

An Inside Perspective on Carbon Disclosure

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Abstract

Part of the vision underlying CDP (formerly the Carbon Disclosure Project) is to enhance firms' climate change strategies by encouraging them to measure their emissions and corresponding risks and opportunities. Drawing on interviews with 38 firms in 7 countries that disclosed to CDP, we find that the benefits firms experience from the measurement and disclosure process are more diverse in nature than expected. They can be both operational and strategic, and internal as well as external. From our analysis of the firms' experiences, we draw several implications for managers. First, managers should beware of various biases that may inhibit investments in profitable emissions reduction opportunities. Second, participating in a disclosure-oriented process can be beneficial, even for a firm that ultimately decides not to disclose. Third, when disclosing GHG-related information, managers need to address multiple groups of stakeholders, not just investors. Fourth, when searching for emissions reduction opportunities, and in organizing the disclosure process, managers should not neglect opportunities that exist elsewhere in the supply chain.

Keywords: CDP, sustainability reporting, benefits of carbon disclosure, carbon footprinting, supply chain

BEHIND THE SCENES OF CARBON DISCLOSURE

One often hears the mantra that “what gets measured gets managed”. For instance, Epstein’s (1996) argument for full environmental cost accounting hinges on the notion that measurement leads to improved management. Applying that principle to sustainable business, an increasing number of frameworks and platforms aim to encourage firms to measure and report more sustainability-related information. The Global Reporting Initiative (GRI), founded in 2001, encourages firms to measure and communicate information about their performance and impacts in four dimensions (economic, environmental, social and governance), and provides a framework of reporting guidelines to facilitate that. The recent Sustainability Accounting Standards Board (SASB) aims to help publicly-listed firms provide more useful information to investors on those same four dimensions in a way that is aligned with a company’s mainstream financial report.

The CDP, founded as the Carbon Disclosure Project in 2000, started with the goal of encouraging firms to disclose more information about their exposure to climate change. This includes asking firms to measure and disclose their own greenhouse gas emissions, as well as those in their broader supply chain, but also asking them questions about their climate change risks, strategies, and actions. They do so “on behalf of 822 institutional investors with US\$ 95 trillion in assets” (CDP 2016), with thousands of companies participating, including 81% of the largest public companies around the world. CDP has since broadened to cover water, forests and land use.

In this paper, we provide an inside perspective on participating firms’ experience with the measurement and disclosure process associated with CDP. To do so, we worked closely with CDP, to interview 38 companies in 7 countries that had participated in the CDP process. We asked the firms why they participated in the CDP disclosure process, what strategies they implemented in order to reduce their greenhouse gas emissions, what emissions reductions and other benefits they experienced, and whether those benefits were greater or smaller than expected. The firms we spoke to reported operational as well as strategic benefits, partly as an immediate result of the measurement process and resulting implementation of projects, and partly due to the subsequent disclosure. We summarize these benefits in a simple framework,

to highlight that managers should be aware of this variety of unexpected outcomes of the measurement and disclosure process. Although we cannot deduce from our sample whether the average firm will experience such greater-than-expected benefits, we can conclude that such benefits, when they occur, are more diverse than often realized. From this observation, we draw implications for managers considering or participating in a measurement and disclosure-focused effort such as that organized by CDP.

BACKGROUND AND LITERATURE ON CARBON DISCLOSURE

Founded as a nonprofit organization in the UK in 2000, CDP sent its first letter to the Chairmen of the FT500 Global Index companies in 2002, and published its first report based on 221 responses in 2003 (CDP 2003). By 2013, 403 of the companies in the FT500 Global Index responded, in addition to many other firms. The questionnaire has evolved over time, from 7 simple questions in 2003 (CDP 2003, p. 69), including a single question on the actual emissions (“What is the quantity of annual emissions of the main greenhouse gases produced by your operations [...]?”), to a much more lengthy and sophisticated questionnaire, asking about emissions from various sources, within the firm and within the broader supply chain, whether those emissions are externally verified, actions taken to reduce emissions, etc.

CDP has compiled the quantitative and qualitative disclosures in a database since 2005, explicitly referring to the distinction introduced in the Greenhouse Gas Protocol between Scope 1, 2 and 3 emissions for the first time in 2006 (CDP 2006). Scope 1 refers to “direct” emissions from fuel combustion and manufacturing activities; Scope 2 refers to “indirect” emissions resulting from electricity purchases; Scope 3 refers to emissions embedded in other inputs, such as purchased components and services, travel, commuting, and more. By 2013, the responding FT500 Global firms reported Scope 1 emissions of over 3 billion tons of CO₂-equivalent greenhouse gas emissions (CO₂e), and Scope 2 emissions of over 500 million tons.

CDP offers firms assistance with completing the survey. It has offices in a number of countries, and their local representative serves as the main contact with the participating companies. That individual faces the task of encouraging as many companies as possible to respond, as completely as possible. Companies who do not respond or who decline to

participate are listed in CDP's annual reports, but there is no evidence of a direct consequence, from investors, customers, or elsewhere, for non-participation. Lee et al. (2015) find some evidence that the stock market in Korea responded negatively to CDP disclosures, though that effect was mitigated by more frequent carbon communication. Stanny (2013) finds that firms disclose the minimum possible to avoid scrutiny, often responding to the questionnaire but not disclosing emissions amounts or accounting methods. She concludes that mandatory GHG reporting should be considered in order to increase the total emissions reported. This is in contrast with Kalkanci et al. (2013), who, based on experiments of how consumers respond to various levels of disclosure, find that mandatory disclosure may lessen a firm's incentive to actually reduce emissions relative to a voluntary mechanism.

The current paper contributes to this emerging literature on sustainability reporting and disclosure to CDP by providing a perspective on the disclosure process from a sample of responding companies, and by highlighting the diversity of benefits reported.

METHOD AND SAMPLE

This paper draws on two sources of data. First, in close collaboration with CDP, we conducted phone interviews with 38 firms in 7 countries; and second, we examined the database of disclosures compiled by CDP. The interviews and part of the initial data analysis were conducted by a team of MBA students, during Winter and Spring of 2013.

The firms were selected in partnership with CDP. We decided to target firms in the industrials and materials sectors, as they often have relatively high emissions and more experience with reporting than firms in other (more service-oriented) sectors; we also added some IT firms. We focused on respondents in Australia, Brazil, Germany, India, South Korea, the UK, and the US. In addition to aiming for a reasonable global representation, these specific countries were chosen based on the number of CDP respondents in each country, and the likelihood that the local CDP representative would be able to assist in recruiting firms to participate. CDP then contacted their representative in each of those countries to ask which companies we could contact. This yielded a list of 166 companies, which we contacted via email, mentioning CDP's involvement; 52 expressed a willingness to participate, and we

successfully interviewed 38 of those, for a 23% response rate. We were unable to conduct interviews with the other 14 willing firms, either because they did not respond to follow-up requests, or because we were unable to schedule the interview before the end of the study window. The breakdown of respondents was as follows: Australia (3), Brazil (4), Germany (5), India (3), South Korea (2), UK (6), US (15). Overall, 11 firms were in the industrials sector, 19 in materials, and 7 in IT. One of the US respondents was a financial institution, included in the figures under “total” but not shown separately. We cannot disclose the specific companies that participated. However, to convey a sense of the type of firms involved: examples of CDP reporters in the industrials sector include Boeing, Rolls Royce, FedEx Corporation, Waste Management, Jacobs Engineering Group, Saint Gobain, Mitsubishi Electric, General Electric, Cummins, Komatsu, and CSX. Examples in the materials sector include Air Liquide, PPG Industries, Shin Etsu Chemical, Lafarge, Alcoa, Newcrest Mining, Rio Tinto, and MeadWestvaco. Examples of firms in information technology include Motorola, Apple, Toshiba, eBay, IBM, Tata Consultancy Services, Taiwan Semiconductor Manufacturing, Adobe Systems, and SAP. (These names are arbitrarily extracted from the three CDP reports from 2010 for those specific sectors. Any one of these firms may or may not have been part of our sample.)

The interviews were conducted by the MBA students by phone, following a semi-structured protocol. The protocol was shared in advance with the respondents in South Korea in response to language challenges; for the others the interviewer followed the protocol but did not send it to the firm. For some of the questions we asked for an answer on a scale (e.g., yes/no, yes/partially/no, strongly disagree/strongly agree, etc.). We instructed the students to ask for clarifications and examples where appropriate. The CDP representatives who made the initial introduction did not participate in the interviews.

This approach has several inevitable limitations. First, because of the sometimes delicate relationship between CDP and the disclosing firms, our sample cannot be representative of the full population of responding firms, let alone of the entire population. However, CDP was looking for critical feedback on the disclosure process, so they did not exclusively list firms that were likely to be positive. Indeed, some of the firms were critical of some aspects of the CDP process. Moreover, our conclusions are not so much about whether

firms experience benefits, but rather about the unexpectedly diverse nature of those benefits of measurement and disclosure; it is not clear that those would be a result of our CDP-selected sample. Second, we only interviewed a single individual within each firm. However, that individual is the person within the firm most involved with CDP-related internal and external communications, and hence the most suited to answer our questions. Interviewing multiple individuals within each firm would further reduce the number of participating firms, and would also likely have reduced CDP's willingness to cooperate in this effort. Although some individual responses to specific questions may therefore not accurately reflect the entire company's perspective, our final takeaways about the diverse nature of unexpected benefits of the GHG measurement and disclosure process are unlikely to be driven by having a single respondent per firm.

FINDINGS

We start by outlining the top reasons firms cite for participating in the CDP process. We then summarize how firms use the information collected, internally and externally. We provide some examples of the emissions reductions initiatives that firms listed. We asked the firms to compare the emissions reductions achieved with what they had expected, what other benefits they experienced, and how those benefits have evolved over time. We note the factors to which firms attribute successful implementation of initiatives, and the importance of collaborating with supply chain partners. After that, we categorize the benefits by their operational and strategic nature, and whether they are attributable to the measurement or the disclosure part of the overall process, before drawing recommendations for managers.

Motivations

We asked respondents to list the top 3 reasons why their company participated in the CDP process. They gave a wide range of answers. Each of the following was mentioned at least once as the main reason: public communication, stakeholders' interest (customers, employees, investors), transparency, need to measure if you want to change, cost reduction, legal requirement, and understand environmental impact. Figure 1 shows that demand from

investors was the main driver of disclosure across the full sample. One instance of investor pressure was illustrated by a respondent who told us that they had been engaged in voluntary disclosure for over a decade; for a while they stopped reporting to CDP, but then restarted because their investors were asking for it. Another firm noted that as a result of disclosing climate change information they were now able to quantify how many investors are interested in this information.

Discussing their motivations to measure GHG emissions, one respondent commented that climate change poses a risk to that firm's operations and products, and that in order to understand that risk, they need to understand their emissions profile. Another firm noted that demand for products might change due to climate change. At a major technology firm, the motivation is more customer-oriented. They believe that, at least in the long term, technology can lead to substantial benefits in terms of energy consumption, and hence see a potential upside with their customers. They added that if the firm does not report to CDP, it is less likely that they will be able to convince customers that their energy consumption will go down.

[Insert Figure 1 about here]

Use of CDP-related information

Although CDP was initiated with support from institutional investors, the resulting disclosures appear to serve other purposes too. We asked the respondents who uses CDP-related information within their organization. Figure 2 summarizes the results. In line with CDP's origin, investor relations staff at 61% of responding firms use CDP-related information. Unsurprisingly, Chief Sustainability Officers (CSOs) were also among the most frequent users (at 63% of firms). The increasing recognition of the strategic importance of climate change is reflected in the fact that at 42% of the firms, the CEO also used CDP-related information. Respondents in the materials sector reported more use of this information in the C-suite than those in industrials; for instance, 37% of CFOs in the materials sector use CDP-related information, compared to 9% in industrials.

[Insert Figure 2 about here]

Following up on this internal perspective, we asked how the firm used CDP-related information with external stakeholders. As shown in Figure 3, investors are the external stakeholders with which firms most often discuss their CDP disclosures, with 61% of respondents confirming that they do so. One materials firm noted that investors are always interested in climate change risk, while another estimated that, although investors do want to understand the climate-change-related risk, it only accounts for a “10-15% weight in their analysis”. Yet another materials firm reported that investors have told them how valuable they consider their CDP submissions to be, and how much they appreciate the coverage of the information the firm provides.

Several respondents mentioned that the CDP disclosure comes up during loan applications; one said that bankers sometimes ask before investing money. Several firms find that their customers explicitly ask about GHG emissions, sometimes in order to determine their own supply chain carbon footprint; other times the customer is more interested in the carbon or energy intensity of products.

[Insert Figure 3 about here]

Emissions reduction practices implemented and reductions achieved

When firms examine their carbon footprint, they often find opportunities to reduce their emissions, as also illustrated by the examples in Buxel et al. (2015). CDP’s mission is not only to facilitate measurement and disclosure of climate change-related information, but ultimately also to encourage firms to reduce their emissions. One materials firm claimed to have over 200 emissions reduction projects with \$275M in savings. We asked firms to describe their top three emissions reduction initiatives. Between them, the respondents mentioned 67 different initiatives that can be clustered into three broad categories as also used in Blanco et al. (2016a):

- opportunities directly related to core operations (defined in Blanco et al. (2016a) as “key business processes where resources are transformed into goods and services”),
- opportunities that are not directly related to core operations, and
- opportunities that cannot be unambiguously classified as either.

The industrial firms listed primarily opportunities that are directly related to core operations such as more efficient generation and use of compressed air, optimizing equipment, and the optimization of ship construction and deployment. The materials firms listed a mix of opportunities, some directly and others not directly related to core operations, including using renewable energy, switching to biomass or hydro-electric power rather than coal or gas, installation of catalytic units, using corex gas as byproduct to replace natural gas, installing regenerative braking in conveyor belts, as well as energy-efficient lighting in corporate offices. The IT firms also mentioned a mix of opportunities, such as reducing gas releases during maintenance, reducing emissions related to travel, more energy efficient data centers, and purchasing green power. Table 1 provides a selection of examples in each category.

[Insert Table 1 about here]

For each of their top three emissions reduction initiatives, we asked firms to indicate how the reductions achieved compared to what they anticipated. The exact question we asked was: “Considering the practices you have just mentioned, for each of them, did you achieve GHG emissions reductions that were smaller than, roughly equal to, or greater than what you anticipated?” For the top-ranked initiative, only 2 firms out of 23 respondents to this question reported lower benefits than expected, while 12 reported benefits (much) greater than expected. For the second- and third-highest ranked initiative, benefits were more in line with expectations, though on average still (slightly) higher than expected. One firm reported a 30% reduction in emissions, while they had only expected 5%. Another firm experienced less reduction than expected “because regulation changed in the meanwhile and our goals could not be achieved”.

The sample initiatives in Table 1 are listed with those yielding the greatest reductions relative to expectations first; many (but not all) of these examples listed provided reductions that were (much) greater than expected. Given how frequently the reductions exceeded expectations, it does not appear, on average, that managers overestimate the anticipated emissions reductions in order to get their projects approved.

Emissions reduction opportunities over time

When considering energy efficiency or emissions reductions initiatives, one often hears references to low-hanging fruit: it supposedly becomes harder to find profitable opportunities after the first easy ones have been picked. To explore that, we asked the interviewees whether the number and size of emissions reduction opportunities available to them today was greater or smaller than before. Several responses suggest that some firms are finding less opportunities than before:

- “The obvious has already been done.”
- “The easy ones have already been identified.”
- “We’ve probably taken the low hanging fruit.”
- “After a point you are probably not going to get much reduction. It depends on where the company is. [...] The opportunity is there but it diminishes over time.”

However, the full numerical responses suggest otherwise. Figure 4 shows that 15 out of 31 respondents find (many) more opportunities today than in previous years, while only 7 find less opportunities than before. The industrial respondents report the smallest increase (but still an increase), while the IT firms see the greatest increase in opportunities. Across the board the responses are skewed towards finding more opportunities, with 14% of firms finding “many more” opportunities, and none reporting “far less”.

[Insert Figure 4 about here]

Several quotes illustrate mechanisms by which opportunities can be increasing.

- One firm opined that CDP is primarily focused on Scope 1 and 2, and that they saw tremendous opportunity in Scope 3.
- At another firm opportunities today are greater because they acquired a new business.
- Another said there are more opportunities today as a result of greater awareness, noting that the opportunities did exist previously.
- One of the firms felt they are getting better and better as their business matures.

The CDP data itself provides another perspective on whether or not the opportunities are diminishing over time, as studied in Blanco et al. (2016a). In each year since 2009, CDP has asked firms how many emissions reductions initiatives they have implemented, as well as more detailed information on some of those, including type of initiative, implementation cost,

payback, and emissions reductions achieved. The average payback period of disclosed projects increased by 3 weeks for each additional reporting period (though with a wide variance). The average number of projects firms claim to have implemented increased from 56 in 2012 to 70 in 2014. (CDP did not ask this question prior to 2012.) This suggests firms are still finding as many or more projects as in earlier years.

Broader benefits experienced from measurement and disclosure

We asked the firms about the main benefits that they had experienced as a result of gathering and reporting climate change information. A wide range of examples was mentioned as the top benefit, including preparing to comply with regulation, increased ability to quantify stakeholders' (investors') interest, tracking and improving performance, improved dialog with stakeholders, transparency, efficiency, understanding impacts, and understanding business and risks.

[Insert Figure 5 about here]

Interestingly, the reasons for disclosing emissions, summarized in Figure 1, are sometimes quite different than the benefits reported in Figure 5. Regulation was listed more frequently as a reason for disclosing than as a benefit, though in one firm's experience, by demonstrating a leadership position on matters like this, they have earned a seat at the table with regulatory bodies and have been able to influence emissions regulation, which helps to make sure that "regulations make sense". We return to this mismatch between motivations and benefits later.

Not all of these benefits are uniquely attributed to CDP, as many of the respondents face emissions reporting requirements from other sources (such as emissions trading schemes), in particular firms in the materials sector. Even in that sector, though, the CDP process is sometimes seen as valuable. One firm commented on the benefits of engaging more with stakeholders and meeting their expectations regarding transparency. This firm considered CDP as a preeminent stakeholder in this space. Another firm noted that several other reports are required, while the CDP disclosure is voluntary; therefore, they assess each year whether the benefits of reporting to CDP outweigh the costs. A third firm highlighted the synergies between

different reporting channels. That firm starts the year with the annual report where they provide general information, then they prepare the CDP disclosure, and subsequently they feed that into the sustainability report which includes all of the information in the annual report but goes into much more detail. A different firm follows the opposite sequence, publishing the sustainability report first, and providing more detail on financial savings in the annual report, which is what investors prefer.

One firm commented that “CDP is pretty important,” and that if companies do poorly in their CDP disclosure there is a reason. Another firm remarked that their CDP report and their sustainability report both helped them to increase their reputation in the market, noting that they have been doing well in several indices. Another firm considers the CDP report “an extension of our CSR report”. Several respondents ranked CDP at the top of the list of reporting channels, because “it gives us a framework”, “people know what it is, it is important to the organizations that give green rankings to companies”, and “CDP is the most highly rated by a good margin.” Other firms noted that the ranking depends on the audience; two specifically commented that, to reach employees, their CSR report is the best channel.

Management practices credited with successful emissions reductions

Given that firms reported achieving benefits from measuring and disclosing their GHG emissions, it is instructive to look at what management practices they attribute that success to. The interviewees mentioned many different practices; the most common responses, as categorized by the interviewers, are summarized in Figure 6. For the materials firms, having a strong business case was the most-frequently mentioned success factor, while for the industrials and IT firms, management support was more important. This could signal that the firms in the industrials and IT sectors are more willing to consider more costly investments in reducing GHG emissions than those in the materials sector. One of the firms recalled that “There was a lot of resistance to the CDP a few years ago, because internal managers could not coordinate to complete the report. With the improvement of our score, we have received a lot of buy in from management.” Two of the technology firms mentioned Six Sigma, specifically the process-based approach and the importance of finding root causes, as success factors.

[Insert Figure 6 about here]

Many opportunities for GHG emissions reductions can lie in the broader supply chain, rather than strictly within a firm's own boundaries. Blanco et al. (2016b) estimate that even the firms in the US who disclose some Scope 3 emissions to CDP on average only report 22% of the emissions that one would expect based on an external benchmark by Matthews et al. (2008), suggesting that many such opportunities are currently going unrecognized. To exploit such opportunities would require collaborating with supply chain partners. Recall that one firm opined that CDP is primarily focused on Scope 1 and 2, and that they saw tremendous opportunity in Scope 3. The CDP (2013, p. 6) report makes the same argument about there being major opportunities in Scope 3.

We asked the interviewees whether or not they agreed that supply chain collaboration is indeed important in implementing emissions reductions. A majority, 18 out of 33 firms who responded to this question, (strongly) agreed, while only 8 (strongly) disagreed.

UNEXPECTED OUTCOMES COME IN DIFFERENT SHAPES AND SIZES

Having summarized the firms' responses to our questions, let us take a closer look at the range of outcomes that they reported. We observed that those outcomes differed from their initial motivations and expectations in several ways. To organize our discussion, we distinguish between outcomes that are primarily operational vs. strategic in nature. Some of these outcomes result directly from the process of measuring GHG emissions and implementing some of the ensuing opportunities, without necessarily disclosing; others do require the additional disclosure step. (One could argue that measurement and implementation may not occur if there was no disclosure-related pressure, but that is not the distinction we draw here.) Figure 7 summarizes these types of unexpected outcomes, which we discuss below.

[Insert Figure 7 about here]

Starting in the left-bottom corner: recall that many of the sample initiatives listed in Table 1 yielded reductions that were (much) greater than expected, including initiatives as diverse as data center efficiency and regenerative braking for conveyor belts. It is not uncommon for firms to find ways of improving processes once they start measuring

environmental impacts (see Corbett & Klassen (2006) for more examples). Furthermore, even though respondents often verbally refer to low-hanging fruit and claim that such profitable opportunities decline over time, 48% reported that emissions reductions opportunities had increased, while only 23% believed they had declined. All in all, it appears that firms frequently achieve greater reductions, and continue to do so for longer, than they expect. The fact that 47% of firms report that their COO uses CDP-related information (Figure 2), despite not being considered a primary audience, further confirms the unexpected but real benefits of measuring GHG emissions.

Measuring emissions does not only lead to immediate operational benefits, but also to more strategic value, in the left-top quadrant in Figure 7. As one would expect, 58% of firms cited demand from investors as a key reason to participate in the CDP process; only 26% claimed to be seeking a better understanding of their business. Interestingly, only 32% of firms listed communication with investors as a main benefit, while 47% pointed to an increased ability to identify opportunities and manage risk. Others have questioned whether the CDP process is addressing the needs of investors (Sullivan and Gouldson 2012), but our findings suggest that CDP is helping firms to better understand their business, presumably an outcome that investors do value.

So far, these outcomes result from measuring and perhaps implementing projects, regardless of whether firms disclose any of this. After disclosure, firms share CDP-related information most frequently with investors, with 61% of firms responding that they do so. However, almost as many firms (53%) report discussing it with clients (Figure 3). In line with that, branding and reputation was mentioned as a main benefit of reporting GHG-related information by 37% of the firms, higher than the 32% who cited communication with investors. Analysis of who uses CDP-related information within the firm portrays a similar impression. Chief Sustainability Officers (CSOs) and investor relations staff were mentioned most frequently as users of CDP-related information, by 63% and 61% of firms. At no less than 55% of the firms, public relations and communications staff use this information, and in 37% of cases, even the marketing department does, even though the nature of the CDP survey is quite far removed from a marketing perspective. This highlights that firms use CDP-related information much

more broadly than anticipated, and reap unexpected strategic benefits in branding and reputation, as shown in the right-top quadrant.

Finally, the lower-right quadrant points to another operational benefit of disclosure. 56% of firms (strongly) agree that implementing emissions reductions initiatives requires collaborating with other stakeholders, such as suppliers or clients; only 24% (strongly) disagree with that statement. In line with that, 53% of firms report discussing CDP-related information with clients, and 32% do so with suppliers; in the IT subsample, the proportions are 86% and 71% respectively. Firms recognize that they will need to collaborate with suppliers and customers in order to achieve meaningful emissions reductions, but also that they will be in a much better position to elicit such collaboration if they disclose their CDP response. While measurement by itself may yield internal operational benefits, the further act of disclosure may be necessary in order to extend those benefits to the entire supply chain.

RECOMMENDATIONS

Our analysis leads to several clear prescriptions for managers, which we discuss in turn below.

Beware of biases

A first implication of the unexpected variety of potential benefits of participating in the CDP process is that the effects are difficult to fully quantify in advance. Therefore, an immediate takeaway from our analysis so far is simple: do not underestimate the value of a measurement and disclosure process, such as that orchestrated by CDP, simply because the effects cannot be fully quantified in advance. If the emissions reductions and benefits achieved are, on average, greater than expected, and new opportunities continue to emerge for longer than expected, it appears as if managers may harbor subconscious biases against this type of project. The energy efficiency literature is replete with examples and explanations for why firms so often leave profitable opportunities on the table, including widely-cited papers by DeCanio (1993) and Jaffe and Stavins (1994) and many others since. Evidence that decisions related to energy efficiency are subject to decision biases is presented in Muthulingam et al. (2013), who

find that simply changing the sequence in which energy efficiency opportunities are listed has a substantial effect on their adoption. In a related context, King and Lenox (2002) find that managers under-estimate the value of waste prevention and hence under-invest in such opportunities.

Our findings deliver additional evidence that managers should take care not to miss out on profitable (and environmentally beneficial) projects by inadvertently underestimating the benefits. This advice should be nuanced, however, by the observation that there are significant differences between sectors. Figure 6 showed that 40% of firms cited a “strong business case” as one of the three main factors facilitating successful implementation of emissions reduction projects. This hides a significant discrepancy between sectors, as the corresponding proportions in the industrials, materials and IT sectors are 40%, 43% and 20% respectively. Conversely, 43% of firms cited “management support”, but the fractions for the three sectors are 60%, 21% and 60% respectively. This suggests that, among the IT firms, management support far outweighs a strong business case, while in materials firms, the opposite is true. A manager seeking approval for an emissions reduction project should therefore follow a fundamentally different strategy if s/he works in the materials sector vs. in the IT sector.

Participating in a disclosure-oriented process can be useful, even if you don't disclose.

CDP's original name, the Carbon Disclosure Project, indicates that encouraging more widespread and comprehensive disclosure about firms' climate change risks, opportunities, and strategies was their primary goal. However, the firms we spoke with repeatedly gave examples that suggested the benefits they experienced from participating in the CDP process followed from the act of measuring emissions and implementing changes, not necessarily from the act of disclosing. Our sample (inevitably) did not include firms that prepared responses to the CDP questionnaire but decided not to disclose, so we cannot definitively disentangle the effects of measurement from that of disclosure; however, firms that find energy efficiency opportunities such as those mentioned earlier, or the 47% of respondents who claimed an increased ability to identify opportunities and manage risk, could presumably harness those gains regardless of whether they ended up actually disclosing to CDP.

Address multiple stakeholders

Another way in which participating in the CDP process appears to yield an unexpected variety of benefits is in the range of stakeholders who use the information. Although CDP's premise is to encourage firms to provide more information about their climate-change related risks, opportunities, strategies, and emissions, we have seen that firms use climate-change related information with other internal and external stakeholders. This is consistent with Burke and Clarke's (2016) observations from a panel on integrated reporting. When completing the CDP survey, managers should therefore keep in mind that a wider range of stakeholders will be reading the responses. Internally, 42% of firms report that the CEO uses CDP-related information, and in 47% of cases the COO does. In many firms, "management support" was a key success factor in implementing emissions reductions initiatives. How a firm completes its CDP survey today will therefore likely have an impact on how the key decision-makers (such as CEOs or COOs) view future proposals for emissions reductions projects.

Even further removed from the primary target audience are PR and communications, who apparently use CDP-related information for reputational purposes, and marketing departments, who discuss CDP disclosures with clients. Although the CDP survey is not geared towards such branding and reputational use, our findings mean that CDP respondents need to be aware that their disclosures may be employed in this way.

Take a supply chain perspective

A firm's CDP disclosures will likely play a role in establishing its credibility when seeking to convince supply chain partners to participate in emissions reductions. We have seen that such collaboration is often considered necessary to achieve further reductions. Most of the CDP disclosures focus on Scope 1 and 2 emissions, which are expected to be reasonably complete; Scope 3 emissions (those elsewhere in the firm's supply chain) are entirely discretionary. Blanco et al. (2016b) estimate that firms only disclose 22% of their Scope 3 emissions (if they disclose at all), and CDP itself believes that "current Scope 3 reporting does not reflect the full impact of companies' activities, and may mislead as to the full carbon impact of a company" (CDP 2014,

p. 9). All in all, our findings suggest that the supply chain perspective is crucial for finding ongoing emissions reduction opportunities, but that both with respect to measurement and disclosure, firms are not yet taking as much of a supply-chain perspective as they should.

CONCLUSIONS

In this paper we have explored to what extent the principle of “what gets measured gets managed” applies to the context of measuring and disclosing greenhouse gas emissions to CDP. From our interviews, we find that firms regularly achieve greater emissions reductions than they anticipate. These unexpected outcomes can be operational as well as strategic in nature, and can result from measurement as well as from disclosure. Given the variety and persistence of these unexpected outcomes, we advise managers to guard against subconscious biases that may lead them to underestimate the value of measuring and/or disclosing GHG emissions. We alert managers to the fact that information that is ostensibly gathered and reported to investors is being used by various other key stakeholder groups. Finally, although the investor-perspective inherent in CDP may induce a focus on the individual firm, we maintain that firms need to intensify their supply-chain perspective, in measurement as well as disclosure.

Our findings are necessarily preliminary, given the limited sample size. We believe that the broad geographic scope and the variation in sectors included does make our conclusions relatively robust, though larger follow-up studies would certainly be welcome.

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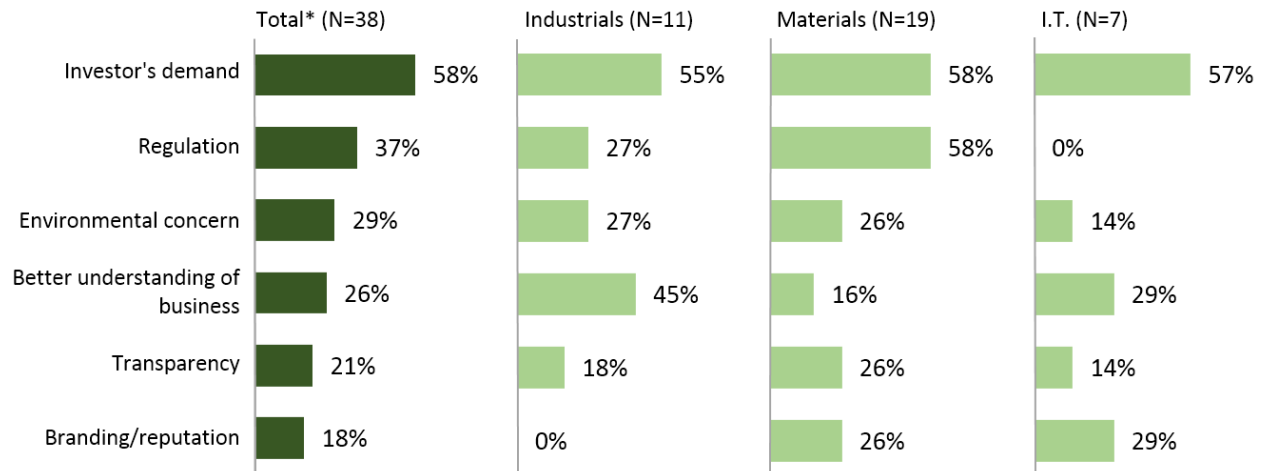
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Table 1: Examples of emissions reduction initiatives implemented

<i>Opportunities directly related to core operations</i>	<i>Opportunities not directly related to core operations</i>	<i>Opportunities that cannot be unambiguously classified</i>
optimization of ship construction and deployment	aggressively pursuing green power purchases	change the company cars
upgrade cement kiln; reducing gas releases during maintenance and other activities	changed electricity from coal to hydroelectric power (energy purchase)	paint optimization
pumps, optimization of equipment	improve buildings' management systems	truck driving (fuel efficiency, safety, monetary savings)
making compressed air generation and usage more efficient	energy retrofits on buildings (LED lighting, building space, etc.)	travel related emissions
reducing emissions associated with fluoride materials	renewable energy portfolio	collaboration technology (behavioral)
substitution of clinker in cement production	HVAC improvements	

Figure 1: Top reasons for disclosing greenhouse gas emissions and percent of firms responding

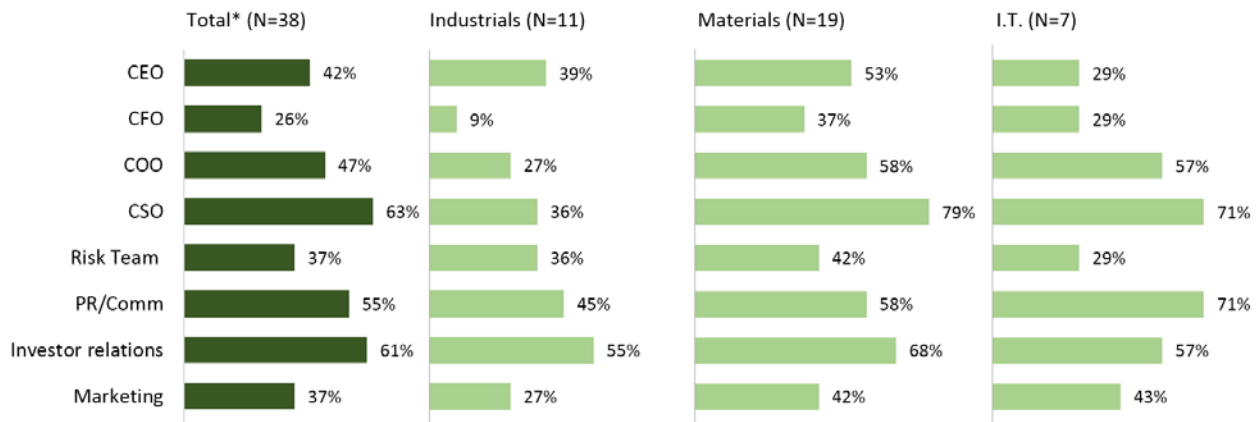
What are the top 3 reasons why your company measures and reports GHG emissions and discloses information on climate change?



*Total includes one financial institution that does not belong to any of the three sectors.

Figure 2: Who uses CDP-related information within the firm

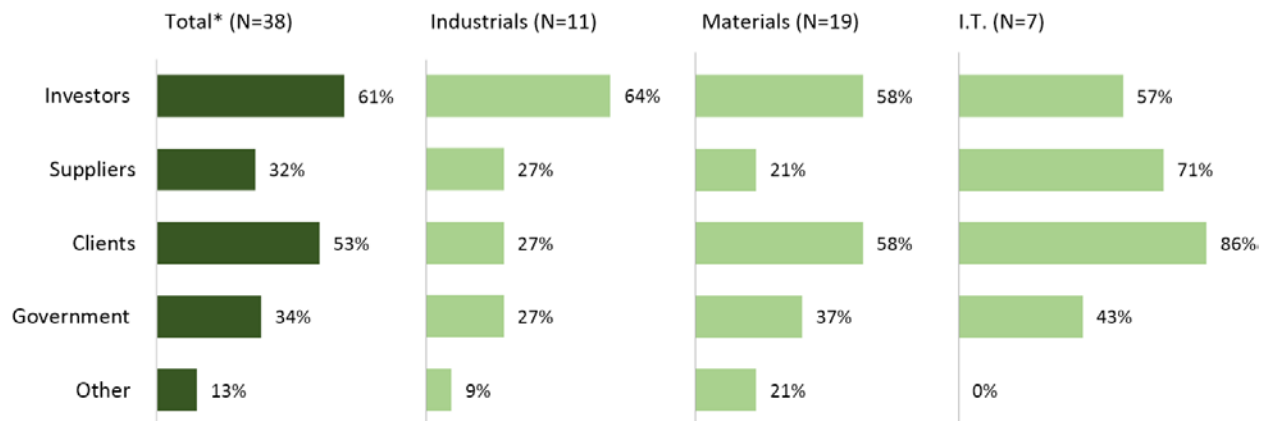
Who uses CDP-related information within your organization?



*Total includes one financial institution that does not belong to any of the three sectors.

Figure 3: Percentage of firms that use CDP-related information with external stakeholders

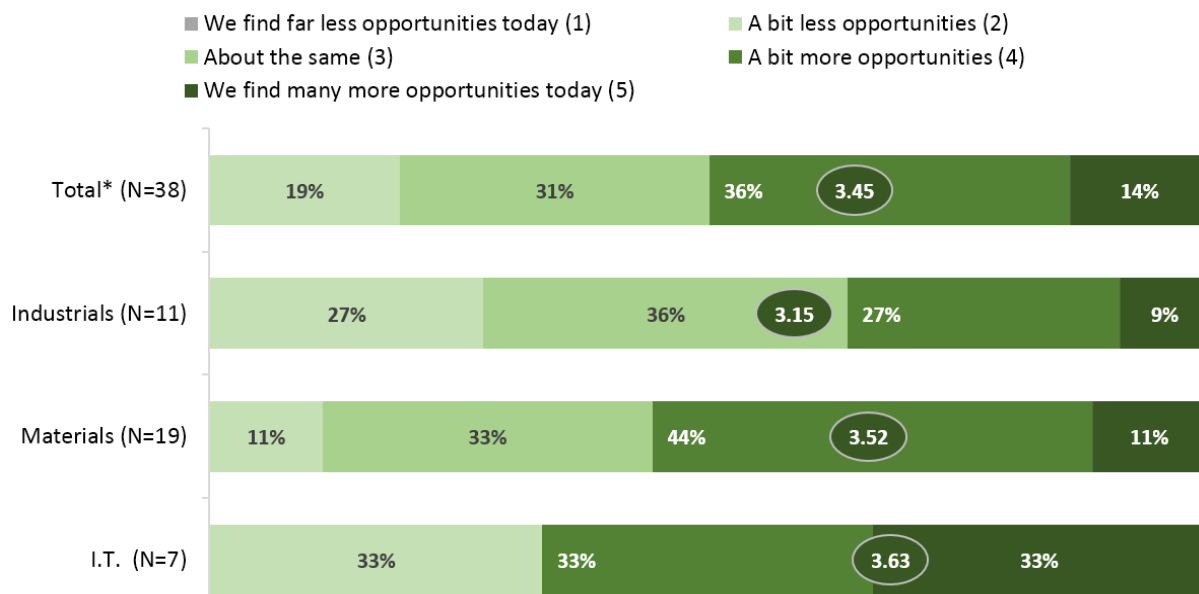
Has your CDP response, or your supplier's CDP response, ever been discussed by your company with any of the following stakeholders?



*Total includes one financial institution that does not belong to any of the three sectors.

Figure 4: Opportunities for emissions reduction relative to earlier years

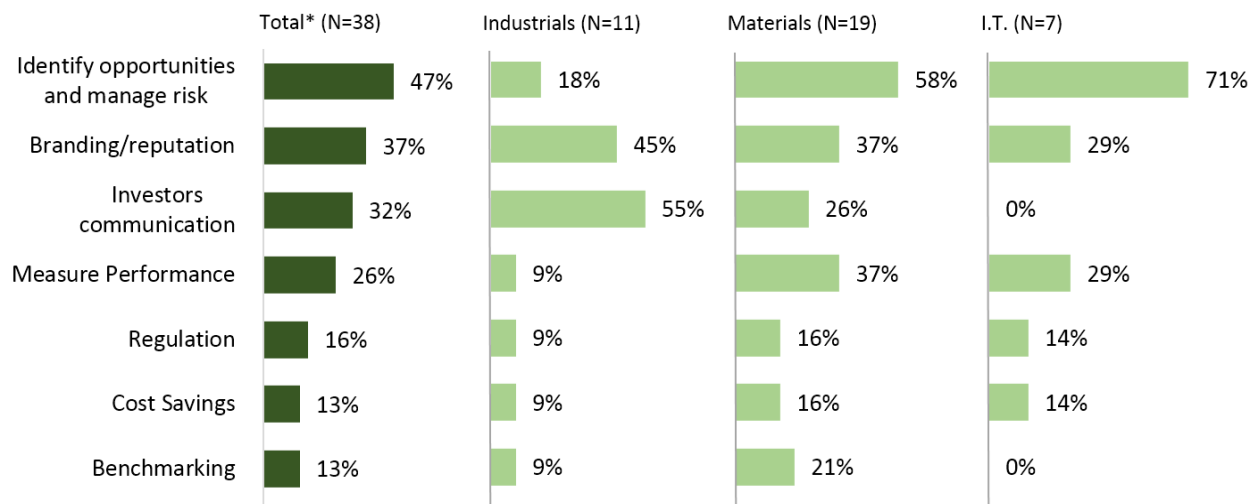
Is the number and size of emissions reduction opportunities available to you today greater or smaller than it was when you first started disclosing to CDP? Please evaluate this on a scale of 1 to 5.



*Total includes one financial institution that does not belong to any of the three sectors.

Figure 5: Main benefits reported from measuring and disclosing climate change information

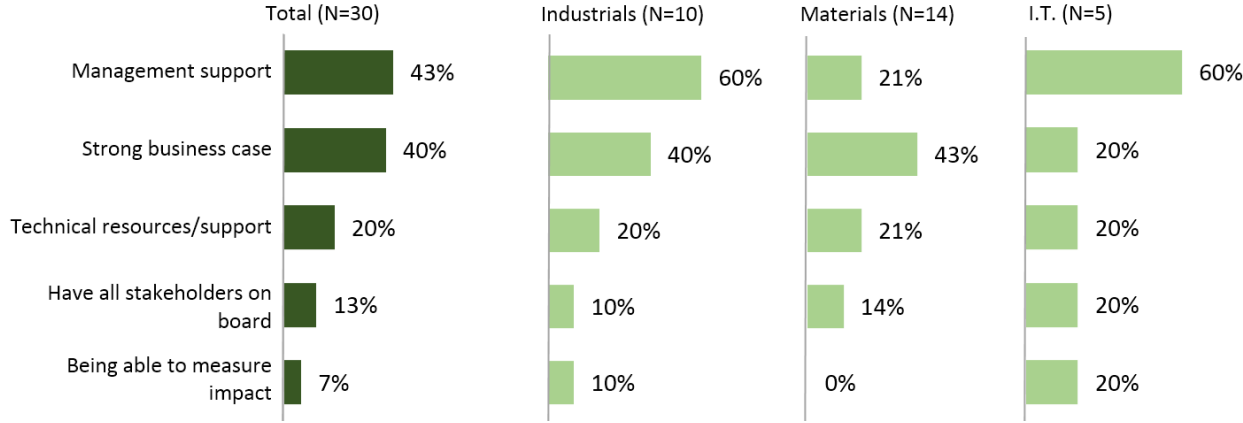
What are the main benefits that your company has experienced as a result of gathering and reporting climate change information (including GHG emissions)?



*Total includes one financial institution that does not belong to any of the three sectors.

Figure 6: Main success factors in reaping benefits from measuring and disclosing GHG emissions

Considering emissions reduction initiatives, what are the 3 main factors that helped you successfully implement them?



Notes: This question was only asked of 30 companies, including a financial institution that does not belong to any of the three sectors above.

Figure 7: Categories of unexpected outcomes of the measurement and disclosure process

strategic	better understanding of business (opportunities and risks)	branding, reputational benefits
	emissions reductions greater and more persistent than expected	communication with supply chain partners
	measurement and implementation	disclosure