

# The effect of prior environmental and financial performance on substantive emission reduction target operationalization in firms



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## **Introduction**

According to the behavioral theory of the firm, firms are goal directed and organizational aspirations are a function of historical aspirations, past performance and the performance of others (Berchicci & Tarakci, 2022). This theory implies that goals are an important signal to stakeholders on firm motivation, since it proposes that they are a function of the firms historical and organizational aspirations. These goals also act as a reference point for firms and stakeholders (Schaltegger & Burritt, 2018; Weingarten et al., 2019). A reference point is a basis for evaluation on a performance metric. Deviations from the reference point are used to determine if there is a performance shortfall or outperformance (Dahlmann, 2019; Weingarten et al., 2019). This indicates that a firms reference point is important for the firm and stakeholders to determine whether or not the firm is performing well on an evaluated metric. An important distinction between goals and reference points is that reference points can exist without a goal being present. A reference point might be intuitive and not written down formally (Ruth & York, 2004). The effect of performance shortfalls and outperformance relative to the reference point has been researched extensively in performance feedback theory (Berchicci & Tarakci, 2022; Greve, 2002; Yang, 2024).

### **Performance feedback**

Common findings in performance feedback studies suggest that performance shortfalls lead to problemistic search (Cao et al., 2024; Dahlmann, 2019; Malen, 2022). Problemistic search is an effort by the firm to address the reason for the performance shortfall through investment or additional attention, leading to better performance if done successfully (Kostopoulos et al., 2023). Performance feedback theory tries to explain how firms respond to failing or outperforming on a performance measure, which is determined by their reference point (Weingarten et al., 2019). However, it is also important to consider the external perspective of performance feedback. As it appears that markets react more positively to beating expectations than to meeting expectations (Degeorge et al., 1999). This might be attributed to the fact that investors and shareholders try to ‘beat expectations’ in investment decisions, and bonus pay-outs are usually only awarded due to outperformance (Degeorge et al., 1999; Maas, 2018). This might encourage firms to restrain their ambition in goal setting, leading them to set goals below their internal reference point in order to manage share- and stakeholder expectations. This exemplifies how goal setting is an important consideration in strategic decision making (Ioannou et al., 2016; Yang, 2024). Most of these relationships in performance feedback theory are investigated through the lens of financial goals and their corresponding financial performance (Greve, 2002). However, in the last few decades, other aspects of firm performance have become more material relative to financial performance (Sehgal et al., 2023). An example of this is environmental performance (Knoppen & Knight, 2022; Lodhia et al., 2023). There is an increasing number of firms reporting on their environmental performance, either because of regulations or as a way to distinguish themselves from competitors (Lodhia et al., 2023).

### **Social performance**

What does this imply for conventional performance feedback theory? Are these findings the same when considering non-financial or social performance? These questions have led to research on social and corporate social responsibility (CSR) performance feedback theory (Delmas & Toffel, 2008; Di Norcia, 1996; Lee & Yang, 2022; Nason et al., 2018). These scholars attempted to investigate the relationship between performance measures on environmental, social and governance criteria and firm behavior. Attempting to explain how social or CSR performance criteria led to different performance feedback mechanisms (Hayibor, 2017; Lodhia et al., 2023; Nason et al., 2018). Social performance feedback appears to have different effects than conventional performance feedback on firm responses to outperformance or shortfalls, though it should be noted that social performance feedback has not been researched extensively as of yet (Nason et al., 2018; Wang et al., 2022; York, 2009).

### **Ambiguity**

The difference in expected outcomes in social performance feedback versus conventional performance feedback can be attributed to the fact that social performance is often ambiguous, due to the many perspectives and metrics it might contain (Cho & Taylor, 2020; Delmas & Montes-Sancho, 2010; Delmas & Toffel, 2008). This also adds complexity to establishing a reference point that is accepted by the firm and its external environment for social criteria, as it is more convoluted than for reference points in financial performance (Delmas & Toffel, 2008; van den Bergh, 2010). Firm perspective also plays an important role in the relationship that goals and reference points have in regard to (social) performance feedback. In social performance feedback, deviations from the reference point in either direction have different proposed effects than in financial performance feedback (Nason et al., 2018). For example, firms might have an 'efficiency frame' when looking at social performance (Nason et al., 2018). Firms with an efficiency frame look at deviations strongly above the reference point as a loss, since this framing defines social performance as additional costs. This framing also causes deviations slightly over or under the reference point to have little effect, due to the results being close to desired efficiency. In contrast, strong deviations under the reference point lead to substantive action to address shortfalls, since it threatens firm legitimacy (Nason et al., 2018; Wang et al., 2022). In this situation, the firm adopts a legitimacy frame to appraise losses. This framing causes the social performance shortfall to be seen as a threat to firm legitimacy. But this type of threat only becomes a problem when important stakeholders take action, which usually only happens when there are strong negative deviations from the established reference point (Eesley & Lenox, 2006; Hayibor, 2017; Ioannou et al., 2016). Illustrating how this relationship is likely different from conventional performance feedback.

### **Environmental performance**

As mentioned in the prior paragraph, social performance consists of many measures that do not have a direct association with financial performance. For this research, we focus on environmental performance. What exactly is environmental performance? A firm might have different effects on the environment, as they might pollute water or negatively influence biodiversity and wildlife in the area they operate (Xiao et al., 2013). Prior research usually defines environmental performance as the amount of greenhouse gas (ghg) emissions a firm emits per year (Dahlmann, 2019; Di Norcia, 1996; Littlewood et al., 2018). How much ghg emissions a firm emits depends on multiple factors (Hickman, 2020). An example of this is industry. an insurance firm does not emit a lot of ghg emissions inherently, but an airline does (Malen, 2022). This is due to the nature of the industry they operate in (Littlewood et al., 2018). Carbon dependency is a measure that expresses how much ghg emissions a firm inherently emits due to their business model or area of operations (Ioannou et al., 2016). We elaborate on these antecedents to environmental performance in our theoretical background.

### **Environmental performance feedback**

But what is so different in environmental performance feedback? How do firms deal with the ambiguity in social performance feedback and what indicates substantive action to address environmental performance versus unrelated responses? Environmental performance is an important aspect of sustainability, and goals associated with sustainability have strong symbolic value (Lodhia et al., 2023). Sustainability can even be seen as a competitive advantage (York, 2009). This symbolic and potentially strategic importance further complicates the matter of establishing what drives firms in environmental performance feedback mechanisms. The way firms respond to results on associated performance metrics might tell us more about their drivers, as was discussed above. Environmental performance ambiguity and the convolutedness of establishing a coherent reference point makes way for firms with an efficiency framing to use this ambiguity to their advantage (Nason et al., 2018).

### **Firm aspirations**

As mentioned before, firms might be motivated to formulate goals slightly below their own reference point for financial metrics in order to manage and exceed expectations (Degeorge et al., 1999). But does this mean it rewards firms to be less ambitious in environmental goal setting? This appears to be quite the opposite, since ambitiousness in goal setting seems to be associated with better environmental performance (Dahlmann, 2019; Hart & Ahuja, 1996). The efficiency framing in environmental performance might also drive firms to be more daring in formulating goals for environmental performance. Since performing slightly below target is not associated with strong negative external consequences when compared to conventional financial performance feedback (Cao et al., 2024; Degeorge et al., 1999). For environmental goals, the degree to which these goals are substantive is

associated with better environmental performance (Dahlmann, 2019). Goals are considered substantive because they lead to intentions and actions to address performance (Cho & Taylor, 2020; Delmas & Toffel, 2008). These substantive goals seem to be more ambitious, and have a longer time horizon, which is necessary to realize these high ambitions (Dahlmann, 2019).

#### **The problem with multiple goals**

Adoption of, and attention to goals by firms also strongly influences performance, since this significantly affects the relationships between the content of the goal and the corresponding actions by the firm (Wang & Sueyoshi, 2018). Firms might respond symbolically to a performance shortfall (Nason et al., 2018). A symbolic response is an acknowledgement of the shortfall but is associated with an ambiguous response that hides a refusal to take action to addresses underlying problems by firms, as this symbolic response still protects firm legitimacy. This opens up the possibility that changing a goal or target operationalization is used as a tool for firms to challenge an ambiguous reference point (Delmas & Toffel, 2008; Malen, 2022). Operationalization in goal setting defines the way a performance metric is measured and evaluated (Malen, 2022). This research aims to investigate this phenomenon and attempts to test current theoretical framing on social performance feedback, substantive goal theory and how prior firm performance relates to substantive operationalization of environmental goals. This phenomenon appears to not have been investigated as of yet. Leading us to the following research question:

#### **How does financial and environmental firm performance relate to substantive environmental target operationalization in firms, and how does substantive environmental target operationalization affect environmental firm performance?**

We will investigate this question by exploring how, and why firms adjust their environmental targets. We also investigate how these adjustments affect environmental performance in later years. Using current theories related to environmental target substantiveness, a framework is developed to determine what indicates a substantive operationalization. Non-substantive operationalization might be used to address a potential shortfall in firm legitimacy instead of environmental performance (Darnall et al., 2010; Nason et al., 2018). The scientific relevance of this study is an attempt to add to performance feedback theory and investigate how ambiguity, social performance, efficiency frames and management attention might impact target operationalization in the context of sustainability performance. Addressing ambiguous metrics in performance feedback is relevant, especially in the field of strategic management where qualitative criteria are becoming increasingly important considerations for decision makers compared to the past (Nelson, 1991).

## **Theoretical background**

### **Key term 1: Target operationalization**

In order to build hypotheses clearly, it is important to define key terms to aid in understanding the structure of our hypothesis development. Firstly, we describe the phenomenon of ‘goal operationalization’ (Malen, 2022). For the purpose of this research, this is defined as: The way a firm defines a goal or target (Malen, 2022). Operationalization is a term used to describe the phenomenon of turning an abstract and ambiguous concept (such as climate change) into a measurable and evaluable metric and target (Dahlmann, 2019; Malen, 2022). We also distinguish between changing a former operationalization of a target as ‘a change in how it is defined, measured or evaluated’. This is considered a reoperationalization (Malen, 2022).

### **Antecedents**

Goal operationalization is done by firms because they want to accurately evaluate their performance (Ioannou et al., 2016; Kostopoulos et al., 2023). If firms are unable to evaluate their performance, they are unable to determine if they are working towards a desired performance outcome (Yang, 2024). As we already touched upon in the introduction, this is closely related to reference point theory (Weingarten et al., 2019). Operationalization is a tool for firms to communicate or materialize their reference point (Gaba & Greve, 2019). Performance outcomes can be ambiguous, so this operationalization is related to how performance outcomes are evaluated and framed by firms or stakeholders (Cao et al., 2024; Lim, 2024). For example; operationalizing a performance metric to be too ambitious might lead performance to be perceived as underperformance by the firm if they do not perform in accordance to said goal, even though their performance might be above average compared to peers (Ioannou et al., 2016; Lim, 2024; Yang, 2024). This might lead to internal and external negativity (Ruth & York, 2004). This emphasizes the importance of careful consideration when creating a (new) target operationalization for firms. Antecedents of operationalization can mainly be summarized as a desire for the measurability and evaluability of a performance metric by firms (Lee & Yang, 2022). Firm aspiration is one of such desires that might lead to operationalization, as it requires them measure and evaluate what they aspire for. They operationalize in order to determine whether or not they should adjust firm behavior if performance is not in line with this operationalization (Xu & Zeng, 2021). In turn, this preceding firm aspiration is influenced by past performance and the performance of peers (Berchicci & Tarakci, 2022). But as we mentioned before, operationalization strongly affects the way a firm is evaluated on its performance (Konduk, 2019; Tate et al., 2014). So how does one discern between types of operationalization? And what type of operationalization indicate a serious effort by the firm to address performance?

### **Key term 2: Substantive target operationalization**

The way we define operationalization for this research is quite general and can be interpreted as ‘to make

anything a firm so desires measurable and evaluable'. Substantive operationalization is a type of operationalization that is associated with an increase in performance after operationalization of the targeted performance measure (Dahlmann, 2019). The reason why this type of operationalization influences performance is not always clear and might be different for separate performance measures (Lim, 2024). For example, there is some research that shows a relation between ambitious goal operationalization and an increase in problemistic search (Berchicci & Tarakci, 2022). Problemistic search has a more direct relation to an increase in performance after shortfalls (Cao et al., 2024). However, this is only one example of how a substantive goal might lead to concrete actions to address performance. More specific antecedents of substantive operationalization depend on the performance measure (Malen, 2022). For this research, we specifically investigate 'substantive emission reduction target operationalization' (Dahlmann, 2019; Lodhia et al., 2023). This type of operationalization is based on substantive emission reduction goal theory (Dahlmann, 2019; Ioannou et al., 2016; Lodhia et al., 2023), which is research on environmental goals that are operationalized in a way that is correlated with an improvement in environmental performance. As we mentioned in the introduction, we define environmental performance as the amount of ghg emissions a firm emits per year. We propose that these substantive goals are associated with better environmental performance based on these theories and proposed relationships. A goal in and of itself obviously does not influence performance, but since environmental performance is ambiguous, it is not yet clear how exactly targets influence firm behavior and or actions in environmental performance feedback, emphasizing the need for research such as this (Nason et al., 2018). Target operationalization that is less substantive and only serves a symbolic function is associated with a decrease in attention and investment into environmental performance by a firm (Dahlmann, 2019; Xu & Zeng, 2021).

### **Antecedents**

Prior research indicates that some firms will operationalize their targets more substantively for short term environmental goals after an environmental performance shortfall, which is an unexpected outcome when considering conventional performance feedback theory (Malen, 2022). They proposed that this was likely due to organizational learning (Tate et al., 2014). This shows how antecedents of substantive emission reduction target operationalizations are not clearly understood as of yet. As some firms still struggle with formulating emission reduction targets that are aligned with their aspirations and their capability to influence performance (Konduk, 2019). In this research, we aim to further investigate performance antecedents to this phenomenon of substantive emission reduction target operationalization, which is further discussed in the hypothesis development.

## **Hypothesis development**

### **H1.1 Attention rules and its effect on goal directed behavior**

'The behavioral theory of firms (BTOF) proposes that firm behavior is goal-directed and that organizational aspirations are a function of prior historical aspirations, past performance, and the performance of others' (Berchicci & Tarakci, 2022, p. 1). This goal-directed behavior is influenced by attention rules, meaning that the attention these goals are given moderates the actual effect they have on performance (Berchicci & Tarakci, 2022; Gaba & Greve, 2019). Similar research suggests that turbulent environments, managerial cognition and other aspects divert attention, as proposed in the Attention Based View of the firm (ABV) (Maas, 2018; Ocasio, 2011). The degree of importance managers or decision makers judge a certain target to be strongly influences the amount of attention these targets are given (Berchicci & Tarakci, 2022; Maas, 2018). This connection seems intuitive, as management attention is a limited resource. Aspiration level and degree of attention are also important aspects in the process of target setting, as they predict to what degree and how often targets are changed due to outperformance or shortfalls (Kostopoulos et al., 2023). This indicates that goals that are deemed as more important will receive more attention and resources to improve performance (Kuusela et al., 2017).

### **H1.2 The effects of prioritization on performance feedback mechanisms**

As described above, there are clear relations between targets or goals and performance feedback mechanisms (Yang, 2024). It appears that firms will prioritize certain goals over others (Gaba & Greve, 2019). Research suggests that most firms will prioritize financial performance over environmental performance (Chiu & Walls, 2019; Garcia & Orsato, 2020; Leong & Yang, 2021). If we link this to the attention-based view of the firm, we propose that poor financial performance will lead to actions to reduce internal attention to goals that are deemed less important, which are environmental goals in the context of this study (Kostopoulos et al., 2023; Weingarten et al., 2019). This leads to (re)operationalization of goals with the purpose of mediating the negative effects of divestment (Eesley & Lenox, 2006; Hart & Ahuja, 1996; Malen, 2022). However, this means we also expect that good financial performance will free up firm resources (and attention), which should lead to an increase in substantive emission reduction target (re)operationalization (Berchicci & Tarakci, 2022; Kuusela et al., 2017; Ocasio, 2011).

### **H1 Summary**

Taking current literature on the ABV and performance feedback into account and linking this to the efficiency framing proposed by Nason (2018). We propose that due to the fact that management attention is limited (Ocasio, 2011), and most firms deem financial performance as more important, poor financial performance should divert attention away from goals that are perceived as a cost. In this context, we expect (re)operationalization to be used as a tool by firms to shift internal management focus without incurring costs related to legitimacy (Nason et al., 2018). Additionally, we expect that above average

financial performance increases attention to environmental performance metrics, since it frees up firm resources and management attention (Kuusela et al., 2017). This leads us to our first hypothesis to aid in answering the research question:

**H1: *Financial performance positively relates to substantive emission reduction target operationalization in firms***

#### **H2.1 The effects of framing on performance feedback mechanisms**

Prior research on social performance feedback indicates that framing in social performance feedback is different than in financial performance feedback, where social performance feedback only leads to problemistic search when there are strong negative deviations from the reference point (Nason et al., 2018; Weingarten et al., 2019). This can be attributed to firms adopting an efficiency and legitimacy frame when looking at social performance (Gaba & Greve, 2019; Nason et al., 2018). This means that firms are unlikely to invest beyond stakeholder expectations due to the uncertain financial benefits of social performance (Manes-Rossi & Nicolo', 2022; Nason et al., 2018). Benefits are uncertain, because it is unclear and hard to measure whether or not stakeholders value this type of performance, and the reference point for this metric might be different between them and the firm (Hayibor, 2017).

#### **H2.2 Operationalization in ambiguous context**

Operationalization of goals seems to have straightforward intentions (Malen, 2022). As it is often an attempt to increase performance by applying conventional performance feedback theory to practice (Cao et al., 2024). In contrast, goal operationalization in ambiguous contexts might be used as a tool for firms to protect or gain legitimacy without actually incurring the costs of improving the associated metric (Malen, 2022). This allows a firm to add to or change unclearly defined metrics to make goals more ambiguous and harder to measure accurately (Cho & Taylor, 2020; Dahlmann, 2019). In this context, the investment into improving the metric is framed by the firm as costs, which hurts the bottom-line in the eyes of the firm (Hart & Ahuja, 1996; Nason et al., 2018). Some research suggests that corporate social responsibility (CSR) or sustainability improves the bottom-line (Hart & Ahuja, 1996; Oh et al., 2017), but this is not always the case. Even though sustainability has garnered a lot more legitimacy in the last few years (In, 2019), delaying investment into sustainability can still benefit financial performance in the short-term (Hart & Ahuja, 1996; Oh et al., 2017). However, due to the potential negative effects that divestment might have on legitimacy, a firm might still be incentivized to be perceived as sustainable without making this investment. This invites the use of (re)operationalization with the intention to hide potential shortfalls in performance compared to peers (Malen, 2022). Operationalization of goals in ambiguous contexts has implications for environmental performance feedback, since it enables the possibility for firm ambivalence to mediate this performance relationship (Malen, 2022).

## **H2 Summary**

The relationship between environmental performance and substantive operationalization is similar, but for different theoretical reasons. This is due to the fact that environmental performance above the reference point is not necessarily rewarded in the eyes of firms (Nason et al., 2018). Indicating that they will not put extra attention into good environmental performance by operationalizing substantively if performance is already adequate. However, this still leads them to have a more substantive operationalization than peers that underperform (Berchicci & Tarakci, 2022). Conventional performance feedback theory also suggests that substantive operationalization is less likely to strongly increase if prior performance is already line with goals (Greve, 2002), indicating a weaker but still positive relation to operationalizing substantively if there is exceptional performance. Lastly, we expect firms that perform worse environmentally to operationalize less substantively, due to either attempting to adjust the reference point, or with an intention to hide the shortfall (Dahlmann, 2019; Malen, 2022). Taking the above into account, we expect that the relationship between environmental performance and substantive operationalization will be weaker than for financial performance due to prioritization, but we still expect this relationship to be positive (Gaba & Greve, 2019). This leads us to our second hypothesis to investigate our proposed performance relation to operationalization:

**H2: *Environmental performance positively relates to substantive emission reduction target operationalization in firms.***

### **H3.1 Substantive emission reduction target operationalization**

As we have already discussed, goals are an important tool for firms to communicate their intentions to their outside environment, as they can be used to symbolize their aspirations (Lodhia et al., 2023; Manes-Rossi & Nicolo', 2022). An operationalization that highlights these aspirations might be similar to stretch goals (Yang, 2024). Sustainability requires a high degree of problemistic search (Cao et al., 2024), and the use of stretch goals in firm sustainability goal setting has become common (Dahlmann, 2019). Stretch goals are operationalized in a way that is purposefully more ambitious than regular goals, and promote problemistic search in employees. Based on current theories on problemistic search, this should lead to improved performance (Gary et al., 2017; Yang, 2024). Building on this, prior research found that the degree to which goals are substantive also predicts whether or not these goals are related to an improvement in environmental performance (Dahlmann, 2019). These substantive components are: The type of goal (absolute versus intensity-driven), the scope of the goal (how far into the value-chain does the firm measure and evaluate), the ambitiousness of the goal (targeted reduction), and the timeframe of the goal (in what timeframe the firm intends to achieve the goal) (Dahlmann, 2019; Ioannou et al., 2016). Dahlmann (2019) found that a longer time-horizon, an absolute measure and higher ambition levels lead to better environmental performance. This specification of substantiveness also seems to address

sustainability ambiguity (Dahmann, 2019; Nason et al., 2018). To illustrate: Absolute measurements are universally interpretable to any stakeholder. Describing how a firm lowered emissions by 50% is less informative than saying a firm lowered emissions by (N) tons, which is a clearly defined unit of measurement. A firm with alarmingly high emissions might be more inclined to use intensity driven (relative) targets, since it does not show the true value and extent of their performance (Cho & Taylor, 2020).

### **H3.2 Substantive intentions**

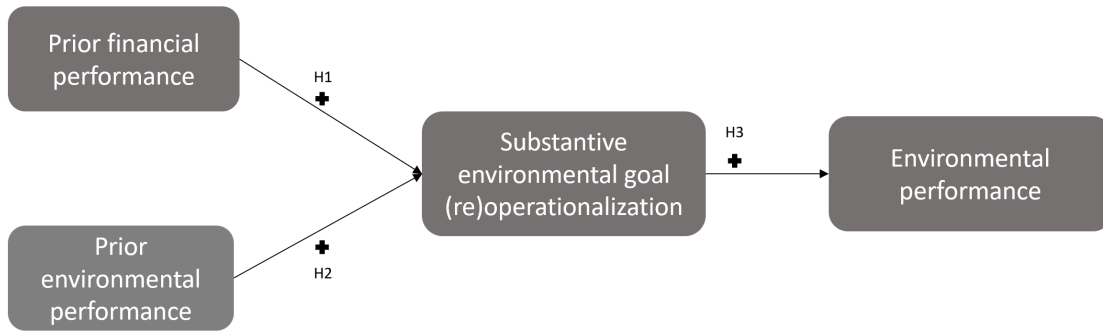
Substantive intentions to reduce emissions are also seen in aspects other than goal setting. For example, a business case or roadmap should be included, and the goal has to encompass the entirety of the desired outcome (Lodhia et al., 2023). This makes sense, since it indicates that the target actually receives management attention (Ocasio, 2011). Which is a sign of problemistic search and leads to actual investment to improve environmental performance (Malen, 2022). If this is not the case, it is more likely that the goal is merely symbolic (Manes-Rossi & Nicolo', 2022). The emergence of the sustainable development goals (SDG) has also led to more research on substantive goal theory (Manes-Rossi & Nicolo', 2022). Most of this research is based on content-analysis of annual reports, which is used to determine SDG developments and materiality for firms (Manes-Rossi & Nicolo', 2022). An important takeaway from that research, which adds to our definition of substantiveness, is the use of frameworks in reporting (Hickman, 2020). A framework such as the Global Reporting Initiative (GRI) is used to standardize sustainability reporting, creating a coherent and clearly defined way for firms to report on their social performance (Wang et al., 2022). A goal that is substantive based on criteria proposed by Dahmann (2019) but does not adhere to a framework makes reported performance less reliable, and might be an indication of greenwashing, which leads to worse environmental performance (Cho & Taylor, 2020). Therefore, the use of a framework is an important aspect to take into consideration when defining substantive intentions.

### **H3 Summary**

A substantive emission reduction target has a long time-horizon, is ambitious, has a large scope, uses unambiguous (absolute) measurements, uses a framework, and is paired with an increase in problemistic search and attention (Dahmann, 2019; Lodhia et al., 2023; Malen, 2022; Schaltegger & Burritt, 2018). These aspects of operationalization are indicators of firm intention to invest into improving environmental performance (Dahmann, 2019). These findings lead us to our third and final hypothesis:

***H3: Substantive environmental target operationalization positively relates to firm environmental performance.***

**Figure 1: Conceptual model**



## Methods

### Sample

Since ESG data is more likely to be collected reliably for large and publicly traded companies (Hickman, 2020; In, 2019) we analyze an index containing the 500 largest publicly traded companies in America through the S&P500. This gives us a suitable representation of the US (and global) economy, since it represents a large market capitalization with an adequate sample size. Since this research has a time-component, we collect data from 2017 to 2022 to see what time horizon is best suited to investigate our proposed relationships. More on this is described in the paragraph on sample characteristics. Since inclusion in the index is based on market capitalization, the sample will contain more than 500 firms due to ex-and inclusion over the sample time period. In order to generate this list, we collected the constituents list of the S&P500 for each year from 2017 to 2022 and removed duplicates. This gives us a total of 623 firms to include in our initial sample.

### Database

In order to extract data on the sample group, a secondary database that collects ESG data on publicly traded companies is used, namely the LSEG workspace/DataStream library. Which holds extensive and if possible, audited data on ESG and financial criteria. This database is commonly used by researchers and investors (Issa, 2024). The ESG metrics used in this database provide measures for environmental performance. Most of these variables are gathered from the annual reports these companies are required to publish (In, 2019). All variables extracted from this database originate from annual reports by firms. This database is made available by the Radboud University library team.

### Analytical approach

Since we plan to measure the effect of both financial and environmental performance on substantive emission reduction target operationalization, which all have continuous measurements (elaborated on later), multiple regression analysis is most appropriate (Hair et al., 2019). Since we measure at different timeframes and measure the effects of our DV as both an IV and a DV, we create two main models

containing different variables depending on the timeframe. One model to test financial and environmental performance and its effect on substantive emission reduction target operationalization, which we will repeat and test at DV<sub>T-1, 2</sub> and 3 including controls at that same timeframe. Our last model will contain our DV as an IV and test its effect at IV<sub>T+1</sub> and 2 on environmental performance including controls. Specific timeframe considerations are discussed in the sample characteristics section.

### Measures

Operationalization table of main IV and DV. Database used is discussed above and is the same for all variables, controls are discussed separately.

**Table 1: Operationalization table**

Construct	Definition	Indicator used in this research	Previously validated by:
Financial performance (ratio)	The way a firm performs in financial metrics. In this case we mainly look at profit.	Profit (revenue-costs) Timeframe: IV <sub>t-1, 2, 3</sub> .	(Gaba & Greve, 2019; Issa, 2024; Simeoni et al., 2020)
Environmental performance (ratio)	How a firm performs in environmental metrics. In this case we refer to performance on GHG-emissions relative to performance.	GHG emissions divided by revenue Timeframe: IV <sub>t-1, 2, 3</sub> and DV <sub>t+1, 2</sub> .	(Dahlmann et al., 2019; Duque-Grisales & Aguilera-Caracuel, 2021; Malen, 2022)
Emission-reduction target time-horizon (ratio)	The time in years a firm designates to reach their targeted reduction	Targeted date minus the year of observation	(Dahlmann, 2019; Malen, 2022)
Emission-reduction target (interval)	The targeted reduction that firm intends to achieve in a given time period	Targeted reduction in percentages	(Dahlmann, 2019; Malen, 2022)
Emission reduction target ambition (ratio)	A firm's emission reduction target, corrected by the time-horizon in which they intend to achieve said target	Target divided by time-horizon Timeframe: DV <sub>t+1, 2, 3</sub> IV <sub>t-1, 2</sub>	Proposed new measure. Important distinction: only measuring from the 'base'-year a firm (re)operationalized in order to avoid skewing results due to time-lag in reporting. **

\*Elaborated on in the sample characteristics section

\*\*Elaborated on in the DV section

### **Missing value analysis**

During preliminary data collection procedures, we observed that many of our ESG-variables were collected less reliably when we go further back in time in our sample timeframe, with 2017 having the most missing values (appendix 3, figure 2). This might indicate time-sensitivity in this sample. We started the analysis by analyzing a variable that acts as both an IV and a DV in our model: emissions divided by revenue. For the 623 firms in our sample, only 273 firms had no missing values across the years. Indicating that we can only analyze the environmental performance of 43,8% of firms in our sample (appendix 3, table 1). Missing data was expected beforehand, since ESG data is still relatively new and many firms still struggle with collecting and reporting this data (In, 2019; Sahin et al., 2022). Prior researchers mostly opt to label the missing ESG data as ignorable and exclude it from their sample due to these considerations, as they acknowledge that many firms do not yet report on this type of data (Dahlmann, 2019; Sahin et al., 2022)

### **MVA in Former research**

Understanding why this data is missing is important, however, the cause of missing data for ESG criteria is most often unknown, and might have multiple reasons (Hair et al., 2019; Sahin et al., 2022). Former research on missing data in ESG criteria leads to multiple perspectives (Sahin et al., 2022). One might expect that missing data in ESG reporting indicates poor ESG performance, however, it appears that missing data is often caused by poor reporting standards and does not necessarily correlate to poor ESG performance (Sahin et al., 2022). This phenomenon also shows up in our sample, with 6 missing values (which is all years) following a similar trend-line to the missing values for profit/financial performance (appendix 3, figures 2 and 3). This indicates that missing values in our sample are likely due to reporting issues. Prior research shows that adding a ‘missing’ pillar actually improves the useability of ESG scores (Sahin et al., 2022). Since this research focusses on relatively new ESG criteria, we label this missing data as ignorable and only focus on complete cases by applying listwise deletion (Hair et al., 2019), as was done in prior research (Dahlmann, 2019; Hair et al., 2019; Issa, 2024; Malen, 2022). Moreover, 273 firms is still an adequate sample size to achieve statistical interference. Sample size considerations will be further elaborated on in the limitations. In order to assess the degree of missingness for other important variables, we created a figure to visualize correlations between missing values for the variable target-date, and target-percentage after deleting initial cases with missing values. This illustrates that there is a high correlation between these two missing values (Appendix 3 figure 1). A last note that will also be touched on in the limitations is the fact that our sample size is now quite low to measure the effect of industry reliably, making the dummies prone to being influenced heavily by outliers (appendix 1, figure 1) (Hair et al., 2019).

## **Dependent variables**

### **Measuring substantive emission reduction operationalization**

Since we aim to measure ‘substantive emission-reduction target operationalization’, which can be described as a factor of multiple measures that have a positive relationship with environmental performance, measuring the complete definition of this term would be out of scope for this research (Dahlmann, 2019). We mainly look at the two most relevant variables from the literature, as shown in the operationalization table. **Reduction target level** (in percentages), and **time horizon** (in years from reported target date) (Dahlmann, 2019; Malen, 2022). These two measures originate from research by Dahlmann (2019) on substantive emission reduction goal theory. As discussed in our theoretical framing, these two measures contain significant predictive power for an increase in environmental performance after operationalization, and indicate an intention to address environmental performance in the future (Dahlmann, 2019). Since we propose to measure the combined effect of both, we create a new measure that includes both of these variables. This combined measure has not yet been used in the literature, but seems to be the most indicative way of measuring substantive emission reduction target operationalization. There does not seem to be prior research that uses a similar sample, database or variable that has similar characteristics, which necessitates the exploration of a new measure to base our proxy variable on. The reason there is few research to base this measure on is likely due to the fact that this type of research on environmental goals is relatively new (In, 2019), and the data is not yet collected as well as some researchers might like. It is also important to mention that this data was collected quite recently, since we measure at T+1 and +2 from 2020. It seems that 2020 is the only year with an adequate sample-size to generate valid statistical interference (more on this in sample characteristics), this date is very recent, so prior researchers have not yet gotten the chance to test this data, especially with a time-lag component. Taking these considerations into account, we propose that this new measure is the best proxy to measure substantive emission-reduction target operationalization (Dahlmann, 2019; Hair et al., 2019).

### **Ambition level**

Target ambition level usually only refers to the total percentage reduction of the goal and is investigated separately in former research (Dahlmann, 2019), but it is logical that a shorter time horizon might compensate for a ‘lower’ percentage reduction. A 100% reduction target with an end goal in 10 years should lead to a 10% reduction per year if measured from the base year. Whilst a 50% reduction in 5 years would yield similar results, but indicating a lower ambition level if we only looked at target percentage reduction. By combining these measures, we can determine the intended reductions that firms aspire for (and how they are measured and evaluated). In order to create this variable, we divide the target date variable minus the observed year of the firms reported target date by the targeted percentage reduction variable (Dahlmann, 2019). This gives us a number between 1 and 100 that gives us an indication of the

relative ambition level of a firm in a given year. A problem with this measure arises with time horizon. If a firm does not update their goals often, the ambition level might not be representative of their actual ambition in a given year due to timeframe skewing this ambition level measure. For example, a firm might have an ambition of 50% reduction in 2020 that they formulated in 2010. If we measure ambition level in 2019 with our proposed method, this ambition level would be 50, which in practice, might actually be less ambitious than a firm wanting to reduce their emissions by 50% in 2024 from the base-year 2019. This leads us to create an important additional variable: **target-date (re)operationalization**. This measure will allow us to only include firms that actually reoperationalized their target-date in the year we investigate target-level ambition. We do this by using the ANY function in SPSS. This allows us to measure firm ambition-level for the base-year in which they formulate their reduction level and target time-horizon. Measuring this at a later timeframe than in the base-year might skew our results. We assume that a target date change (re)operationalization implies a new base level for measuring the targeted percentage reduction at the target date. Controlling for this variable strongly influences the group means (appendix 1 figure 8 and 9). We see how controlling for this usually lowers ambition-level in firms for that year, which we expected to happen due to the delayed timeframe measurements skewing our results. Only including firms that (re)operationalization in the observed year gives us a more accurate indication of our new measure of ambition level.

#### **Environmental performance**

We measure environmental performance in our sample by measuring total GHG emission and dividing this by revenue, as is the way it's measured in the database. This is similar to former research on environmental performance (Issa, 2024). Dividing GHG-emission by revenue removes some of the correlations that firm scale has on emissions, making it easier to interpret relative performance.

#### **Control variables**

In order to isolate the effects that explain and cause substantive emission reduction target operationalization, we take multiple measures from the literature into account in our models. The most common controls for financial and environmental performance are **size** and **industry** (Dahlmann, 2019). Another important control for ambition level and emission reduction from the literature is **foreign sales** (Malen, 2022). Foreign sales means that firms are required to cross borders, which should increase emissions. Additionally, there is more regulatory pressure when doing business across borders. Especially since we only measure the S&P500, doing business with countries from the EU might require firms to have higher ambitions compared to only doing business in the U.S. We also add a control for **resource-use** to our model, which is a variable from the ESG database that measures a firm's capability to use their resources to improve environmental performance within their operating activities. This variable seems to be appropriate to measure the capability of a firm to increase environmental performance if there are no

financial resources available (Cao et al., 2024; Kuusela et al., 2017). This variable might act as a substitute for firm capabilities. If resource use score remains high with poor financial performance, resource use should still influence emission reduction target-ambition, since the firm still has the capability to address shortfalls (Malen, 2022). Our last control is **firm slack** (Kuusela et al., 2017). Firm slack controls for the fact that firms might not have access to financial resources due to high debt. A firm with high debt is less inclined to invest than firms with low debt at similar profit levels, which might have a relation to operationalizing emission reduction targets.

#### **Independent variables**

Our first independent variable is **firm profit**. We use firm profit since it seems the most constant within our sample, and by controlling for firm slack we still get a good indication of a firm's financial situation (Oh et al., 2017). Our second independent variable is **environmental performance** measured in emissions divided by revenue (Hart & Ahuja, 1996; Schons & Steinmeier, 2016; Tate et al., 2014). This independent variable also acts as a dependent variable in our model, which is also the case for our last independent variable (and new measure): **ambition level**.

#### **Ethical considerations**

Since this research uses publicly available secondary data, ethicality mostly pertains to external validity and scientifically responsible application of the data and results. Even though the data might not be in line with the formulated hypothesis, tampering with this data is against the Radboud University's code of ethics and it is generally immoral for a researcher to do. This is mentioned in the NWO code of conduct on research integrity (2018). Which emphasizes honesty, scrupulousness, transparency, independence and responsibility (NWO, 2018). Reporting the data transparently and describing every step in the research process clearly has been an important aspect of the data analysis to avoid the incorrect usage and application of this data. Lastly, the reporting of the findings will potentially only be done after approval from Radboud University in order to protect the integrity of Radboud University's quality standards in research practices. Publishing unapproved results might be an integrity risk, especially if the results are not validated by an experienced supervisor. The consideration between theories and their applicability to the design have also been taken into account by using journals that are relevant to the field, and by using publications that are as recent as possible (NWO, 2018). Lastly, data transformations have only been used to increase interpretability, outliers were not removed except for the applied Winsorization on ambition level and profit, which was necessary to meet assumptions, we used the non-Winsorized version, when possible, to stay close to the true values in the data.

## Results

### Sample characteristics & descriptive statistics of the sample

Since we proposed a new measure, we analyze ambition level to get an impression of its applicability for our analysis. We computed this variable over the sample period and analyzed how it changes over time in the sample (appendix 1, figure 5). We see that, as we expected beforehand, ambition level is not a constant measure over the 6-year time-period, with 2019 being the most ambitious year in the sample. This indicates that firms do not update their emission-reduction targets often to be aligned with their base year ambitions, since we would expect to see a trend for an increase in ambition within the sample if they updated often, as the percentage reduction variable steadily climbs (appendix 1, figure 3). There is also a slow-down of ambition level reduction in 2022. This indicates that most firms update their ambition in the lead up to 2020/21, since most firms seem to have targets aimed towards the end of the decade (appendix 1, figure 2). The average targeted reduction percentage per year shows that the targeted percentage reduction variable only increases year over year except for 2022 (appendix 1, figure 3). This indicates that target date updating is not done yearly, or frequently in our sample, since the ambition-level measure we created decreases significantly. This makes timeframe skewing a problem as we expected. We also see that the time-horizon variable increases by 4 years in 2020 and increases less than 0.5 years per year beforehand. This means that ambition level changes are most prominent in 2020 for our sample, and most firms update to a long time-horizon for emission-reduction targets. This also displays how target (re)operationalization is most frequent in 2020 (appendix 1, figure 4). Which is a characteristic of the proposed symbolic function that environmental goals have, that might correlate with a symbolic time period (start of a new decade) making them similar to stretch-goals (Gary et al., 2017; Yang, 2024). We also investigated how often firms (re)operationalized their emission reduction target percentage or timeframe (table 2). This shows that firms in our sample change their target percentage more often than their target-date, even though these should theoretically correlate. This might indicate that firms that update their target-percentage more often have a lower time-horizon, which necessitates a higher frequency of (re)operationalizing at least target time-horizon. We created a table using this variable to analyze what percentage of firms reoperationalize their targets per year in our sample, separated for a change in target date and target percentage.

Percentage of firms that did **not** change their targets compared to the prior year

Date reop 2018	72.16 %	Perc reop 2018	70.70 %
Date reop 2019	78.39 %	Perc reop 2019	74.36 %
Date reop 2020	49.08 %	Perc reop 2020	46.52 %
Date reop 2021	70.70 %	Perc reop 2021	61.54 %
Date reop 2022	76.19 %	Perc reop 2022	66.67 %

Table 2: Reoperationalization of targets (also visualized in appendix 1, figure 4)

**Considerations**

Due to these sample characteristics, some additional considerations are taken into account. Firstly, a year over year change for our variable: target ambition is not very indicative of an in or decrease in firm ambition level. This measure is most useful to check for differences in firm ambition level in a year where they (re)operationalized. To check for changes in ambition level, it is best to analyze this measure at that specific point in time, and the difference between firms in the sample that also (re)operationalized, since we cannot distinguish between firms that had targets in place prior to operationalization. If we want to check changes in ambition level, we will have to go back further in time to look at ambition level in the base-year to compare that operationalization to the current one, which is impossible with our current dataset.

**Other variables**

Lastly, we visualized the changes for our other variables over the years in graphs (appendix 1 figures 1, 2, 3 and 5). We see a deviation of the trends for our financial metrics in 2020, and some general trends in regard to emission-reduction and financial performance. Using these visuals, we see that target-updating is completed for most firms in 2021, with 2020 and 2021 having many target-date or percentage changes. Table 1 also gives us an indication that 2020 is the year in which most firms (re)operationalized, meaning it has the highest sample size to measure our proposed relationships. Measuring the effects in 2020 and 2021 seems to be the best way to approach our research. If we measure in 2022, we will not have enough firms that reoperationalized in that year to measure their base-year ambition and we risk overfitting (Hair et al., 2019).

**Descriptives**

Since we are working with data over multiple years, we only include the descriptives of the variables from 2020 after necessary transformations. Descriptives for other years are found in the dataset and all have similar characteristics.

**Table 3: Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Environmental performance	273	-.340	3.740	1.677	0.919
Size (nr of employees)	271	2.081	14.650	10.113	1.644
Resource use score	273	2.531	4.610	4.343	0.311
Slack	270	0	191.230	53.198	27.059
Foreign sales	261	-2.000	2.000	0.698	1.518
Profit	271	16.760	17.370	16.938	0.155
Ambition	223	.110	1.300	0.665	0.288
Date reoperationalization	273	0	1	0.490	0.500
Industrial-dummy	271	0	1	0.708	0.455
Utility-dummy	271	0	1	0.092	0.289
Transportation-dummy	271	0	1	0.048	0.214
Banks/savings/loan-dummy	271	0	1	0.044	0.206
Insurance-dummy	271	0	1	0.036	0.188
Other financial-dummy	271	0	1	0.070	0.255

Valid N= 260

**Table 4. Pearson Correlation Matrix**

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Industrial dummy	--												
2. Utility dummy	-.497**	--											
3. Transportation dummy	-0.350**	-0.072	--										
4. Banks, Savings, Loan dummy	-0.336**	-0.069	-0.048	--									
5. Insurance dummy	-0.305**	-0.062	-0.044	-0.042	--								
6. Other Financial dummy	-0.428**	-0.088	-0.062	-0.062	-0.054	--							
7. Slack (2020)	0.027	0.085	0.088	-0.043	-0.206**	-0.031	--						
8. Target Percentage (2020)	-0.100	0.118	0.038	0.013	-0.058	0.032	0.022	--					
9. Time Horizon (2020)	-0.143*	0.006	0.255**	0.040	0.012	0.003	0.040	0.519**	--				
10. Resource (2020)	0.126*	-0.168**	-0.098	0.033	-0.013	0.031	0.029	0.136*	0.020	--			
11. Size (2020)	0.205**	-0.215**	0.116	0.094	0.026	-0.314**	0.069	0.145*	0.149*	0.241**	--		
12. Foreign sales (2020)	0.551**	-0.464**	-0.171**	0.043	-0.132*	0.204**	0.039	0.074	-0.053	0.182**	0.320**	--	
13. Em div rev (2020)	-0.059	0.414**	0.229**	-0.177**	-0.333**	-0.168**	0.148*	-0.076	0.054	-0.316**	-0.260**	-0.263**	--
14. Ambition (2020)	-0.018	0.130*	-0.139*	-0.017	-0.071	0.038	-0.027	0.636**	-0.307**	0.113	0.037	0.114	-0.125

**Note:** \*\* $p < 0.01$ , \* $p < 0.05$

## Hypothesis 1

For hypothesis 1 we expect that financial performance positively relates to substantive emission reduction target operationalization, which is measured through the variable: ambition level.

Our first model with only controls is insignificant at  $F(1, 115) = 1.065, p=0.395$ . This can be observed in the table below containing the results from our regression analysis. Our second model is significant at  $F(2, 114) = 9.265, p=0.003$ . Profit in 2019 is the only significant predictor of ambition level in firms that reoperationalized their target-date within our sample with a beta coefficient of  $\beta=0,389$ . Providing evidence that profit in the prior year positively relates to our measure for ambition level in 2020. Our second model has an adjusted R squared of 0.077, which explains 7.7% of the variance for ambition level in our sample if we include model complexity.

Since we find evidence that profit influences emission-reduction target ambition in our sample for 2020 with a beta coefficient of  $\beta=0,389$  and a significance level of  $p=0.003$ , we **accept** our first hypothesis that financial performance positively relates to substantive emission-reduction target operationalization.

## Hypothesis 2

For hypothesis 2, we expect that environmental performance to positively relate to substantive emission reduction target operationalization, but that this relationship is weaker than for financial performance.

We repeat the analyses from our first hypothesis and add profit as a control variable for 2020. We create model three by adding environmental performance measured in emissions divided by revenue. As can be observed in the table below, our third model is significant at  $F(3,112)=4.603, p=0.034$  and has an adjusted R squared of 0.108. The beta coefficient for profit in 2019 lowers slightly to  $\beta=0.384, p=0.003$ . The model also displays how emissions divided by revenue at T-1 has a significant effect on target ambition operationalization in 2020 at  $\beta=-0.072, p=0.034$ . Two of our controls also find significant correlations with ambition level in this model, with the industry: Industrial becoming significant at  $\beta=-0.213, p=0.040$ . Size also becomes significant at  $\beta=-0.043, p=0.037$ . This leads us to **accept** our second hypothesis that environmental performance positively relates to firm ambition level operationalization. We also see that this relationship is slightly weaker than for financial performance as displayed by the lower beta coefficient. The resulting beta coefficients and directions are visualized in appendix 1, figure 10.

**Table 5: Multiple regression analysis model 1 (controls), 2 (+ profit), and 3 (+ environmental performance) at T-1.**

**Dependent Variable: Ambition level in 2020**

**Selecting only cases that (re)operationalized for 2020**

**N=116**

<b>Variables</b>	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>
Foreign sales 2019	0.023 (0.069)	0.014 (0.512)	0.010 (0.651)
Resource use 2019	0.004 (0.294)	-0.030 (0.714)	-0.054 (0.509)
Slack 2019	-0.51 (0.959)	-0.018 (0.610)	-0.012 (0.721)
Size 2019	-0.004 (0.130)	-0.034 (0.098)	-0.043* (0.037)
Industrial dummy	0.100 (0.331)	0.152 (0.131)	0.213* (0.040)
Utility dummy	0.188 (0.124)	0.134 (0.257)	0.252 (0.052)
Transportation dummy	-0.66 (0.672)	0.026 (0.861)	0.096 (0.562)
Banks/saving/loans dummy	0.093 (0.588)	0.058 (0.738)	-0.036 (0.831)
Insurance dummy	0.013 (0.949)	0.055 (0.789)	0.008 (0.966)
Profit 2019		0.389** (0.003)	0.384 (0.003**)
Emissions 2019			-0.072 (0.034*)
Constant	0.756 (0.069)	-5.552** (0.010)	-7.948** (0.010)
<b>AdjR<sup>2</sup></b>	0.005	0.077	0.108
<b>F-statistic</b>	1.065	9.265**	4.603*
<b>Prob (F-statistic)</b>	0.395	0.003	0.034

\* $p < 0.05$

\*\* $p < 0.01$

values in brackets are significance levels

### Hypothesis 3

For hypothesis 3, we expect that substantive emission reduction target operationalization leads to better environmental performance in the following year.

In order to test how our proxy for substantive emission reduction target operationalization (which is ambition level) influences emissions divided by revenue, we created a new model and tested for environmental performance at  $IV_{T+1}$  after (re)operationalization in 2020. We use the variables: Size, industry, foreign sales, and resource use as controls as they are correlated to environmental performance according to the literature (Dahmann, 2019; Malen, 2022; Manes-Rossi & Nicolo', 2022). Results are found in the table below. Our controls appear to have significant correlations to environmental performance, as our initial model is significant with an F value of  $F(8, 109) = 8.619, p < 0.001$ . The Industrial dummy has a significant positive effect with  $\beta = 0.789, p < 0.001$ , The Utility dummy is also significant with a positive effect of  $\beta = 1.563, p < 0.001$ . Lastly, the Transportation dummy shows a positive relation to environmental performance  $\beta = 1.607, p < 0.001$ . These values are relative to the industry: Other financials.

By adding our new IV, which is ambition level, our results stay significant even through an increase in model complexity with an F value of  $F(9, 107) = 5.177, p = 0.025$ . Foreign sales and resource use remain insignificant, and size become significant at  $\beta = -0.136, p < 0.001$ . The same industries are significant, displaying values of: Industrials=  $\beta = 0.866, p < 0.001$ , utility=  $\beta = 1.661, p < 0.001$ , and transportation reporting  $\beta = 1.607, p < 0.001$ . compared to the industry: Other financials.

Our controls (model 4) have an adjusted R squared of 0.344, which explain 34.4% of the variance in our DV. Adding our dependent variable improves the adjusted R squared to 0.369. Which increases the variance predicted in our DV by 2,5%. Indicating that target ambition improves our models predictive capability for environmental performance by 2,5% in our sample if we include model complexity. Our 5th model has an adjusted R squared of 0.369, which explains 36,9% of the variance in our DV including model complexity. Since lower emissions indicate better environmental performance, negative relations are interpreted as positively influencing environmental performance.

Since our measure of ambition level has a significant negative relation to emissions at  $\beta = -0.602, p < 0.025$ , we **accept** our third hypothesis which states that substantive emission reduction target (re)operationalization is positively related to environmental performance. Results visualized in appendix 1, figure 11.

**Table 6: Multiple regression analysis model 4 (+ controls) and model 5 (+ ambition) at T+1**  
**Dependent Variable: Environmental performance in 2021**  
**Selecting only cases that (re)operationalized for 2020**  
**N=117**

<b>Variables</b>	<b>Model 4</b>	<b>Model 5</b>
Foreign sales 2020	-0.069 (0.201)	-0.048 (0.424)
Resource use 2020	-0.390 (0.085)	-0.431 (0.079)
Size 2020	-.004 (0.839)	-0.136** (0.007)
Industrial dummy	0.789** (0.004)	0.866** (0.003)
Utility dummy	1.563** (<0.001)	1.661** (<0.001)
Transportation dummy	1.607** (<0.001)	1.607** (<0.001)
Banks/saving/loans dummy	0.339 (0.453)	0.395 (0.400)
Insurance dummy	-0.746 (0.065)	-0.730 (0.215)
Ambition level 2020		-0.602* (0.025)
Constant	3.832** (<0.001)	0.389** (0.003)
<b>AdjR<sup>2</sup></b>	0.344	0.369
<b>F statistic</b>	8.619**	5.177*
<b>Prob (F-statistic)</b>	<0.001	0.025

**Note: \* $p < 0.05$  \*\* $p < 0.01$**

negative relation means better environmental performance, because emissions are lower  
values in brackets are significance levels

## **Robustness tests**

### **Time sensitivity hypothesis 1 & 2**

When we test the effect of performance at DVT-2 on ambition level, our results show signs of robustness with both profit and environmental performance remaining significant for predicting ambition level in 2020 for firms that (re)operationalized with an F value of  $F=(9,107) 9.205, p=0.003$  (appendix 5). Profit is still the most significant predictor, reporting a positive relation of  $\beta=0.645, p<0.001$ . Environmental performance shows a value of  $\beta=-0.077, p=0.024$ . Running the model at DVT-3 leads to environmental performance no longer being significant at  $p=0.061$ . Profit remains significant at an identical value of  $\beta=0.645, p<0.001$ . This is the furthest we can go back in time within our sample. We find some indication that the model starts losing significance at T-3, showing signs of time-sensitivity in regard to the influence of environmental performance. The F value of this last model is  $F(8,109) = 3.006, p=0.010$

### **Time sensitivity hypothesis 3**

We tested the effect of ambition level on environmental performance at  $IV_{T+2}$ . This model is similarly significant to our original model at  $F(11, 105) = 4.925, p=0.029$  level. Indicating that our results for ambition level stay robust when measuring environmental performance two years after ambition level operationalization. In this model, ambition level reports a value of  $\beta=-0.566, p=0.029$ , with the same controls from our earlier model remaining significant.

### **Targeted reduction**

Lastly, we tested targeted percentage reduction without adjusting for time horizon. We see that profit influences targeted percentage reduction significantly at  $\beta=0.355, p=0.004$ . The full model is significant at  $F(10, 106) = 1.915, p=0.045$  if we only include profit. Adding environmental performance in the second model causes the model to no longer be significant at  $F(12, 104) = 1.436, p=0.233$ . Correcting for time horizon by using our new measure seems to cause statistical significance for our initial models. In this model, profit is the only significant predictor at  $\beta=0.355, p=0.004$ .

Models with all variables included are found in appendix 5: full models and model summaries of robustness tests.

## **Discussion**

We set out to investigate how financial and environmental performance influence the substantive operationalization of emission-reduction targets and how substantive operationalization is related to environmental performance. We found evidence that for at least 1 year in our sample, when most firms (re)operationalized emission-reduction targets, firms that perform well environmentally and financially operationalized their emission-reduction target ambitions more substantively. This substantive operationalization also correlates with an increase in environmental performance for the following two years in our sample. Robustness tests showed that measuring performance at T-2 and T-3 also held significant relation to ambition level in 2020.

Most firms seem to update their emission-reduction targets around the end of the decade or 5-year period, as was observed in the sample characteristics. This might indicate that firms that update around the end of the decade are more prospective, which might correlate to better performance (Weingarten et al., 2019). Our timeframe turned out to be very suitable for this analysis. We found support for all three of our hypotheses and seem to have found strong predictors for substantive emission reduction target operationalization for our sample in 2020. Our controls seemed to have mixed significance, which signals that there are many different aspects influencing ambition level depending on firm characteristics. Giving us indication that this field of research still has many avenues left to explore.

### **Theoretical implications**

Our results give no indication of substantial evidence that (re)operationalization is specifically used as a way for firms to hide environmental performance shortfalls or poor performance in general. Whether or not the correlation between profit and substantive emission reduction target ambition is caused by underlying firm drivers, cannot be deduced from our results. We did find that financial performance was a better predictor of emission-reduction target ambition after operationalization. Though this does not diminish from the fact that environmental performance also positively correlates with emission-reduction target ambition after (re)operationalization in our sample, but it is an interesting finding that financial performance is responsible for more variance explained, since it is a completely different performance measure to environmental performance. This supports the theory that social performance feedback causes different metrics and performance outcomes to lead to different organizational action, most likely influenced by management attention and prioritization (Di Norcia, 1996; Leong & Yang, 2021; Nason et al., 2018). Findings in performance feedback theory indicate that the main metric to predict organizational action should be their respective performance measures (Yang, 2024). However, in our sample, it appears that profit is a better predictor of this environmental performance feedback mechanism (Chiu & Walls, 2019; Lim, 2024). Indicating that firm attention is an important factor to take into consideration when

predicting firm target operationalization in response to performance outcomes (Berchicci & Tarakci, 2022; Ocasio, 2011). From our results, we find some indication that firms are willing to increase their environmental target ambition if profits are good. This ambition level increase is also correlated to an increase in environmental performance, which requires substantive actions if they intend to meet said goal. This might be explained by current theories on financial slack, that ascertain how a firms freedom to invest in longer term actions or having free resources to address environmental performance lead to this phenomenon (Duque-Grisales & Aguilera-Caracuel, 2021; Kuusela et al., 2017), even though financial slack did not seem to directly correlate with more substantive emission reduction targets after (re)operationalization.

#### **Multiple drivers & its effect on aspiration**

This research provides evidence that firms are still partly profit-driven in regard to addressing their environmental performance, since our models show that profit is the most significant predictor of addressing environmental performance through substantive emission reduction target operationalization. If firms were not profit driven whatsoever in environmental target operationalization, this correlation would not exist in our sample. This correlation remained significant even when controlling for resource use and our other controls. Environmental performance has a positive relation to substantive emission reduction targets after (re)operationalization according to our models. However, the fact that profit is more significant in our model indicates that this effect should not be underestimated when predicting substantive operationalization of emission reduction targets, and a firms commitment to reducing emissions, alluding to the requirement of a broader view toward firms that have multiple goals when researching (social) performance feedback (Lee & Yang, 2022; Nason et al., 2018). A last important consideration for this research is the fact that we measure the effect of performance on emission reduction target ambition level after (re)operationalization as an indicator of forward intentions to address environmental performance, but we do not measure the actual underlying cause of increased environmental performance. We proved that substantive emission-reduction target (re)operationalization led to better environmental performance, but the reason why or how this substantive operationalization improves environmental performance is not investigated outside of our theoretical framing (Dahlmann, 2019; Malen, 2022). We provide further evidence that there are latent factors underlying to substantive emission reduction targets after (re)operationalization that cause an improvement in environmental performance. This opens up the avenue of questioning why this might be the case, hinting at stretch-goal theory (Gary et al., 2017). Our sample contained many targets that had similar characteristics to stretch goals, as was observed in the sample characteristics (Gary et al., 2017; Yang, 2024). If a firm sets an ambitious target, it serves as an indicator that they intend to substantively address the underlying reasons for their currently lacking performance compared to said goal. Understanding exactly why these

substantive goals lead firms to increase their environmental performance remains speculation based on current theories and is not replicated in our sample (Cao et al., 2024; Malen, 2022).

### **Comparing to prior research**

The firms in our sample seemed to have goals with a high average time horizon in 2020. Which was 9 years, with an average reduction target of 50%. Stretch goals are ‘more ambitious’, but the environmental targets in our sample were ambitious in general, which is not necessarily ‘more ambitious’. This slightly undermines stretch goal theory and its effect on organizational change i.e. problemistic search in environmental performance feedback (Gary et al., 2017). Do stretch goals work if all goals in a sample are ambitious? And what if the entire sample uses stretch goals? Does this remove the effects of stretch goals due to making them standard practice? Similar research on environmental goal (re)operationalization mainly looked at the effects of problemistic search and short-term environmental targets (Malen, 2022). This research is different due to having long term goals in our sample, and not correcting for problemistic search. We combine findings from Dahlmann (2019) and Malen (2022), and add to their research by investigating the antecedents of substantive operationalization. Adding profit as an additional variable and researching firms with different characteristics and goal types. Our research is also not really able to look at ‘shortfalls’, since we do not have access to short-term targets in our sample and we look at base-year ambition level, which was not possible to extract fully reliably. Malen (2022) found that shortfalls in environmental performance more often led to an increase in aspiration formation for firms, where he expected the opposite to occur. He also proposed that it was hard to measure the direction for aspiration change in his sample and found evidence that reoperationalization in general led to a decrease in environmental investments (Malen, 2022). Interestingly, the timeframe he used was 2011 to 2017, which is still a time where ESG data is not collected very reliably, which is shown by his use of a survey for firms in Tokyo, and having 58% missing values in his sample (Malen, 2022). Another important basis for this study is from research on substantive emission-reduction targets (Dahlmann, 2019). This study had a sample from 2010 to 2014, but in this study, there is no mention of the effects of symbolic timeframes (decades, 5-year periods) and the possible relation that a firm will operationalize substantive emission-reduction targets. In his discussion he outlines that they find evidence that targeted emission reduction (in percentages, so not including time horizon) and time horizon separately lead to substantive intentions to reduce emissions. By including time horizon in our measure for this research, we add to his findings and prove that combining his findings lead to a significant reduction of emissions for firms in our sample. Interestingly, his sample had a mean time-horizon of 7,5 years, but he does not seem to acknowledge the effect that the beginning and endings of decades have on time-horizon in climate goals if you subtract the observation year. We theorize that this happens due to the symbolic value those time periods hold, which seems logical, but we have not found research to support this theorized effect. The time period in his

research (2010 to 2014) is indicative of a time where climate-change targets were quite new for firms, while in our sample, the (re)operationalized 2020 targets are most likely not the first time that firms operationalized emission reduction or ESG targets, though past data to confirm this is unavailable. This trend is important to take into consideration for future research and will be addressable when data collection improves.

### **Practical implications & recommendations**

Practical implications that can be derived from this study include that we add to prior research on substantive emission-reduction goal theory, further emphasizing how (re)operationalizing a substantive emission-reduction target seems to be a driver for an increase in environmental performance in firms. By using these findings, managers might be more inclined to formulate ambitious goals, and see how substantive environmental goals lead to additional efforts and investments into increasing environmental performance. Secondly, policymakers and other non-financial stakeholders might be able to use these findings to improve their decision making when balancing stakeholder actions related to firms. Firm financial performance seems to ‘allow’ firms to become more sustainable. There is circumstantial evidence that there is some sort of feedback loop between financial performance and increased environmental performance, which might be due to the fact that good financial performance frees up management attention, allowing firms to invest into resources to improve on environmental performance. This might mean that punitive action (such as large fines) towards firms that perform poor environmentally, might be counterproductive. This does not mean firms that perform poorly should not be punished, but adjusting these punishments to not impact resource freedom of the firm might be a better way to incentivize better environmental performance. We also argue that firms who formulate new environmental targets should acknowledge the effect of their financial targets on related performance measures. Especially since ESG performance is becoming a more important metric to include in a firms valuation (In, 2019). The last important practical implication is that firms should include the base-year from which they measure their emission reduction target, and ESG databases should include this variable in their database. This makes it more reliable to measure substantive target ambition, which would reduce ambiguity and makes measuring relative environmental performance compared to targets much more reliable.

### **Limitations**

Firstly, this research intended to investigate how environmental and financial performance relate to environmental goal changes and frequency of goal (re)operationalization over time, in order to investigate what drives firms to change environmental goals over time. However, due to sample size and methodological constraints, we had to make some adjusted and only analyzed substantive

(re)operationalization at one point in time and compared that to performance at different timeframes. Secondly, we proposed that current theories on social performance feedback give us enough information to determine whether or not an environmental goal is substantive. However, this field of research is not as well developed as other fields in strategic management. The way in which goals are substantive is still debated, and this research tried to extrapolate some of the current findings to a new sample, hoping to see similar results. Thirdly, we used a proxy measure for substantive operationalization, which means we did not measure the entirety of the current definition of substantiveness. It is quite possible that in our sample, other indicators would have yielded different results. It is also important to mention we used a secondary database, in order to collect ESG data, which is still not collected as reliably as financial data in secondary databases (Sahin et al., 2022). The relationships we found might also be different when measuring in other countries. This research looks at the S&P500, which is a sample based in the United States. Which also adds potential problems to external validity, especially when we attempt to extrapolate results to non-western countries. Another limitation is that there were too many potential control variables to include in this analysis, as becomes evident from the variance explained in our models. There are many other reasons why firms might formulate ambitious goals, such as: legislation, industry changes, technological advancements, political incumbency (in the US, a democratic incumbent president might positively influence emission reduction target ambitiousness of firms). These relationships might have been investigated in the past but add too much complexity to our model. It is important to take into account that there is a lot of variance that cannot be explained by our model. Lastly, one of the most important limitations in this research is that we did not have an adequate sample size to measure the effects of industry reliably, making those results very sensitive to outliers. We did use this to correct for industry differences in our model. This research is mainly externally valid when applying our findings to large public U.S. Industrial companies.

### **Future research**

As has been discussed in the methods section, this area of research seems to be relatively new. Not due to terms and theories being new, but mostly due to recent improvements in ESG data quality (Duque-Grisales & Aguilera-Caracuel, 2021). Defining what to measure is still up for debate, but by research such as this and by finding more datapoints that can be used to predict firm responses to performance outcomes, managing firms with multiple goals might become less reliant on intuition. We also argue that we provide enough evidence that ambition level correlates with an increase in environmental performance, which opens the avenue for new research on the exact causes that this correlation has on environmental performance. Do ambitious firms invest more in problemistic search? Does individual employee motivation lead to more innovation, or does management attention change due to these higher ambitions? Since environmental performance is not a historically homogeneous performance measure in firms and it

has garnered popularity over time, future research on this topic will likely have different results, as we see by the difference in time-horizon that Dahmann found in 2010 at 7,5 years, but our sample having a higher time-horizon (9 years) at that same time-frame (start of the decade). With ESG data and performance becoming more relevant in less ambiguous, the more it seems likely that its corresponding feedback mechanisms will become similar to financial performance feedback. But there is also an important reverse implication, since the weight in importance and attention to these goals change over time, what might the effects of environmental performance on financial performance become when stakeholders and shareholders start assigning more and more value to ESG performance? And how does past research hold up when these values change?

### **Reflection**

Setting up this research was quite challenging due to the complex nature of some of the variables. Our research focusses on a relatively large phenomenon, and general predictors of firm behavior. Profit strongly influences many aspects of firm behavior (Gaba & Greve, 2019), but proving how it strongly influences target ambition for environmental performance is a new finding. Initially, we tried to set up a very complex research, investigating many variables that are associated with substantive emission reduction targets. With the goal of identifying firm drivers of emission reduction target reoperationalization. We theorized that poor financial performance might lead firms to make their environmental goals more ambiguous (Nason et al., 2018). However, measuring such a phenomenon is very convoluted and would be out of scope for a master's thesis. Since the environmental target date and targeted reduction variables are quite new, there are still few studies on firm environmental target ambition level. This made it more difficult to replicate prior studies, leading us to explore new ways to use the data in this study. Using the date reoperationalization variable turned out to be a great way to extrapolate the base year, improving the results of our study through the use of this creative new measure. In hindsight, our initial plan led to some problems at later stages. Our first idea made it difficult to simplify our model, since it incorporated too many aspects of the phenomenon we wanted to investigate.

### **Concluding remarks**

We set out to investigate what leads firms to operationalize substantive emission reduction targets, and found that both environmental and financial performance positively affect the operationalization of substantive emission reduction targets. This is in line with current theories, and emphasizes how performance outcomes of one target might be a stronger influence on the operationalization of a different target, even though these might not be practically related. We also found that profit has a stronger positive relation to substantive emission reduction target operationalization compared to environmental performance. This provides some evidence that firm financial performance might be a more important

consideration by firm decision makers when formulating substantive emission reduction targets compared to actual environmental performance. This further substantiates how a multiple perspective approach to environmental performance is important, since it assists in acknowledging how underperformance in one goal might negatively influence the future performance of a seemingly unrelated goal through adjustments in operationalization. Lastly, we proved how substantive environmental target operationalization positively relates to environmental performance through our last model. Showing how current theories on some aspects of substantive emission reduction targets are replicable to a new sample.

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