies that are rated higher by their employees have been active as lead investor more often than companies that have an average rating, although this finding is not statistically significant.

Table 2a: Characteristics of top 10 investors listed by number of engagements

Institutional investors ranked by total number of engagements					
Investor name	HQ	Type	AUM (\$B)	# Engagements	# Leads
Aviva Investors	United Kingdom	AM	438.2	1,018	12
Boston Common	United States	AM	2.2	978	141
Robeco	Netherlands	AM	146.2	908	86
Amundi	France	AM	1158.7	898	20
NI LGO	United Kingdom	AO	7.4	867	0
Candriam Investor	Luxembourg	AM	109.1	857	0
CPPIB	Canada	AO	210.1	832	13
MN	Netherlands	AM	131.9	809	97
The Cooperative	United Kingdom	AM	2.7	803	56
NZ Superannuation	New Zealand	AO	23.2	799	0

Table 2b: Characteristics of top 10 investors listed by number of engagements led

Institutional investors ranked by number of engagements led					
Investor name	HQ	Type	AUM (\$B)	# Engagements	# Leads
APG Asset Mgt.	Netherlands	AM	523.1	318	185
Hermes Investment	United Kingdom	AM	34.3	306	182
Hermes Equity OS	United Kingdom	SP	n.a.	228	182
Boston Common	United States	AM	2.2	978	141
PGGM Investments	Netherlands	AM	220.3	624	124
ACTIAM	Netherlands	AM	58.6	719	101
Martin Currie	United Kingdom	AM	14.4	40	98
MN	Netherlands	AM	131.9	809	97
Threadneedle	United Kingdom	AM	129.7	417	96
BMO Global	Canada	AM	237.0	542	87

Determining factors of decision to engage

Apart from the characteristics of the engaging companies, there are additional factors that seem to drive engagement through the PRI platform. Dimson et al. (2019) find that an important role in incentivising a PRI signatory to become involved is being in the same country as the target. Moreover, being located in the same region (i.e. continent) but in a different country does not impact this decision, suggesting that cultural similarity and linguistic advantages, rather than geographical distance, are most likely to create incentives for engagement. This also suggests that investors may be subject to home bias, where investors are more interested in issues related to local companies and care more about local clients and, therefore, seek to be involved in engagements close to home. Another factor driving engagement is past experience. Being a member of PRI before a certain project starts increases the likelihood of participation. This suggests that information sharing and processing between the PRI and the signatory is an important motivation for participating. However, it should be noted that in some cases an institution joined an engagement before becoming a PRI signatory; membership of PRI is not a prerequisite for joining an engagement. An investor's stake in the target, however, plays a limited role in the decision to join an engagement initiative. Two opposing effects could account for this. On the one hand, investors may prefer to engage alone if their ownership is relatively high, and on the other hand, engagement also requires certain influence in the company, which is mainly achieved through ownership.

There are also several determinants of the choice to play the lead role. Being the lead entails being the point of contact, posting the invitation, reporting back to the PRI periodically and committing significant time and resources to the engagement. The incurred costs are mainly for the lead investor while the benefits (e.g. improved company performance and/or increased stock price) are shared among all shareholders. In these engagements, the free-rider problem may disincentivise investors from playing a lead role. Consistent with this conjecture, lead

investors are typically found to have a larger share in the company (i.e. more 'skin in the game'), meaning that the benefits are mostly reaped by the lead investor itself. Moreover, becoming a lead investor is more likely when the investor and the target are located in the same country. Arguably this is a result of lower engagement costs, higher familiarity with the interests in the matter and higher benefits of engagements through reputational enhancement.

Becoming a support investor, on the other hand, is less likely if the investor is already busy with other projects. Interestingly, whether target companies are domestic to the investor is not a determinant of becoming a support investor, possibly due to PRI's preference for foreign members in the coalition. Past and ongoing engagement experience decreases the likelihood of being a support investor, consistent with the costly nature of engaging.

Outcome of engagements

Having engaged with a coalition of investors, the engagement itself may or may not be successful. On average the success rate for PRI engagements as analysed by Dimson et al. (2019) is 42%. Some target company characteristics are found to have an impact on this percentage. To elaborate, target company size (measured by market capitalisation) and market-to-book ratio seem to negatively influence success rates. This suggests that success is less likely when the target is large, potentially due to the higher voting power investors have in relatively small companies. Similarly, success is less likely among high growth companies (high market-to-book ratio) potentially because such companies cannot afford costly E&S changes. Success is more probable when there is a larger long-term institutional holding in the target company, which enhances receptivity to long-term, value-enhancing changes.

Apart from target company characteristics, engagement process specifics can also determine success. In particular, the presence of a lead investor can boost the probability of success tremendously, by an estimated 16% to 25% depending on the statistical model. This increased chance of success is bolstered if the engagement is supported by an influential group of investors (greater shareholding, larger assets under management and higher employee rating). In a deep dive into the impact of lead investors, it seems that a larger shareholding and larger assets under management positively influence the success of engagements. Furthermore, the average employee rating of the lead investor also plays a role in the success of the engagement. This is not surprising. Given that lead investors are responsible for directly contacting the target company, the cultural impact of leaders is likely to be more instrumental. It also suggests that the corporate culture of the lead investor has to measure up to the commitment of its leadership role in the collaborative engagement. In the absence of a lead investor, success rates are also found to be substantially improved when pension plans constitute a majority of the coalition.

The impact of investor location on engagement success is also noteworthy. Having influential (i.e. high shareholdings and larger assets under management) foreign investors significantly increases success rate. This supports the view that having foreign investors on board broadens the scope and impact of the engagement, especially when those investors are influential. In addition, success is more probable when the lead investor is located domestically and is influential. The reason for this

is that local leaders already have local knowledge and expertise, leading to improved effectiveness. To sum up, the most effective structure for coordinated E&S engagements involves appointing local lead investors who have high stakes and influence and who are supported by influential foreign support investors.

Engagement results

A compelling question related to coordinated E&S engagements is how current market participants think about these events. As such, Dimson et al. (2019) document a significant increase in annual abnormal stock returns within three years after the engagement initiation, relative to the pre-engagement level for the subsample of engagements with lead investors. For engagements without a leader, no significant change in the target company's stock performance is found. This indicates that leadership in an engagement coalition is associated with a positive shareholder outcome. Unsuccessful engagements, on the other hand, especially those without a lead investor, seem to yield significant negative stock performance. Collectively, this indicates that coordinated engagements are value-enhancing provided that the engagements are headed by a lead investor and are successful. On another note, stock return volatility seems to decrease after a successful engagement with a lead investor, while it increases after unsuccessful engagements without a lead.

Company sales and profitability can also be impacted by E&S engagements. Subsequent to engagements with a lead investor, an increase in return on assets and sales growth is documented, especially in the second and third year after engagement. This is not surprising given the average of two years for a project to complete. Similar findings are observed after successful engagements. Unsuccessful engagements, however, do not seem to impact company performance heavily. Hence, it appears that successful engagements on E&S issues lead to improvements in a company's sales and profitability (even more so for engagements with lead investors).

Interestingly, after successful engagements with lead investors, the lead investors appear to take increasing stakes in the target company. Such results are not observed after unsuccessful engagements. This could be a result of lead investors increasing their holdings in the target after foreseeing success as value-enhancing. This could also be driven by lead investors who increase holdings as an additional bargaining tool (i.e. increased voice) to achieve success. Additionally, supporting investors seem to decrease holdings after engagements, which may be partially due to realising profits or avoiding losses.

These results suggest that successful engagements lead to improvements in the profitability of the target companies in the medium term and long term. Increases in the lead investor's holding in the target post-engagement suggest that these entities are 'universal owners' with positions that are to be held over a long investment horizon. The decreased holding of some investors in the first year after engagement may be a result of these investors realising potential gains or reversing overweight positions that had been necessary to boost their voice.

7 Sustainable development goal contribution

Material ESG outcomes and SDG externalities: evaluating the healthcare sector's contribution to the SDGs

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Relevance for businesses and business schools

Sustainability rating and ranking agencies often use different definitions and methodologies in their scores which leads to discrepancies and incomparability. The United Nations Sustainable Development Goals (SDGs) potentially offer a solution to these problems by functioning as superordinate guidelines. Building on the premise that companies need to combine improvement on sustainability issues with financial returns, companies need to pick and choose which material SDGs to work towards rather than just selecting them at random. A framework that connects industry materiality to the SDGs and specific SDG targets helps to map the scope of impact of a company or industry on individual SDGs. Combining the scope of impact with a weighted ESG performance score on material ESG issues should help investors and policymakers determine their asset allocation or point of focus. Scoring high in an area that has low impact would not appear to be very effective. It is preferable for companies to score high in an area that also has a high scope of impact in order to progress towards SDG fulfilment.

Sustainability rating incomprehensibility

Amid the global rise in sustainability standards, metrics and ratings, a high-level framework for environmental and social impacts has been developed by the United Nations: the Sustainable Development Goals. This framework is used by many companies to guide resource allocation decisions or highlight those in place. There are, in total, 17 different goals that shed light on the social impacts (both positive and negative) of corporate behaviour. The SDGs also help to determine which areas of sustainability remain unexploited. In this sense, the SDGs offer the opportunity to clarify company social performance, in contrast to the opaqueness of ESG ratings.

For a long time researchers have been noting that sustainability rating and ranking agencies and indices frequently rate the same corporation differently on the ESG elements. Considering the profusion of the many different sustainability indices and ratings, this can be problematic. It has been noted that CSR reports are selective, subjective and incomparable. The same goes for ESG rating and ranking agencies. At first glance, the incomparability of such ratings seems to be in contrast to the high levels of correlation between credit rating agencies for corporate default probabilities. However, the main reason for ESG ratings not being aligned is that rating agencies disagree in areas such as corporate governance as well as in investment prohibitions and capital requirements among institutional investors. While corporate default data is harder, timelier and more standardised, areas such as corporate governance, investment prohibitions and capital

requirements among institutional investors are softer and more open to interpretation. Hence, it would seem that drawing a parallel between ESG rating agencies and sell-side stock analysts, who typically have different buy, hold or sell recommendations despite having access to similar information, would be more appropriate.

The industry of sustainability data providers, rankers and rating agencies is rapidly consolidating. Yet the problem of data quality and transparency has not changed. Eight generic problems are listed in the following table.

Table 3: Generic problems with sustainability rating and ranking agencies and indices

Problem	Description
Lack of standardisation	Large diversity of approaches to sustainability assessment with little evaluation of the multiplicity of these approaches leading to no comparability.
Lack of transparency	Full disclosure of methodology, criteria or threshold values and levels is uncommon.
Biases	Biases in several dimensions, putting special weight to some criteria: <ul style="list-style-type: none"> • Geographical bias. Tendency to use European standards as ESG is more developed in Europe. • Factor bias. No transparency regarding the weighting of various categories or the categories themselves, leading to no balance in ESG dimensions. • Selection bias. Bias towards investors or stakeholders. Large companies are often more positively rated than smaller companies.
Trade-off problems	Some rating agencies focus on a single, top-level score while others are very granular. Focusing on one part of a dimension while another part is not considered (e.g. governance: focus on diversity in the board rather than scandals).
Lack of credible information	Use of questionnaires and interviews minimises independent information for some rating agencies. Other agencies rely heavily on the company's own sustainability report.
Lack of independence	Sometimes rating and ranking agencies have connections with those they rate (e.g. clients) leading to a possible conflict of interest.
Delays in reporting	Some data are available only annually.
Lack of auditing of self-reported data	CSR or sustainability reports are neither standardised nor audited.

Another way to view the problem is the range of meanings of sustainability, ESG, CSR or corporate social performance (CSP). Furthermore, there is huge variation in the measurement and weighting of factor definitions. These two issues are referred to as theorisation and commensurability problems respectively. Unsurprisingly, this leads to very low convergence validity among different rating agencies.

Nevertheless, Consolandi et al. (2018) argue that even with similar theorisation, factor measurement still varies considerably. Combined with the data collection and data transparency problems, it seems that there are huge gaps in existing sustainability literature.

Sustainable development goals

The 17 SDGs for 2030 have been described as “the closest thing the Earth has to a strategy” and they have been adopted by 193 countries. Fortunately, the private sector had a say in the development of these SDGs and their 169 targets. Although it was largely the corporate part of the private sector rather than the investment community who was involved, it is mostly the investment community who are excited about the SDGs. Many investors see SDGs not only as a useful framework for thinking about their portfolios, but also as a tool for identifying system-level issues. This is particularly interesting for very large asset owners and managers who cannot diversify away from system-level risks such as climate change. Moreover, the system-level risks are important for those with a long-term horizon. For these investors, the SDGs can help in the development of investment strategies.

On the other hand, companies can do little to affect the ‘state of the world’ on an individual basis. Even if the importance of long-term value creation is recognised, it may be hard to act hereto as these companies feel pressure from shareholders to deliver returns, especially short-term returns. This poses a dilemma for companies: how can they support the SDGs while still delivering returns to shareholders? While investors may be enthusiastic about the SDGs, most of the money devoted to achieving them will come from the resource allocation decisions made by the companies in which they invest. Thematic investment strategies, such as impact investing, are and will likely remain a small portion of an investor's total portfolio. One solution to the dilemma of supporting the SDGs while still delivering returns is to choose the most material SDGs, and targets within each SDG, to be addressed by the company given their industry and strategy. Doing so requires companies to first identify which ESG issues create value for shareholders and to then identify which SDGs and targets are impacted by these issues. This creates a node between shareholder wealth (which investors care about) and SDG targets (which the world cares about). Consequently, companies can state how their value creation activities contribute to the SDGs. Investors can use this to evaluate their portfolio.

Material SDG-ESG framework

Standardisation and theorisation along with a materiality focus will be important for cutting through the noise and profusion of metrics while also identifying overlap between societal stakeholder interests and the interests of shareholders. One way to rectify the absence of standardisation is through public goods standards. The Sustainability Accounting Standards Board (SASB), as well as other parties, seeks to create a widely accepted set of specific materiality-based standards. When combined with data transparency, as provided by new technologies, mapping the SDGs to a SASB framework aids in resolving theorisation and commensurability problems.

Consolandi et al. (2018) create a framework that evaluates company performance on a material ESG performance dimension and SDG impact dimension. Rather than adding to the profusion of ESG and SDG metrics and concepts, they utilise readily available standards using the SASB materiality map. The SASB materiality map is organised under five dimensions - environment,

social capital, human capital, business model and innovation, and leadership and governance - and it is a useful tool for conducting SDG-ESG mapping. It also enables comparison across sectors. Considering that the SASB standards have been developed in order to measure investor-oriented materiality and not sustainability impact, connecting this framework to the SDGs provides a powerful tool and a starting point for focusing on the most pertinent and influential environmental and social SDG issues by industry. Materiality differs per industry according to the nature of the products or activities, for example CO2 emissions may not be of much importance to an accounting firm.

In their study, Consolandi et al. (2018) seek to develop and apply such a framework to evaluate the SDG impact in a given sector, using SDG 3 (Ensure healthy lives and promote well-being for all at all ages) and the healthcare sector. In doing so, they present a framework that can help private companies identify where they can make meaningful contributions to the SDGs.

Industry materiality of the SDGs

Consolandi et al. (2018) report that their healthcare sample is quite unbalanced: 80% of the companies in their sample are active in medical equipment, biotechnology or pharmaceuticals, accounting for 34% of total market capitalisation yet only 5% of the total revenues. Drug retailers, on the other hand, with only two companies, account for nearly 40% of market capitalisation and revenues. In terms of ESG performance (based on TruValue Labs' insights, considering only material issues as defined by the SASB materiality map) across industries, it is seen that the managed care and pharmaceuticals industries perform best. Drug retailers and healthcare distributors have the lowest scores.

In order to link ESG performance to SDG impact, it is useful to tabulate impact indices. The values in the impact indices represent the ratio between the number of material issues of an industry impacting all (or specific) SDG targets and the number of total SASB general issue category (GIC) issues impacting all (or specific) SDG targets, multiplied by 100. This ratio indicates the scope of impact an industry can have across all SDGs when considering only its material issues and taking into account the specific SDG targets for each SDG. A score lower than 50 means that the majority of the SDG impact of an industry comes from non-material ESG issues, as defined by the SASB. In the table below, Consolandi et al. (2018) consider the material ESG issues per industry in the healthcare sector as how they map to the specific targets of SDG 3.

Table 4: SDG 3 impact of the healthcare sector – industry/sector SDG target impact index and industry/sector target impact index

	Biotech.	Pharma.	Medical Equip.	HC Delivery	HC Distr.	Mngd Care	Drug Retailers		Health care
SDG 3 ISTII	65.75	65.75	57.53	34.25	17.81	26.03	30.14	SDG 3 SSTII	42.47
Target 3.1 ITII	70.00	70.00	60.00	40.00	20.00	30.00	40.00	Target 3.1 STII	47.14
Target 3.2 ITII	66.67	66.67	66.67	44.44	22.22	33.33	44.44	Target 3.2 STII	49.21
Target 3.3 ITII	50.00	50.00	33.33	33.33	0.00	33.33	0.00	Target 3.3 STII	28.57
Target 3.4 ITII	66.67	66.67	60.00	33.33	20.00	20.00	26.67	Target 3.4 STII	41.90
Target 3.5 ITII	77.78	77.78	66.67	33.33	22.22	33.33	33.33	Target 3.5 STII	49.21
Target 3.6 ITII	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Target 3.6 STII	0.00
Target 3.7 ITII	100.00	100.00	50.00	50.00	0.00	50.00	0.00	Target 3.7 STII	50.00
Target 3.8 ITII	71.43	71.43	57.14	42.86	14.29	42.86	42.86	Target 3.8 STII	48.98
Target 3.9 ITII	57.14	57.14	57.14	21.34	21.34	7.14	28.57	Target 3.9 STII	35.71

SDG 3 impact of the healthcare sector. Scores below 50 represent that the majority of the impact on SDG 3 and its targets derives from the industry's non-material issues (these scores are highlighted in grey).
 ISTII = Industry SDG Target Impact Index; SSTII = Sector SDG Target Impact Index; ITII = Industry Target Impact Index; STII = Sector Target Impact Index; Biotech. = Biotechnology; Pharma. = Pharmaceuticals; Equip. = Equipment; HC = Healthcare; Distr. = Distributors; Mngd = Managed.

Reading the impact index table

In the impact index table, the scores represent how much of the impact on the specified SDG (e.g. SDG 3) or SDG target (e.g. SDG 3.8) is derived from industry material issues. SASB categories are attached to each specific target and, consequently, it is determined which category is material for each industry. A score above 50 implies that the majority of the impact comes from the industry's material issues. The highlighted cells (in grey) display values that are below 50 meaning that the majority of the SDG impact is derived from non-material concerns.

Take, for instance, target 3.8 (Achieve universal health coverage, including financial risk protection, access to quality essential healthcare services and access to safe, effective, quality and affordable essential medicines and vaccines for all). SASB's access and affordability category is most directly pertinent to this target for the healthcare sector. Other relevant SASB GIC

categories include customer welfare; product quality and safety; supply chain management; employee health, safety and well-being; and environmental and social impacts on assets and operations.

If healthcare distributors are considered, their potential impact on target 3.8 seems to be only 14.29. Access and affordability is, according to the SASB assessment of materiality, not material to that industry. Yet it would contribute to the achievement of target 3.8 for healthcare distributors. A vast majority of the impact on target 3.8 for this essential component of drug and medical equipment supply chains comes from the industry's non-material issues. About half of the impact on target 3.8 from the healthcare sector comes from healthcare industries' non-material issues. Moreover, only 42% of the impact on SDG 3 in the healthcare sector seems to be derived from material issues. Only for the biotechnology, pharmaceuticals and medical equipment industries would improved performance on material ESG issues translate into improved impacts on SDG 3.

Healthcare companies are most likely to focus on improving material ESG issues rather than non-material issues because of the resulting improved financial performance. Increasingly, there is focus on materiality in corporate ESG reporting and related investor engagement and decision-making. Hence, it is not reasonable to expect companies to improve on SDG targets which they do not regard as being material. The impact index table directly presents which SDGs and targets are viewed as such by each industry. For example, healthcare delivery, healthcare distribution, managed care providers and drug retailers lack incentives today to conduct activities that advance progress towards SDG 3, whereas the other three industries experience stronger incentives and payback already exists for most of the targets of SDG 3.

ESG performance and SDG contribution

When material ESG issues drive the majority of the potential impact on an SDG target, this does not automatically translate into progress towards the SDG and overlapping targets. Companies must also perform well on those issues for their activities to contribute towards achieving the SDG target and, as such, a measure of SDG-related performance is necessary to evaluate this progress.

To find out actual SDG contribution, the potential impact index per industry and target is compared against the actual performance of companies on directly related material ESG issues. This comparison helps to identify industries, companies and targets for which engagement from investors and policymakers to improve performance may be required.

When considering the medical equipment and supplies industry and its relevance to target 3.2 (related to ending preventable deaths of newborns and children under 5 years of age) and target 3.3 (related to ending the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases, and combatting hepatitis, water-borne diseases and other communicable diseases), it can be seen that the industry has a relatively high impact index of 66.67 on target 3.2 and a low impact index of 33.33 on target 3.3. This indicates the potential of the medical equipment

and supplies industry to impact target 3.2 is much stronger than its potential to impact target 3.3. But what is the actual performance of this industry for these targets? For this, Consolandi et al. (2018) suggest calculating weighted ESG scores for material ESG issues. First, the material ESG issues for a specific target are determined, for instance, for target 3.2 these are energy management; access and affordability; customer welfare; fair marketing and advertising; product quality and safety; and supply chain management. Next, the weighted average ESG materiality performance for companies in the industry for these material ESG issues are collected (via TruValue Labs). The score is weighted by the total historical (10-year) volume per category. The next table displays the results.

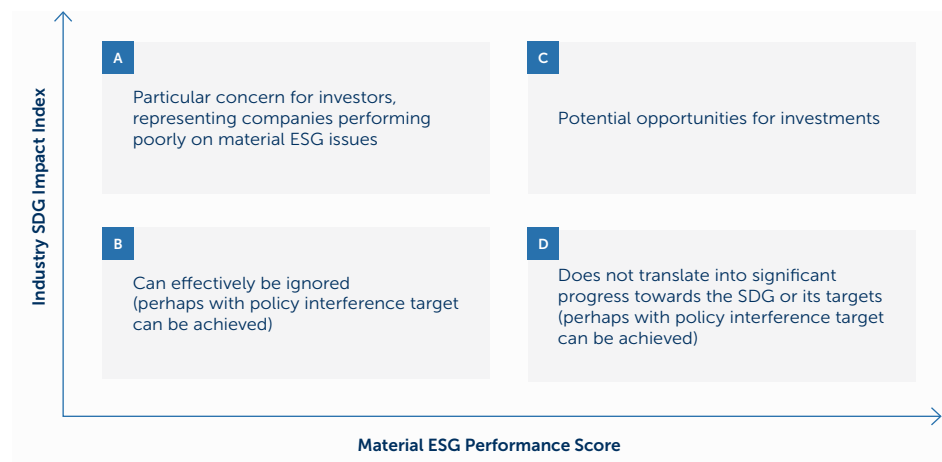
Table 5: Comparison of weighted ESG materiality performance scores (for the subset of material ESG issues overlapping with each target) with the target impact index for the medical equipment and supplies industry

	Target 3.2: adjusted material ESG Insight	Target 3.3: adjusted material ESG Insight
Mean	60.7	74.1
Median	61.4	74.1
Min	37.2	37.4
Max	88.0	93.7
	Target 3.2 ITII	Target 3.3 ITII
	66.67	33.33

The table shows that while the medical equipment and supplies industry has a large impact on target 3.2 (ITII of 66.67), the industry average material ESG score is only 60.7. A score above 50 indicates positive ESG performance; nevertheless, with the full range of scoring being up to 100, there is much room for improvement in order for the industry to make a meaningful contribution to achieving target 3.2. In relation to target 3.3, the industry is performing better with a score of 74.1. Unfortunately, with the ITII for target 3.3 being less than 50, the scope of impact of the industry on target 3.3 is limited.

When choosing between target 3.2 and target 3.3, investors and policymakers for the medical equipment and supplies industry should focus on target 3.2 for two reasons: the room for improvement is larger, as the average industry performance is lower, and the impact on the SDG will be higher. A similar analysis can be conducted for every industry (or company) and target to identify areas on which to engage companies to improve their performance on material issues. The following matrix represents a useful tool for conceptualising ESG materiality performance and SDG impact.

Figure 1: SDG-ESG materiality asset allocation matrix



In the SDG-ESG materiality asset allocation matrix, a low material ESG performance score can be considered as representing a negative or poor performance (scores below 50 in TruValue Labs' dataset). The industry SDG impact index represents the scope of impact for a particular SDG or a particular target across all SDGs. Each area in the matrix can be interpreted to represent investor asset allocation or government policy decisions in relation to the SDGs:

- a *Low material ESG performance score, high industry SDG impact index:* particular concern for investors, representing companies performing poorly on material ESG issues related to the particular SDG or target where the industry has a high scope of impact. An area for engagement or elimination of companies or industries from an investor portfolio.
- b *Low material ESG performance score, low industry SDG impact index:* can effectively be ignored (perhaps with policy interference target can be achieved).
- c *High material ESG performance score, high industry SDG impact index:* potential opportunities for investment in order to drive SDG impacts while ensuring strong financial performance.
- d *High material ESG performance score, low industry SDG impact index:* does not translate into significant progress towards the SDG or its targets (perhaps with policy interference target can be achieved).

SDG impact score

An additional instrument for analysis can be an SDG impact score which combines the material ESG performance score with the impact index in the matrix. For each company in a specific industry and for each month the SDG impact score is calculated as the product of the company's material ESG performance score and the Average Industry SDG Target Impact Index (AISTII) of the industry to which the company belongs, divided by 100. An illustrative table of the healthcare sector is presented below.

Table 6: SDG impact score (all SDGs)

Industry	Mean	Median	Min.	Max.	St. Dev.
Biotechnology	34.08	35.31	1.56	54.45	8.82
Drug Retailers & Convenience Stores	12.85	13.29	6.56	16.24	2.06
Healthcare Delivery	16.32	16.52	2.62	26.59	3.90
Healthcare Distributors	7.98	8.25	2.05	12.92	2.47
Managed Care	9.96	10.06	6.15	14.57	1.40
Medical Equipment & Supplies	29.07	29.93	1.74	45.32	7.48
Pharmaceuticals	36.12	36.67	1.13	54.25	8.55

The higher the SDG impact score, the better the actual performance of an industry (or company) in relation to the SDGs. Rather than just material ESG performance, this score is the result of two components: (a) the material ESG performance score and (b) the scope of SDG impact. This implies that a company with a high material ESG performance score might have a low SDG impact score because it is in an industry that has a low scope of impact on the SDGs.

8 Corporate governance and sustainability

Renewable governance: good for the environment?

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Relevance for businesses and business schools

Well-established corporate governance mechanisms are prerequisite for the effective monitoring, control and engagement of companies by outside investors (e.g. institutional investors). The relationship between corporate governance and corporate environmental performance is scrutinised. In particular, contemporary corporate governance mechanisms that focus on changing a company board's mindset by renewing its members seem to be effective and hold a strong relation with the particular company's environmental performance. Companies with entrenched insiders, such as family-controlled companies, or those whose board members are older or have long tenures seem to have a significantly lower environmental performance than otherwise controlled companies. These findings also hold for settings in which environmental performance is more salient, such as in countries with a weak environmental performance or in dirty industries. Renewing board members with female directors in particular appears to drive environmental performance. Hence, in order to drive corporate environmental performance, investors should first seek to engage in and establish a good corporate governance structure.

Governance (G) before environmental performance (E)?

Institutional investors recognise that environmental risks have implications for their portfolio companies and that these risks have begun to materialise. According to investors, engagement rather than disinvestment is important in order to address these risks. However, the likelihood of improving environmental performance may be dependent on governance structure. For instance, is it predominantly insiders (such as family owners or other blockholders) who determine the course of events or are outside investors (such as stock market participants) in control? How easily can the current management be replaced? Are the CEO and chairman roles separated? Such matters may have a significant impact on the level of environmental performance.

Having higher ownership stakes does not necessarily translate into greater control for outside investors. Control rights are only meaningful when there are effective governance mechanisms in place. Hence, for outsiders to influence environmental performance the corporate governance structure must be supportive. In order to test whether efficient governance (G) does indeed drive environmental performance (E), Dyck et al. (2019) seek to study the impact of governance mechanisms.

Insiders versus outsiders

Improving environmental performance requires current cash outlays for potential long-term benefits. The level of ESG investment depends on whether the decision-maker is an

entrenched insider or an outside investor due to two underlying factors. First, insider short-termism may arise from compensation package and career concerns, where managers place a disproportionate focus on current performance. Hence, the private benefits of insiders may lead to procrastination or even renunciation of environmental performance improvement. Second, the value placed by insiders and outsiders on non-pecuniary returns from environmental performance may differ. Insiders will choose higher levels of environmental performance than outsiders only if they have negligible short-termism and place a higher value on the non-pecuniary benefits of environmental performance than outsiders. Under these strong assumptions, better governance that conveys greater power to outside investors would lower a company's environmental performance. In any other circumstance, outsiders are likely to improve environmental performance. If insiders and outsiders value the non-pecuniary benefits equally, better governance improves outsiders' control rights allowing them to reduce short-termism. This positive impact of outsider control on environmental performance will be even greater when outsiders place a higher value on the non-pecuniary benefits from environmental performance than insiders.

Governance mechanisms

Dyck et al. (2019) are principally interested in governance structures and mechanisms that could plausibly increase the power of outside investors and, consequently, environmental performance. Different types of mechanisms and structures are collected. First, Dyck et al. (2019) study companies' aggregate governance scores. Next, specific traditional international governance structures that have been shown in literature to be important are analysed. Finally, new contemporary governance mechanisms that develop and potentially impact a company's environmental performance are investigated.

The aggregate governance score is based upon ASSET4 item scores for board functions, board structure, compensation policy and shareholder rights. The average score of all items serves as the aggregate governance score.

To make an actual impact on the company as an outsider, control rights are required. Typically, outsiders lack such rights when companies are owned and controlled by a family or other blockholders. Dyck et al. (2019) refer to blockholder-controlled companies as a traditional governance structure. It is of most interest to investigate the effects of different governance mechanisms on companies that are family-controlled in particular, since family-controlled companies often reap private family benefits from current cash flows/holdings rather than environmental performance. Family insiders will, thus, be less inclined to use current cash to make potentially value-enhancing, long-term investments.

In addition, a traditional governance index is created based on several governance mechanisms. These mechanisms include:

- **Board independence:** the board has more than 50% independent directors
- **Board size:** the board has more than five but less than 16 members
- **CEO/chairmen separation:** the roles of CEO and chairman are separated

- **Board structure:** directors are elected individually (no staggered board)
- **Audit committee independence:** the audit committee is composed solely of independent directors
- **Stock classes:** only one class of common stock (all shares have equal voting rights; no dual classes)

Notably, the above-mentioned governance mechanisms rely largely on independent directors. This is, however, not a guarantee of better governance. Independent directors are often co-opted by insiders and therefore feel an obligation towards the insiders. As a result, independent directors may be subject to groupthink, where the desire for unanimity overrides their motivation to realistically appraise alternative courses of action. However, the index may still proxy for better governance.

In response to the widening gap between outside investors and insiders on the importance of environmental performance, new contemporary governance mechanisms are often deployed. To convince the management board of certain policies, investors may need to force a change of board members. This is one of the mechanisms which investor activists often use to change company policies. Prior to board renewals, investors often seek to change the voting process in order to ensure influence and they focus on three ways to refine the process: nominating committees composed of independent directors, majority voting and giving investors enhanced proxy access. Dyck et al. (2019) focus predominantly on the majority voting mechanism. Majority voting allows independent directors or managers who have the support of a majority of the shareholders to enter the board.

Alternatively, a board turnover can be enforced by outside investors. Board turnovers bring in new directors with new thinking (aligned with outside investors), which may help to overcome groupthink. Two ways of imposing such a turnover are to impose age or term limits on board members and/or to establish diversity requirements on the board (such as gender diversity). There has been significant focus internationally on increasing the number of female board members. Regulators and investors have undertaken both soft measures (e.g. investor requests or comply-or-explain gender targets) and hard measures (e.g. mandatory gender quotas). Two underlying beliefs drive these actions according to Adams and Ferreira (2009):

- 1 Board quality will be improved by drawing from a broader talent pool that includes women.
- 2 Female directors could more closely correspond to the concept of the independent director as emphasised in theory.

These concepts are supported by evidence that female board representation, as a matter of fact, significantly impacts governance. For instance, greater board attendance and higher sensitivity of CEO turnover to financial performance is found among US companies when there are women on the board.

Dyck et al. (2019) also add indicators of when management may be subject to stale thinking and lack governance. To elaborate, when a board member's tenure exceeds nine years, that member

is no longer considered to be an independent member. Similarly, board members aged over 70 years old may be subject to stale thinking. These two indicators are combined and conceived as 'old and stale boards' if either 50% of the directors have a tenure longer than nine years or if at least 20% of the directors are over 70 years old.

Country differences in company characteristics

Calculating average scores by country for company characteristics in terms of environmental performance and governance measures facilitates comparison across countries. The highest environmental performance is documented in European countries (top 5: France, Finland, Sweden, Portugal and Spain), while companies that score lowest are concentrated in Asia, Australia and Africa. The countries with the highest percentage of family-controlled companies are Mexico, Portugal, Luxembourg, Turkey and Russia. In Japan, Taiwan, Singapore and New Zealand, however, family companies are relatively rare. Traditional governance, as measured by the traditional governance index, appears to be strongest in Canada, the UK and Finland. Majority voting as a governance mechanism is dominant in the UK, Canada and Australia, while this mechanism is relatively weakly represented in Japan, South Korea and Egypt. In terms of female board members, Finland, Israel, Norway and Sweden have the highest representation of women on the board, while Japan and South Korea have lowest.

Relating governance (G) to environmental performance (E)

Corporate governance and environmental performance have been demonstrated to have a significant and important relationship with one another. A statistically significant negative relationship has been documented between family control and environmental performance. Statistically, companies controlled by fully entrenched insiders (such as family companies) seem to have environmental performance scores that are, on average, 9.8% lower than otherwise similar widely held companies. The coefficient of the aggregate governance score (including both traditional and contemporary measures) indicates that improvement on these mechanisms leads to a higher environmental performance. A one standard deviation increase in governance is associated with an increase of approximately 11.4% in environmental performance. Isolating only traditional governance mechanisms (as measured with the traditional governance index) shows that companies that add one additional traditional governance measure (e.g. separating the role of CEO and chairman) are predicted to improve their environmental performance by 3.3%.

Old and stale boards appear to have significantly lower environmental performance (circa 8% lower). This highlights the importance of board renewals or turnovers for environmental performance. Majority voting, being a way to enforce board renewals, has a positive impact on environmental performance. Companies who have majority voting policies in place display an environmental performance that is, on average, about 8.4% higher than companies who do not have such policies in place. Finally, having female board members (possibly as a result of board turnover due to investor and societal pressures) seems to increase environmental performance by 14.2%. In order to assess the unique impact of each governance mechanism, Dyck et al.

(2019) also test majority voting, female director presence, traditional governance index and blockholder control all together in one specification. The results show that each measure indeed has an independent and significant impact on a company's environmental performance.

G leads to E

To address causality, that better governance leads to better environmental performance rather than improved environmental performance being the result of something else, Dyck et al. (2019) seek exogenous shocks to corporate governance mechanisms that are not simultaneously shocks to a company's environmental performance. Board renewal mechanisms are sometimes forced by outside pressure, leading to adoption of either female board members or majority voting rules and could suffice as exogenous shocks.

The authors stress the case of Canada, where the creation of the Canadian Coalition for Good Governance (CCGG) led to a major campaign for companies to adopt a majority voting policy. In the two years subsequent to the creation of the CCGG a substantial increase in the adoption of majority voting was documented. The impact of the adoption of this policy on environmental performance is tested by comparing a group who implemented the policy to a group who did not. A positive and significant effect of the policy is found. In terms of economic significance, the effects on environmental performance of the plausibly exogenous change in majority voting is sizeable; a company that adopts majority voting increases its environmental performance by 30%. This finding is supported in an international sample where companies in specific countries were likely to have faced identical pressures.

Another quasi-exogenous shock is analysed: female board representation. Exogenous pressure by both regulators (e.g. by mandated female quotas as introduced in Norway in 2003 and in many other European countries as of 2018) and investors (e.g. demands to increase board diversity) encourages companies to increase the proportion of female board members. However, the tests may lack some power as many companies already had at least one woman on the board.

As in Canada, an analysis and review in the UK led to a recommendation, published in 2011, which stated that FTSE 100 companies should have at least 25% female board representation. Two years later, 22% more companies had at least one female board member. Subsequently, it was found that companies who added female board members had a 5% to 8% higher environmental performance than those who did not. Again, this finding was supported in an international sample.

Overall, the results suggest that governance mechanisms are positively related to a company's environmental performance. In particular, contemporary governance mechanisms that seek to change the mindset of the board via renewals are most important for improving environmental performance. The table below presents various governance mechanisms and structures and their relation to environmental performance.

Table 7: Governance mechanisms and structures and their relation to environmental performance

Governance mechanism/structure		Description	Effects on environmental performance
Sc.	Aggregate governance score	Average aggregate governance score (ASSET4)	++
Trad.	Family blockholder	Family is in control of company	--
	Traditional governance index	Index based on several governance factors	+
Cont.	Majority voting	Board members are elected with majority vote	++
	Female board member	Female board member present	++
No	Old and stale	Board may be subject to insider thinking	-

Governance where it matters most

In some settings there is more room for improvement in environmental performance than others - in countries where the environmental performance is low, for example. Sustainability-oriented investors need to overcome local societal norms which place little emphasis on environmental improvement. Does the relationship between G and E still hold in settings where environmental risks are more salient?

The answer to this question is positive. Even when both insider short-termism and societal norms are not very supportive of improvement in environmental performance, there seems to be a significant positive relation between both traditional and contemporary governance mechanisms and environmental performance. Contemporary governance aimed at renewing the mindset of the board is especially helpful in this case.

Similarly, room for improvement seems greatest in family-controlled companies, as these often score lowest on environmental dimensions. Specifically investigating the effect of governance controls on family companies, by comparing them to non-family-controlled companies, allows Dyck et al. (2019) to determine whether governance is effective in family companies. It is found that traditional governance (measured by the traditional governance index) does not impact the environmental performance of family companies. Likewise, majority voting has no significant impact as family-owned companies are likely to have enough voting rights to effectively have full control of the company and its board. Having a female director on board, on the other hand, seems to significantly improve environmental performance, possibly because women on the board are less prone to the groupthink of established board members and they have other preferences.

It is also plausible that well-established corporate governance improves only some aspects of environmental performance rather than all dimensions and that, in particular, the most material environmental issues are improved. Building on the SASB materiality map, Dyck et al. (2019) analyse whether companies in certain industries indeed emphasise material environmental

challenges rather than general performance. However, the effects of corporate governance appear to be very broad and they are not concentrated in specific environmental performance categories.

In a similar vein, governance could be more or less effective in polluting industries, which have the largest environmental footprint. Resistance is expected to be greatest in these industries because improving environmental performance might be very costly. According to the SASB, dirty industries include agriculture, forestry, fishing, mining and services. In these industries family control continues to be significantly negatively related to environmental performance, while contemporary governance mechanisms have a positive influence. Traditional governance measures seem to have only limited positive impact or no impact at all.

In general, the effects of G on E are similar in settings where environmental risks are more salient, with family control and female board members being the most important.

Table 8: The effects of various governance mechanisms and structures on environmental performance

Governance mechanism/structure			Settings: *		
			WC	FC	DI
Trad.	Family blockholder	Family is in control of company	-	n.a.	--
	Traditional governance index	Index based on several governance factors	+	+/-	+/-
Cont.	Majority voting	Board members are elected with majority vote	++	+/-	+
	Female board member	Female board member present	++	++	++

*WC = countries with weak environmental performance; FC = family-controlled companies; DI = dirty industries.

Women on the board

The relation between board member gender and environmental performance has become apparent throughout the analysis of Dyck et al. (2019). In additional robustness tests, it is examined whether this is due to specific director characteristics (e.g. CEO experience, higher education other than MBA, director age) or due to the person’s gender. Both CEO experience and higher education other than MBA are significantly related to environmental performance, but these characteristics are not exclusive to female board members. In order to scrutinise gender effects, female directors with low levels of CEO experience and low levels of higher education are examined. If these two variables indeed drive results, gender should have no direct impact for female directors with low levels of either of these. However, a strong significant impact of gender is still found for this group, indicating that a female director, independently of her characteristics, strongly influences a company’s environmental performance. Three potential reasons for this have been identified: female directors as new board members shake up groupthink; they bring new corporate governance skills; and/or they have an innate preference for other-regarding behaviour.

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