

CARBON DIOXIDE REMOVAL - A TOOL IN A TOOLBOX FOR REACHING NET-ZERO EMISSIONS

Abstract: Corporations play a vital part to limit global warming within the lines of the Paris Agreement and are increasingly making net-zero pledges for committing to decarbonising their operations. The ability to reach these ambitious targets will rely on the development of negative emission techniques referred to as carbon dioxide removal (CDR). Scholars have raised concerns that corporations are putting too much faith in the nascent CDR technologies and there is a fear of CDR having a negative effect on internal reduction efforts. On the contrary, the voluntary carbon market is rapidly growing, and corporations continue to invest in CDR. The purpose of this thesis is to explore the drivers behind, as well as the role of, CDR investments in corporations' efforts to reach net-zero emissions. To achieve this, we conduct a qualitative study where we interview twelve sustainability managers or climate specialists at large corporations who are using or planning on using CDR in their strategies for reaching net-zero. In terms of drivers for CDR, we identified six potential drivers for investing in CDR. Further, we found that corporations' belief in CDR technology development affected the time horizon of CDR investments as well as the carbon norm adopted. Regarding the strategic implications of CDR, we found that corporations have a strategic intent to prioritise internal reductions over CDR. However, such approaches can be done simultaneously, at all levels of the value chain. CDR is a tool in a toolbox for corporations to reach net-zero.

Keywords: carbon-dioxide-removal, corporate carbon strategy, carbon norms, climate change strategies

Supervisor: Tina Sendlhofer

Acknowledgements

We would like to thank all the sustainability managers, climate specialists and CDR enthusiasts who participated in either expert interviews or the main study. Our thesis would not have been possible without their rich insights into the strategic aspect behind net-zero and CDR investments.

Further, we would like to thank our supervisor, Tina Sendlhofer, for her support throughout the process. Tina continuously provided valuable feedback and inspired us to become immersed in the research process. In addition, we would like to thank our Course Directors Markus Kallifatides and Susanne Sweet for organising valuable lectures and learning opportunities throughout the semester.

Kajsa-Stina Ströby & Madeleine Hjalber

December 2021

Table of Contents

Definitions	4
1. Introduction	5
1.1 The growing voluntary carbon market	5
1.2 Reaching net-zero emissions	6
1.3 Research gap	10
1.4 Purpose & Research questions	10
2. Literature Review	12
2.1 Drivers for corporate response to climate change	12
2.2. Drivers for carbon management	14
2.3 Stakeholder pressure for climate change action	15
2.4 Lack of institutions for the voluntary carbon market	16
2.5 Strategies for carbon management	17
2.5.1 Carbon offsetting as a strategy for carbon management	20
2.6 Synthesis	21
2.7 Theoretical framework	21
2.7.1 Carbon norms in the absence of an institutional framework	22
2.7.2 A typology for climate change strategies	25
3. Method	28
3.1 Pre-study	28
3.1.1 Initial focus on sustainability and CDR	28
3.1.2 Pre-study interviews	28
3.2 Research design and approach	29
3.2.1 Qualitative approach	29
3.2.2 Research design	30
3.2.3 Inductive approach	30
3.3 Data collection	31
3.3.1 Interview sample	31
3.3.2 Interview design	33
3.3.3 Interview process	34
3.4 Data analysis	34
3.5 Quality of study	37
3.5.1 Credibility	37
3.5.2 Transferability	37

3.5.3 Confirmability	37
4. Empirical Findings	39
4.1 Factors affecting corporations' take on CDR	39
4.1.1 Stakeholder pressure to reach net-zero	39
4.1.2 CDR a key component to reach net-zero	40
4.1.3 Lack of regulations creating market uncertainties	41
4.1.4 CDR as a competitive advantage	42
4.1.5 Waiting for the CDR market to mature	43
4.2 The role of CDR in carbon management	45
4.2.1 Reduce our best, remove the rest	45
4.2.2 Simultaneous strategies	46
4.2.3 Value chain perspective	47
4.2.4 Internal considerations when investing in CDR	48
4.2.5 Collaborating with external actors	49
5. Discussion	51
5.1 Drivers for CDR	51
5.1.1 Committing to net-zero and the role of CDR	51
5.1.2 CDR and drivers for carbon management	53
5.1.3 CDR as a carbon norm	54
5.1.4 Synthesis of Drivers for CDR	56
5.2 CDR as a key component to net-zero strategies	58
5.2.1 Simultaneous strategic aims	58
5.2.2 Simultaneous degree of cooperation	60
5.2.3 CDR effects on internal reductions	61
5.2.4 Synthesis of CDR as a key component to net-zero strategies	61
6. Conclusions	63
7. Contributions and future research	65
7.1 Theoretical contributions	65
7.2 Empirical contributions	65
7.3 Limitations	66
7.4 Future Research	66
8. References	67

Definitions

Carbon dioxide removal (CDR) = refers to the process of physically capturing carbon dioxide from the atmosphere and transferring it into a durable storage (IPPC, 2018)

Carbon footprint = defined as a measure of the amount of carbon dioxide emissions caused throughout a product's life cycle, both directly and indirectly (Wiedmann & Minx, 2008).

Carbon offsetting = refers to the compensation of carbon dioxide by purchasing equivalent reductions of carbon dioxide in the atmosphere (Bellassen & Leguet, 2007).

Carbon dioxide removal technologies = The techniques used to implement CDR (Peters & Geden, 2017). Also referred to as negative emission technologies (Boysen et al., 2017).

Decarbonisation = Refers to the decrease of carbon dioxide emission intensity as part of a trend. Decarbonisation as a trend is a result of social development and technological progress (Voyko, Sycheva, & Glisin, 2020).

Net-zero = Net-zero carbon emissions are achieved when emissions are balanced by CDRs over a specified period. Net-zero emissions are sometimes referred to as *Carbon Neutrality* (IPPC, 2018).

1. Introduction

1.1 The growing voluntary carbon market

The voluntary carbon market is growing rapidly and the volume of carbon offsets has reached an all-time high (Sankar, 2020). Carbon offsetting refers to the compensation of carbon dioxide (carbon) by purchasing equivalent reductions of carbon in the atmosphere (Bellassen & Leguet, 2007). Using carbon offsetting is a strategy for corporations to reduce their climate footprint (Wiedmann & Minx, 2008) and the voluntary demand among corporations to participate in the offset market is driving the market growth (Sankar, 2020).

Accordingly, the voluntary carbon market is not regulated, but completely optional for corporations to participate in. Its distinction from the compliance market is important, which is regulated by a mandatory national, regional or international carbon reduction regime (Kollmuss, Zink, & Polycarp, 2008)¹. The compliance market is used by corporations and governments that by law are obligated to account for their greenhouse gas emissions (ibid). The voluntary market, on the other hand, allows corporations to finance offsetting projects which are usually smaller and vary in quality and price (Bellassen & Leguet, 2007). This is due to the absence of methodological rules and product traceability which has resulted in not only high-quality options but also projects with poor quality and lack of reliable information to the buyer (ibid).

While traditional offsetting and the old voluntary carbon market have raised several quality concerns, newer methodologies for compensating corporate emissions are emerging. Thus, this is now being referred to as the new voluntary carbon market and includes options such as carbon dioxide removal (CDR) (Kriegler, Edenhofer, Reuster, Luderer, & Klein, 2013). CDR refers to the process of physically removing carbon from the atmosphere and storing it for a long period of time (Boysen et al., 2017). Further, its underlying technology is often referred

¹ This thesis will solely focus on the voluntary carbon market, the compliance market and regulated trading schemes are regarded as separate.

to as negative emission techniques (ibid). While new technologies keep emerging, currently, CDR can be categorised into three main approaches; biological methods, geological methods and carbon-utilisation methods (Morrow, Buck, Burns, Nicholson, & Turkaly, 2018).

While CDR techniques are gaining traction (Peters & Geden, 2017), forming realistic implementation pathways to reducing one's emission can be problematic since the technologies are in a nascent stage (Berrutti, 2021; Shue, 2017). There has been an academic debate whether policymakers are putting too much hope into these nascent technologies and that not enough decarbonisation efforts are made (Dyke, Watson, & Knorr, 2021; McLaren, Tyfield, Willis, Szerszynski, & Markusson, 2019; Shue, 2017). Some studies on CDR are concerned that corporations put too much faith in these novel, small-scale technologies when including them in their climate change strategies and that it is harmful for the successful transformation of global decarbonisation (Honegger, Michaelowa, & Roy, 2021; Kaya, Yamaguchi, & Geden, 2019).

Furthermore, objectors argue that it is important to shift focus from ambitious and unrealistic emissions targets relying on immense amounts of CDR, to more realistic roadmaps that account for current limitations of the negative emission techniques (Kaya et al., 2019). Thus, being dependent on future negative emissions is risky as it can be harmful for the acceleration of emissions reductions (Anderson & Peters, 2016; Fuss et al., 2014).

Despite the debated implications and future outlook on CDR, corporations continue to amplify their carbon emissions strategies by investing in scaling such technologies (Puro.earth, 2021). Research on what drives corporations to make such mitigation actions, despite conflicting signals, is vital for a sustainable world (Pinkse, 2007). Further, an understanding of the underlying reasons behind such corporate action is essential in developing policies for further participation and emission reductions by market actors (Okereke, 2007).

1.2 Reaching net-zero emissions

Scientists have concluded that global warming needs to be limited to 1.5 degrees Celsius and achieving this requires a global goal of net-zero carbon dioxide emissions by 2050 (IPPC,

2018). Reaching net-zero emissions refers to the balance between greenhouse emissions produced and emissions taken out of the atmosphere by using negative emissions technologies (Zhongming, Linong, Wangqiang, & Wei, 2020). It differs from regular reduction efforts since it provides a negative effect on carbon dioxide levels, as illustrated in Figure 1 (IPPC, 2018).

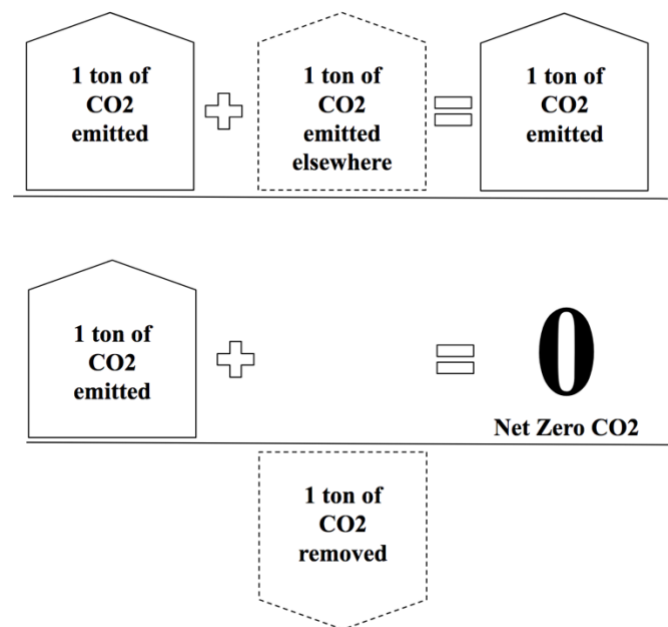


Figure 1: illustration of net-zero emissions using the IPCC (2018) definition

Certain industry sectors are more carbon dependent than others which can limit their ability to decarbonise at the pace required to meet the global climate goal (IPCC, 2018). Thus, while reducing and avoiding emissions through conventional means will be vital, all pathways that are limiting global warming requires CDR to a certain extent (ibid). The actual process of reducing carbon emissions output is referred to as decarbonisation (IPCC, 2018). As such, decarbonisation of corporate emissions is increasingly relying on investing in CDR (EASAC, 2018; Peters & Geden, 2017).

Although increased investments in CDR is a recent development, research has shown that corporate responses to climate change have been increasingly represented on top managements' agendas for a long time (Windolph, Harms, & Schaltegger, 2014) and that it is

a strategic issue for corporations globally (Glienke & Guenther, 2016). The implications of climate change can offer both opportunities and risks for corporations (Kolk & Pinkse, 2004) and corporate sustainability has been found to provide social and environmental contributions as well as financial gains (Voyko et al., 2020).

There have been various approaches developed to assist corporations with managing sustainability and addressing the climate crisis, including corporate sustainability management, corporate environmental management and sustainability reporting. Nonetheless, such approaches seem to be having quite limited impacts on corporate emissions (Gończ, Skirke, Kleizen, & Barber, 2007; Hopwood, Mellor, & O'Brien, 2005; Sneddon, Howarth, & Norgaard, 2006). Previous, the focus has been on avoiding, replacing or reducing emissions, rather than removing the emissions residual, addressing the top and middle section of the reduction hierarchy (Hejbøl Jense, Feb 19, 2021). The reduction hierarchy, as illustrated in Figure 2, is an approach for evaluating one's current emissions and providing an overview of how to reduce emissions based on a priority system (ibid).

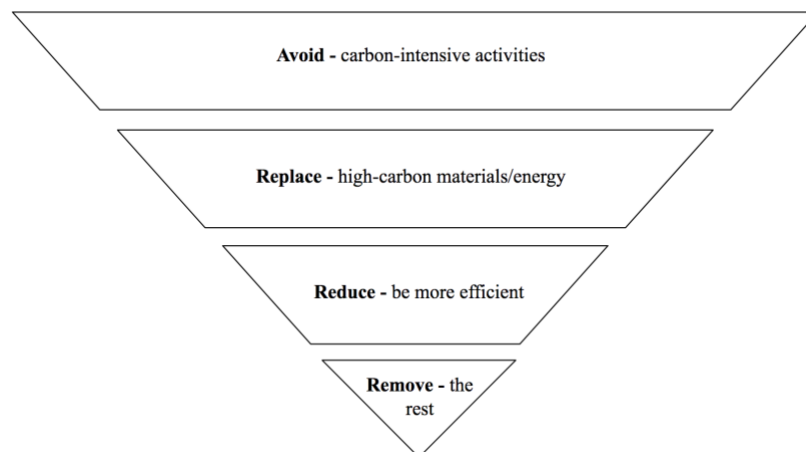


Figure 2 - The Reduction Hierarchy

Adopted from Hejbøl Jense, M. (Feb 19, 2021). How to calculate a company's carbon footprint? Paper presented at the How to Remove Corporate Emissions with CORCs? - Puro.Earth Webinar, Retrieved from <https://puro.earth/how-to-remove-corporate-emissions-with-corcs>

Corporate responses and strategies to mitigate climate change is a stream of research particularly concerned with cutting emission and carbon management (Hoffman, 2005; Kolk & Pinkse, 2005; Kolk, Levy, & Pinkse, 2008; Weinhofer & Hoffmann, 2010). Carbon

management can be considered a strategy that corporations use to manage both the reduction and removal of carbon emissions (Lee & Klassen, 2016). These strategies include implementing a range of activities, including investing in CDR. Moreover, these strategies have frequently been divided into internal and external strategies (Jeswani, Wehrmeyer, & Mulugetta, 2008; Lee & Klassen, 2016; Weinhofer & Hoffmann, 2010). CDR is categorised as an external strategy since it is an activity taking place independently from a company's value chain (Lee & Klassen, 2016). Internal strategies, however, include activities that take place within the company's value chain such as internal reduction efforts (ibid).

When implementing carbon management, corporations need to measure and follow-up on their emissions using specific emission targets, which are crucial steps for establishing a strategy for climate change (Shen et al., 2020). Global efforts to combat climate change such as the Paris Agreement (EASAC, 2018), are motivating corporations to set ambitious targets in line with limiting the global temperature under 1.5 degrees Celsius (Savaresi, 2016). In fact, in less than one year, companies committed to reaching net-zero emissions have doubled from 500 to 1000 between 2019 and 2020 (Zhongming et al., 2020). Such pledges will be crucial to reach the climate targets within the Paris Agreement (IPCC, 2018).

“Climate action failure” refers to the inability to move towards a net-zero economy and is stated as one of the most severe risks facing communities worldwide (World Economic Forum, 2021). Thus, corporations play a vital role and their efforts to reach net-zero will be crucial for transitioning towards sustainable development (Kramer & Porter, 2011). Especially considering that 100 large corporations account for over 71% of industrial carbon emissions (Griffin & Heede, 2017), making their commitments to decarbonisation crucial (Wade & Rekker, 2020).

Consequently, companies need to continue to reduce carbon emissions caused throughout their value chain but also start removing already emitted carbon from the atmosphere (Bushell, Colley, & Workman, 2015). However, the current net-zero ambition does not always separate emissions reductions and CDR. Critics claim that lack of transparency and separation of the two can lead to CDR substituting possible emissions reductions through conventional

mitigation (McLaren et al., 2019). Although this may be true, there cannot be a trade-off between such strategies since both are vital for reaching the net-zero emission targets and thus, the Paris Agreement (IPCC, 2018).

1.3 Research gap

Acknowledging the extant literature on sustainable development, corporate response to climate change, and carbon emission management, we have identified two gaps in the current literature.

Firstly, scholars have raised the concern that countries and businesses put too much faith in CDR to reach net-zero and limit global warming, when in fact the technologies for CDR are in a nascent stage (Shue, 2017). However, the drivers behind corporations making the strategic decision to rely on such technologies, despite the future uncertainty, have received little attention. Further, scholars have focused on drivers from a general climate change perspective (Backman, Verbeke, & Schulz, 2017; Gasbarro, Iraldo, & Daddi, 2017; Ivanaj, Ivanaj, McIntyre, & Da Costa, 2017) and a carbon management perspective (Okereke, 2007), but less attention has been brought to the strategic role of CDR investments to fulfil the business' emission goals. Pinkse (2007) stated that future research of what drives companies to implement mitigating actions for climate change will be vital for combating climate change. However, considering that pathways to reach net-zero emissions relies on CDR technologies (IPCC, 2018), it will also be crucial to understand the drivers for investing in CDR.

Secondly, while scholars claim that the promise of CDR can be harmful for the acceleration of internal emission reductions (Anderson & Peters, 2016; Dyke et al., 2021; Fuss et al., 2014; Honegger et al., 2021; Kaya et al., 2019; McLaren et al., 2019), research on the overall strategic implication of relying on CDR remain rather unexplored. By investigating the drivers behind and the strategic role of CDR for corporations, we aim to fill these gaps.

1.4 Purpose & Research questions

The purpose of this thesis is to explore the drivers behind, as well as the role of, CDR investments in corporations' efforts to reach net-zero emissions. By looking into the drivers of CDR, we aim to gain insights to why corporations are using CDR in their net-zero strategies.

Moreover, contributing to clarifying some of the uncertainties in the academic debate, such as the scalability and future reliability of the CDR technologies.

Further, by looking into the strategic implications of CDR on the overall emission-reducing efforts, we are exploring the forward-looking aspects and implications of CDR investing among corporations. The net-zero strategy is a direction, showing ambition and signalling of the long-term emission goals of a corporation. However, even if the roadmap to reach net-zero is conceptually viable, it is also dependent on the ability to transform to low-carbon options as well as the development of CDR (IPCC, 2018). Therefore, reaching the targets of the net-zero strategy involves many uncertainties and it is difficult for companies to predict the vital amount of CDR (Kaya et al., 2019). Due to the current uncertainties regarding CDR, practices and processes are far from standardised (Berrutti, 2021; Shue, 2017). Hence, we will focus on the strategic aspect of CDR rather than practices and processes for CDR.

Accordingly, this thesis examines the following research questions:

“Why are corporations using CDR as part of their climate mitigation strategy to reach net-zero?”

“How does CDR as an external emission strategy affect internal emissions strategies?”

2. Literature Review

To understand the role of CDR in reaching net-zero emissions, this section will review the previous literature and provide the context for the study. The literature review is divided into seven parts. First, the drivers for corporate response to climate change are reviewed to provide a foundation of which potential factors impact corporate response (2.1). Second, research about drivers for carbon management specifically is explored (2.2). Third, the literature surrounding stakeholder pressure from a climate change aspect is reviewed (2.3). Fourth, literature on the lack of institutions in a new market context is explored (2.4). Fifth, a review of the literature on strategies for carbon management is outlined (2.5). These five sections are later concluded in a synthesis (2.6) presenting gaps in extant literature. The last section (2.7) describes the theoretical framework later used for analysing our data.

2.1 Drivers for corporate response to climate change

A frequent area of interest to management scholars have been climate-related drivers in terms of business response to climate change (Gasbarro et al., 2017). Climate change strategies are influenced by both external and internal drivers (Okereke & Russel, 2010). Drivers can be described as climate-related risks and opportunities that make businesses respond to climate change (Kolk & Pinkse, 2004). Existing literature on business response to climate change has identified several drivers for such responses; regulatory change, physical change, product & technology innovation, operational efficiency, financial and changes in customer needs (Gasbarro et al., 2017). In the below text, we will be reviewing four of these drivers in-depth.

One driver that has been frequently researched is regulatory change and how the ability of businesses to pursue growth and profitability is impacted by regulations (Wittneben & Kiyar, 2009). Corporations that are unable to manage those regulations aiming to limit emissions are likely to face additional costs (ibid). Conversely, corporations prepared for such regulations, even though regulation is not yet in place, can experience a competitive advantage compared to ill-prepared competitors (Boiral, 2006; Hoffman, 2005); Schultz & Williamson, 2005).

Further, whether regulatory changes are perceived as a risk, or an opportunity is related to the industry in which the company operates (Kolk & Pinkse, 2004). For example, industries with high levels of emissions such as the oil, gas, or mining industry are more likely to interpret regulations as a risk, whereas the financial industry can view it from an opportunistic point of view by assisting customers facing these regulations (ibid).

Another driver is product and technology innovations for corporate response to climate change (Gasbarro et al., 2017). The vision of a world with lower, neutral and even negative carbon emissions can spur innovation and new markets such as low-carbon products, or renewable energies (ibid). Investing in know-how and innovation as a response to climate change can bring competitive advantage (Gasbarro, Rizzi, & Frey, 2016). By exploiting and exploring new goods or process opportunities, businesses can both achieve financial gains (Wittneben & Kiyar, 2009), and strategic advantages compared to their competitors (Porter & Reinhardt, 2007).

Reputation and risks related to the brand image are also drivers frequently researched (Gasbarro et al., 2017; Lash & Wellington, 2007; Wittneben & Kiyar, 2009). It has been found that corporate behaviour with a negative impact on the climate can influence corporate reputation (Wittneben & Kiyar, 2009). Conversely, corporations can leverage the reputational risk by engaging in climate-positive activities and thus portraying themselves as good citizens (ibid). By implementing a climate change strategy and taking corporate responsibility to cope with climate change can improve brand image, reputation and the relation to different stakeholders such as customers, institutions and employees (Hoffman, 2005; Kolk & Pinkse, 2004; Wittneben & Kiyar, 2009).

In addition, the financial risk of an investment has also been identified as a driver (Wittneben & Kiyar, 2009). However, the financial impact is asymmetrically distributed across and within industries, since it is dependent on carbon usage (Busch & Hoffmann, 2007).

2.2. Drivers for carbon management

While drivers related to climate change have gained much scholarly attention, another stream of literature is particularly concerned with drivers for carbon management (Okereke, 2007; Okereke & Russel, 2010; Yunus, 2017). Okereke (2007) makes a distinction between motivations and drivers for carbon management when studying underlying mechanisms and identifies five of each category as having a clear impact on climate change strategies.

Motivations regard the factors that are related to the “innate concern of business for profit and comparative advantage” (Okereke, 2007, p.475). Such factors encourage corporations to engage in carbon management, even in the absence of regulatory or public pressure (ibid). The five motivational factors identified were (1) profit, (2) competition for credibility and leverage in climate policy development, (3) fiduciary obligations and (4) guiding against risk and (5) ethical considerations (Okereke, 2007).

While many of them are straightforward, it is worth noting that by fiduciary obligations, Okereke (2007) refers to the increased sense of responsibility among leaders to take strategic action that will benefit the corporation long-term. Specifically, leaders who believe that climate change is of fiduciary concern stresses that despite external pressure, they still need to do everything they can to make sure that their corporate success is not disadvantaged by their climate change action in the future (ibid).

In contrast to motivations, which encourage corporations to engage in carbon management despite no external pressure, drivers are used to explain the factors that can force corporations to engage in carbon management, even if they would not intend to do so initially. They are the “factors that are rooted in wider societal pressures and concern for the environment” (Okereke, 2007, p.475). The five drivers identified were (1) energy prices, (2) market shifts, (3) regulation and government directives, (4) investor pressure and (5) technological change (Okereke, 2007). These drivers are similar to those drivers identified by Gasbarro et al. (2017) in the context of corporate response to climate change.

Although Okereke (2007) chose to separate drivers from motivations in his research, he emphasises that there are overlaps between each category. In fact, other researchers have strayed away from this distinction and studied solely drivers for carbon management strategies. An example is (Yunus, 2017), who found that financial benefits, gaining a competitive advantage and stakeholder pressure are all drivers for carbon management strategy adoption.

An additional attempt to categorise carbon management strategies has been dividing them into market and non-market drivers. Market drivers refer to the incentive of increasing profitability or shareholder value, while non-market refers to external factors such as regulatory pressure (Okereke & Russel, 2010). Even though there are numerous factors influencing carbon management strategies, most consistently, regulatory pressure and competitive dynamics have been found as the most crucial drivers (ibid).

2.3 Stakeholder pressure for climate change action

Taking a stakeholder perspective is a widely used and recurring approach in environmental, social and sustainability management research (Frynas & Yamahaki, 2016; Montiel & Delgado-Ceballos, 2014) and it is also applied in carbon management studies (Herold & Lee, 2019; Yunus, Eljido-Ten, & Abhayawansa, 2020).

A common description of the term ‘stakeholder’ is provided by (Freeman, 2010), who suggests that firm existence goes beyond its shareholders to include stakeholders, which are individuals or groups that can affect or are affected by a corporation and its activities. Stakeholders are groups from the internal and external environment of the corporation, such as employees, financiers, customers, suppliers, governments, environmentalists, media and special interest groups (ibid).

Applying a stakeholder approach to sustainable management is not a guarantee for the most sustainable outcome but it can spur sustainable development (Hörisch, Freeman, & Schaltegger, 2014). However, challenges might appear when managing stakeholder relationships for sustainable development. Hence, it is important to strengthen the overall interest for the topic from stakeholders, creating a shared view of these interests to mitigate and

encourage stakeholders to act as mediators for sustainable development through empowerment (ibid).

Implementation of climate change actions is often due to demand from stakeholders (Rasi, Raja Zuraidah Raja Mohd, Abdekhodae, & Nagarajah, 2014) and it is also becoming vital for organisations to include stakeholders throughout this process (Reyers, Gouws, & Blignaut, 2011). In fact, stakeholder pressure has been determined as a driver for the adoption of carbon management strategies, as well as which strategies are adopted (Yunus et al., 2020). According to the findings of Yunus et al. (2020), corporations' tendency to adopt carbon reduction, innovation and compensation strategies are significantly impacted by external stakeholders. Such stakeholders mainly include non-governmental organisations (NGOs) and policymakers (Herold & Lee, 2019).

2.4 Lack of institutions for the voluntary carbon market

An institutional framework with laws and regulations issued by governments is necessary for businesses to function and interact with each other accordingly (North, 1991). But in the context of climate change, regulatory standards are lacking (Pinkse & Kolk, 2012). The lack of market morality and enforceable agreements is consequently resulting in institutional failures regarding climate change (ibid). For multinational corporations, it is even more complex as institutional failure is emerging individually in different countries (ibid). Despite the institutional failure, corporations are still experiencing institutional embeddedness in combination with non-market forces which creates strategic challenges when dealing with climate-related strategies (ibid).

The impact of corporations and non-governmental initiatives on climate change should not be disregarded to create a new international treaty for when institutional frameworks are failing (Andonova, Betsill, & Bulkeley, 2009). In the absence of institutional frameworks for climate change, companies can show their commitment and position themselves in the climate debate by adhering to specific carbon norms, such as carbon neutrality or carbon labels (Pinkse & Busch, 2013).

When adopting and implementing voluntary carbon norms, corporations risk getting accused of greenwashing, mainly from NGOs and media (Delmas & Burbano, 2011). To avoid this, it is important for corporations to consider the level of transparency and inclusion of various stakeholders in the process of achieving the goals of the corporate carbon norm (Pinkse & Busch, 2013). Further, according to Pinkse and Busch (2013), the primary aim is to fulfil the strategic purpose of the business, rather than substituting the absent role of the government.

However, engaging in sustainability efforts does not necessarily mean a positive market response from stakeholders as withdrawing from these indices can have negative effects (Doh, Howton, Howton, & Siegel, 2010). For instance, in 2009, when Shell withdrew from its commitment to increase investments in renewable power it had a negative impact on the firm reputation (Stockman, Rowell, & Kretzmann, 2009). Hence, the corporate context needs to be considered when implementing carbon norms. In fact, the purpose of these norms is to appeal to different types of stakeholders and depending on how the industry or country deals with climate change this will likely affect the norms applied (Pinkse & Busch, 2013).

Furthermore, committing to emission targets, such as net-zero, raises the expectations from stakeholders (Levin, Cashore, Bernstein, & Auld, 2012). As a result, corporations risk getting locked into low-carbon pathways that can be difficult to accomplish (Pinkse & Busch, 2013).

2.5 Strategies for carbon management

Corporate sustainability has been found to impose corporate actions against climate change, including carbon emission reductions, or decarbonisation (Voyko et al., 2020). Such increased integration of climate change in corporate strategies has received growing attention among management scholars (Damert, Paul, & Baumgartner, 2017).

One stream of research concerned with the differences in corporate response to climate change regards carbon management, which can be understood as strategies companies use to respond to climate change through greenhouse gas emission management (Lee & Klassen, 2016). They include a range of activities, such as carbon footprint accounting, reporting, new technologies including CDR processes and financial trade-offs such as emission trading schemes (ibid).

Overall, numerous suggestions have been made for strategies to mitigate climate change by cutting carbon emissions, both internal and external (Kolk & Pinkse, 2004; Lee & Klassen, 2016; Weinhofer & Hoffmann, 2010; Weinhofer & Busch, 2013). Lee and Klassen (2016) make a division of two separate areas referred to as intra-organisational and inter-organisational carbon management. The former refers to strategies that target a company's internal activities, comparable to the middle section of the "reduction hierarchy" (Hejbøl Jense, Feb 19, 2021), such as implementing innovative low-carbon technologies in production (Pinkse & Kolk, 2010) or product improvement practices for low-carbon offerings (Weinhofer & Hoffmann, 2010). The latter refers to strategies taking place outside the company and focuses on joint efforts with stakeholders (Lee & Klassen, 2016). Thus, including CDR efforts (ibid).

Kolk & Pinkse (2004) has an extended view of this categorisation, deploying a typology for climate strategies that cover two important dimensions of climate change, strategic intent and degree of cooperation. Strategic intent refers to the company's aim of either reducing emissions through innovation such as improving internal processes, or through compensation such as emission trading or even offsetting. Further, the degree of cooperation refers to the organisational approach to reaching their objectives, meaning the decision to do it internally, vertically, or horizontally together with other companies (Kolk & Pinkse, 2004).

Weinhofer & Hoffman (2010) illustrate emission management strategies in an aggregated framework where different strategies are divided by their strategic objective. They differ between three carbon strategy types that imply different time horizons for strategic decisions. The short-term measures relate to the carbon compensation category, which includes actions that aim to balance or offset emissions caused by one's business activity. Buying carbon credits or CDR projects are included in this category and viewed as short-term compensation measures that do not deal with the underlying cause of emissions. On the contrary, carbon reduction means more long-term emission measures which include changes in production and products. Carbon independence refers to an even longer-term scenario that aims to completely move away from carbon resources to renewable options (Weinhofer & Hoffmann, 2010).

Though the terminology differs, the categorisation of emission strategies into internal and external strategies is a common theme (Jeswani et al., 2008; Lee & Klassen, 2016; Weinhofer & Hoffmann, 2010). Extant literature on climate mitigation strategies is also concerned with the assessment of corporate carbon strategies, such as the framework by (Damert et al., 2017)). According to the authors, a corporate carbon strategy is:

“a complex set of actions to reduce the impact of a firm's business activities on climate change and to gain competitive advantages over time” (Damert et al. 2017, p.124).

It is argued that a corporate carbon strategy has three objectives, carbon reduction, carbon governance and carbon competitiveness (Damert et al., 2017). Further, there are several measures or activities available to corporations for achieving each objective.

Carbon governance addresses the managerial capabilities of an organisation, how they deal with opportunities and risks concerning climate change mitigation and related governance mechanisms (Tang & Luo, 2014). Carbon governance as an objective can be achieved by two main activities (ibid). First, organisational involvement, meaning the engagement of a corporation's employees in climate change mitigation measures (Lee, 2012; Tang & Luo, 2014). By implementing organisational roles and responsibilities to employees at different levels, it can raise awareness, promote climate-friendly behaviours and contribute to innovation processes for climate mitigation (Backman et al., 2017). Second, risk management, referring to the assessment of risk and opportunities concerning strategies to mitigate climate change (Tang & Luo, 2014). Besides the direct physical impacts, companies face risks relating to the indirect effects of climate change, including regulation or changing consumer preferences (Galbreath, 2010).

Carbon reduction as an objective concerns a corporation's commitment to emission reduction and its measures to achieve specified targets (Lee & Klassen, 2016; Weinhofer & Hoffmann, 2010). Four corporate activities are used by corporations to achieve this objective. First, implementing reduction policies and monitoring systems for carbon emissions (Alvarez, 2012). Second, reducing the carbon footprint throughout the product life cycle by product innovations

(Weinhofer & Hoffmann, 2010; Yunus, Elijido-Ten, & Abhayawansa, 2016). Third, reducing the emission caused by production and distribution processes by process improvements (Lee, 2012). Fourth, compensating through carbon compensation such as acquiring carbon credits (Pinkse & Busch, 2013).

An additional objective discussed concerning climate change strategies is carbon competitiveness (Damert et al., 2017). This concerns the activities taken to retain or gain a competitive advantage and/or legitimacy as a company engage in climate change mitigation (ibid). It has been found that gaining such advantages or legitimacy can be achieved in several ways. For instance, by launching new products or services in markets where change can become a unique selling proposition (Kolk & Pinkse, 2005), or by stakeholder engagement and collaborating with external actors, such as NGOs or political organisations (Eberlein & Matten, 2009). Other examples include engaging in political activities for influencing regulatory processes related to climate change (Sprengel & Busch, 2011) or working with corporate communications by the public disclosure of information related to climate change, such as through annual reports (Galbreath, 2010).

2.5.1 Carbon offsetting as a strategy for carbon management

Using carbon offsetting as an external strategy for corporations to mitigate climate change (Jeswani et al., 2008; Lee & Klassen, 2016; Weinhofer & Hoffmann, 2010), is increasingly used by companies with the voluntary carbon market growing rapidly each year (Blaufelder, Levy, Mannion, & Pinner, 2021). Such trends have created a discussion around how corporations can implement a carbon-offsetting strategy together with their more traditional sustainability strategies, with a particular concern for the neglect of internal reduction strategies (Tolhurst & Embaye, 2012). Further, although there is an increased demand for carbon offsetting, private actors are facing a high degree of uncertainty and struggling to define their role in the voluntary carbon market (Lang, Blum, & Leipold, 2019).

It should be noted that while carbon offsetting is recognised as a way for corporations to compensate for their emitted emissions externally, the current net-zero target does not separate emissions reductions and CDR (McLaren et al., 2019). There is a concern that clustering the

two will decrease transparency and increase the risk of CDR substituting decarbonisation efforts (Anderson & Peters, 2016; Fuss et al., 2014; McLaren et al., 2019). Furthermore, Fuss et al. (2020) describes the need for new alliances for CDR to lower existing barriers, close current knowledge gaps and target action for the rollout of CDR in net-zero strategies.

2.6 Synthesis

As a result of our literature review, we have identified two gaps in the current literature. First, it is evident that drivers have not been studied with regards to CDR. Although research on the drivers for corporate response to climate change (Gasbarro et al., 2017) and underlying mechanisms of carbon management (Okereke, 2007; Okereke & Russel, 2010; Yunus, 2017) provides empirical evidence to a certain extent, investing in nascent CDR technologies involves a high level of uncertainty which is not accounted for in the reviewed driver studies. However, since achieving net-zero will rely on these CDR investments (IPCC, 2018), understanding the drivers for CDR is essential. Therefore, by providing more empirical insights into this area, we aim to contribute to this gap.

Second, while several scholars have categorised emission cutting activities into internal and external strategies (Jeswani et al., 2008; Lee & Klassen, 2016; Weinhofer & Hoffmann, 2010), there is to our knowledge limited research on how external strategies affect internal strategies (Herold & Lee, 2019). Exploring this area becomes particularly interesting considering the general concern of businesses relying on nascent CDR technologies and its potential negative effects on traditional reduction efforts. Thus, by looking at whether external strategies affect internal strategies, we aim to contribute to this theoretical gap.

2.7 Theoretical framework

To elaborate on the proposed gaps, this study will rely on the below theoretical framework which was developed using our empirical insights. The carbon norm framework developed by Pinkse and Busch (2013) will be used to analyse the drivers and implications of CDR. In addition, the typology for climate change strategies by Kolk and Pinkse (2004) will be used to analyse net-zero strategy effects and implications.

2.7.1 Carbon norms in the absence of an institutional framework

Pinkse and Busch (2013) created a framework for explaining why corporations adhere to specific carbon norms. The concept of carbon norms stated by the authors is a translation of private norms (Ingram & Silverman, 2000) and self-created norms (Andonova et al., 2009) in the context of climate change. These norms occur in the absence of a global regulatory framework (Andonova et al., 2009; Pinkse & Busch, 2013).

According to the framework suggested by Pinkse and Busch (2013), carbon norms have a dual function. First, carbon norms can act as part of corporations' strategic positioning to create a competitive position. However, fulfilling this strategic positioning is constrained because of the corporation's carbon dependency and stakeholder influence. So, the second function of carbon norms is to help deal with these two constraining factors. To describe this dual function, Pinkse and Busch (2013) outline two strategic factors that influence the adopted corporate carbon norm, image and aim, as well as two constraining factors, carbon dependency and stakeholder influence.

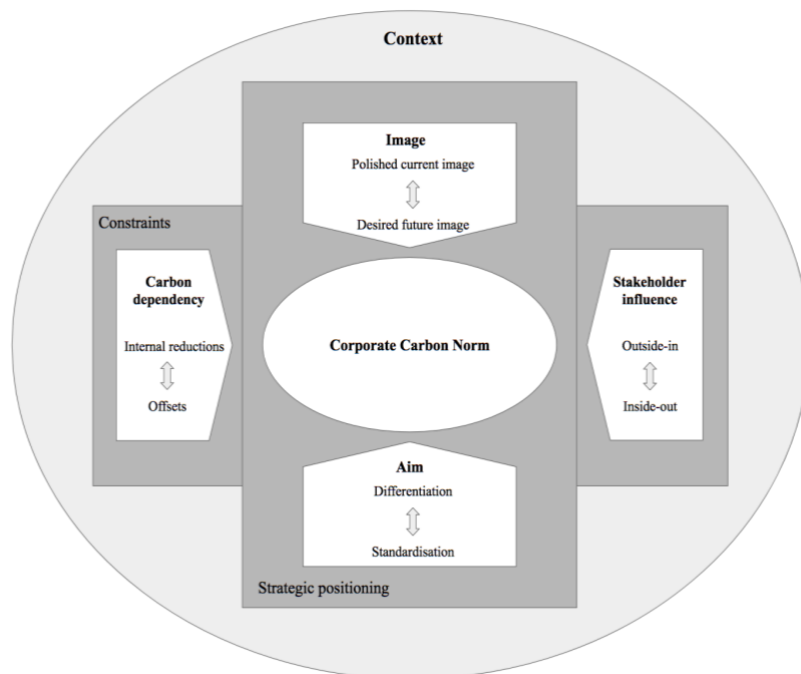


Figure 3 -Refigured from Pinkse, J., & Busch, T. (2013). Corporate Carbon Norms: A framework. Figure. Thunderbird International Business Review, 55(6), p633-645, Figure found on p637, <https://doi.org/10.1002/tie.21580>

In terms of strategic positioning, corporations can use carbon norms to create a favourable image of their actions for climate change (Pinkse & Busch, 2013). The authors describe it as a strategic choice from a temporal perspective of whether the carbon norms should have the purpose to establish a desired future image or polish a current image.

Creating a desired future image is often expressed through different commitments to minimise climate impact (Pinkse & Busch, 2013). Corporations commit to a target and set decarbonisation pathways to reduce emissions (Pinkse & Kolk, 2009).

The purpose behind these commitments can differ. Either it can have the intention to accelerate the commercialisation of required technology towards a low-carbon economy or to create a buffer against outside scrutiny (Pinkse & Busch, 2013). However, there is a risk that stakeholders perceive the commitment as a reactive “watch-and-wait” strategy. By adopting a reactive approach, corporations can legitimately maintain the status quo due to immature technology and argue that an active strategy will occur when the technology is further developed (ibid).

Pinkse and Busch (2013) describe that a carbon norm constructed to polish the current image is more focused on short-term actions by using existing emission-reducing alternatives and proven technology or carbon offsetting that only requires a market transaction.

Besides creating a favourable image, carbon norms can strategically position the corporation with a strategic aim to differentiate from competitors or to standardise business practices (Pinkse & Busch, 2013). The aim to differentiate can either be due to stakeholder expectations or to gain a competitive advantage from being an early adopter (ibid). However, if the carbon norm is not perceived as credible, the corporation will face the risk of potential backlash (Crane, 2000). In contrast to early adopters, carbon norms adopted by followers aim to push for standardisation and stress the need for clear rules before adhering to a specific carbon norm (Pinkse & Busch, 2013).

The corporation's carbon dependency and stakeholder influence are constraining the corporation's ability to pursue a strategic position through image and aim (Pinkse & Busch, 2013). A corporation's level of carbon dependence is related to the capability to reduce emission in a cost-effective and credible way over time (Pinkse & Busch, 2013). According to Pinkse & Busch (2013), emission-reducing efforts can be separated into internal reduction strategies and offsets.

A corporation with lower carbon dependency can more easily reduce its carbon intensity through internal reduction strategies over time than corporations with higher carbon dependency (Hoffmann & Busch, 2008). Moreover, the carbon dependency impacts the time frame of the carbon norm. If carbon dependency is high, a longer time horizon is needed to be perceived as realistic and credible (Pinkse & Busch, 2013). However, a too extensive time frame can signal that climate change is not taken seriously and an attempt to evade short term actions resulting in an opposite effect (ibid). Corporations with higher carbon dependency are more likely to use offsets if it entails the more cost-effective option (ibid). Although offsets can offer corporations a cost-effective alternative to deal with their carbon impact, potential drawbacks should be highlighted (Pinkse and Busch, 2013). The highlighted drawbacks often refer to the quality and legitimacy of offsets (Bumpus & Liverman, 2008; Dhanda & Hartman, 2011) and the risk of potentially substituting internal reduction efforts (Dhanda & Hartman, 2011; Lovell, Bulkeley, & Liverman, 2009).

The second constraining factor that impacts the adopted carbon norm is stakeholder influence (Pinkse & Busch, 2013). Pinkse and Busch (2013) state that stakeholder influence can occur from an outside-in or inside-out perspective. In other words, while a corporation is affected by its stakeholders, it can also influence its stakeholders from the inside-out perspective (Porter & Kramer, 2006). Viewing stakeholder influence from an outside-in perspective can be explained in terms of pressure to account for the corporation's carbon impact (Sprengel & Busch, 2011). This stakeholder pressure is often stronger for corporations acting in industries with higher carbon dependency (Pinkse & Busch, 2013). In contrast, corporations operating in industries with a lower internal carbon impact, such as the financial sector and the retail industry, do not view stakeholder influence equally as a constraint compared to those with higher carbon impact

(ibid). Corporations inclined to take an inside-out perspective on stakeholder influence are using the adopted carbon norm to change the behaviour of others (ibid).

Further, the concept of carbon norms by Pinkse and Busch (2013) can translate into corporate carbon targets (Dahlmann, Branicki, & Brammer, 2019). Dahlmann et al. (2019) investigate if corporate carbon targets are substantive commitments with the intent to reduce the environmental impact or if the targets are only symbolic attempts. Their research found that targets with a significant effect on corporate emissions are characterised by a longer time frame, setting ambitious targets, and including absolute reductions (Dahlmann et al., 2019).

2.7.2 A typology for climate change strategies

Kolk and Pinkse (2004) developed a typology for climate change strategies when mapping out corporations' climate change-related activities. According to the authors, corporations differ between two important dimensions regarding climate change strategies, the strategic intent (the aim) and the form of organisation (the degree of cooperation).

The typology concerns to what extent corporations aim of developing green capabilities and resources on a firm-level (Rugman & Verbeke, 1998), as well as their intentions of obtaining this through their supply chain or cooperation with other parties (Contractor & Lorange, 1988). Further, it concerns the control and coordination needed for a corporation to reach their internal, supply chain or market-related targets (Husted, 2003).

In particular, the typology illustrates how the aim of corporations differs by either focusing on innovation or compensation (Kolk & Pinkse, 2004). Having a strategic aim of innovation means focusing on reducing emissions by improving current processes or products. On the other hand, having a strategic aim of compensation refers to internal or external emission trading or similar offsetting (Kolk & Pinkse, 2004).

Climate Change strategies

Organisation	Aim	
	Innovation	Compensation
Internal (company)	Process improvements	Internal targets, control and trading
Vertical (supply chain)	Product development	Supply chain targets control and trading
Horizontal (beyond the supply chain)	New product/market combinations	External market mechanisms

Table 1, Climate Change Strategies

Refigured from Kolk, A., & Pinkse, J. (2004). Market strategies for climate change. European Management Journal, 22(3). Table found on p311. DOI:10.1016/j.emj.2004.04

Further, corporations vary in the degree of cooperation that they use to achieve their goals (Kolk & Pinkse, 2004). An internal level means working on the individual company level only, while a vertical level means engaging across the whole company value chain. Further, a horizontal level means engaging with other companies such as partners or competitors (Kolk & Pinkse, 2004).

Both strategic aims can be obtained in various degrees of cooperation (Kolk & Pinkse, 2004). Innovation can be achieved within the corporations' supply chains, but also beyond it. For instance, by developing products for other markets together with other companies in strategic alliances. Compensation can be also achieved outside one's value chain through external mechanisms such as emission trading. However, it can also be done within the supply chain by creating awareness among employees or implementing energy conservation programmes (Kolk & Pinkse, 2004).

Kolk and Pinkse (2005) extend the typology further by clustering corporations into six different profiles, emergent planners, cautious planners, internal explorers, horizontal explorers, vertical explorers, and emissions traders. Where the first two illustrate corporations in an early phase

of development of their climate change strategy and the latter four represent corporations that are exploring potential market opportunities and taking a proactive standpoint in their climate change strategy (Kolk & Pinkse, 2005).

Moreover, (Damert & Baumgartner, 2018) build upon the typology created by Kolk and Pinkse (2004) by adding a continuum-based perspective. A continuum-based perspective allows us to explain the evolutionary process for incremental transition to what can be stipulated as an “ideal” strategy. By combining the two it can capture dynamic aspects that consider integration and different strategic prioritisation of corporations' strategic intent evolving over time (Damert & Baumgartner, 2018).

3. Method

In this section, we will start by presenting our pre-study and provide a background to our research focus (3.1). Further, we argue for our choice of conducting a qualitative study using the Gioia et al., (2013) inductive approach (3.2). We also describe our data collection, including the interview sampling, design and process (3.3). In addition, we provide a thorough description of our coding process and examples from all coding dimensions (3.4). Lastly, we discuss and assess the quality of our study using criteria specific for qualitative research (3.5).

3.1 Pre-study

3.1.1 Initial focus on sustainability and CDR

Both having a passion for sustainability and sustainable business transformation, we knew early on that we wanted to focus our research within the sustainability area. Further, having worked for larger corporations and seen the substantial investments put into decarbonisation first-hand, we were intrigued by these strategies and this emerging market. Thus, we decided to enter the field of CDR strategies.

3.1.2 Pre-study interviews

In our early attempts of grasping CDR and understanding how businesses can participate in the voluntary carbon market, we conducted an exploratory pre-study by interviewing three industry experts. All interviews were exploratory with an aim of understanding how the market and its actors are operating today, but also its future development (See Appendix A for an interview protocol example).

The first Respondent was a representative from a Swedish CDR supplier and working directly with corporations exploring to invest in CDR. The person had extensive experience in supply-side development for CDR technologies. The second Respondent was a representative from the world's first business-to-business marketplace for CDR certificates, providing businesses with an opportunity to invest in larger volumes of CDR. The Respondent had worked closely with

external corporations as an Account Manager for the marketplace. The third Respondent was Head of Climate at a carbon advisory business who had extensive experience in advising companies on their emission cutting strategies.

Pre-study

Respondent	Position	Location	Interview type	Date
<i>Respondent A</i>	Business Developer	Stockholm, Sweden	Teams-Meeting	30-09-2021
<i>Respondent B</i>	Sales & Account Manager	Helsinki, Finland	Teams-meeting	05-10-2021
<i>Respondent C</i>	Head of Climate Solutions Nordics	Stockholm, Sweden	Teams-meeting	07-10-2021

Table 2 - List of pre-study interviews and respondents

Findings from the pre-study interviews resulted in a further understanding of the CDR market and the options available for corporations. Further, by respondents frequently mentioning the industry's nascent stage, as well as the confusion around CDR among companies, we deviated from one of our initial research questions that were more focused on the implementation aspects of CDR. Moreover, an interesting topic that frequently came up in our discussions was the drivers behind corporations' decisions to invest. Consequently, we decided to pivot and focus on investigating the drivers behind investing in CDR.

3.2 Research design and approach

3.2.1 Qualitative approach

To answer our research questions of “*Why are companies using CDR as part of their climate mitigation strategies to reach net-zero?*” and “*How does CDR as an external emission strategy affect internal emissions strategies?*”, we adopted a qualitative approach using semi-structured interviews. Since qualitative research aims at addressing questions that are concerned with understanding the “meaning and experience dimensions of humans' lives and social worlds” (Fossey, Harvey, McDermott, & Davidson, 2002, p. 717) it allowed us to discover the work of sustainability managers and their sensemaking when dealing with this new phenomenon that is CDR investing (Fossey, Harvey, McDermott, & Davidson, 2002; Marshall & Rossman, 2014).

Using a quantitative approach would have been inadequate considering that we were aiming to explore words and meaning, rather than any quantification or frequency of data (Creswell, 2021; Ketokivi & Choi, 2014).

3.2.2 Research design

Aiming to provide a deeper understanding of the phenomena using explorative and open research questions, we further motivate our choice of using semi-structured interviews as our method for data collection (Gioia, Corley, & Hamilton, 2013; Silverman & Marvasti, 2008). This provides our respondents with certain guidance and ensures some consistency in what information we collect, while also allowing for discovery and elaboration of information on sustainability strategies. Private corporations are essential in the transition towards net-zero (Kramer & Porter, 2011) and are driving the voluntary market (Sankar, 2020). Considering the CDR market being in an early stage (ibid), and as discovered in our pre-study, many corporations have not yet invested in CDR but are rather exploring the options available due to net-zero commitments, we decided not to limit our sample to a specific industry or geographical location.

3.2.3 Inductive approach

Due to the novelty of the subject, it was adequate to adopt an inductive research approach, starting with observations that later allowed our empirical findings to guide us to theory (Prince & Felder, 2006; Spector, Rogelberg, Ryan, Schmitt, & Zedeck, 2014). Gioia et al., (2013) attempted to reconcile inductive research with rigorous theoretical advancement by developing a holistic approach to inductive research. Deploying the Gioia et al., (2013) approach to our research allows for an inductive approach while also bringing qualitative rigour.

This approach takes an important assumption also deployed in our research, namely that “people constructing their organisational realities are ‘knowledgeable agents’” (Gioia et al., 2013, p.17), meaning that they are aware of what they are trying to accomplish and capable of explaining their intentions and actions (ibid). Consequently, we have avoided imposing constructs of prior theories on the respondents and made their voices heard early on in our

process. Instead, we put a lot of emphasis on our interview process and letting the empirical data influence our study.

The research process conducted is visualised in the below figure.

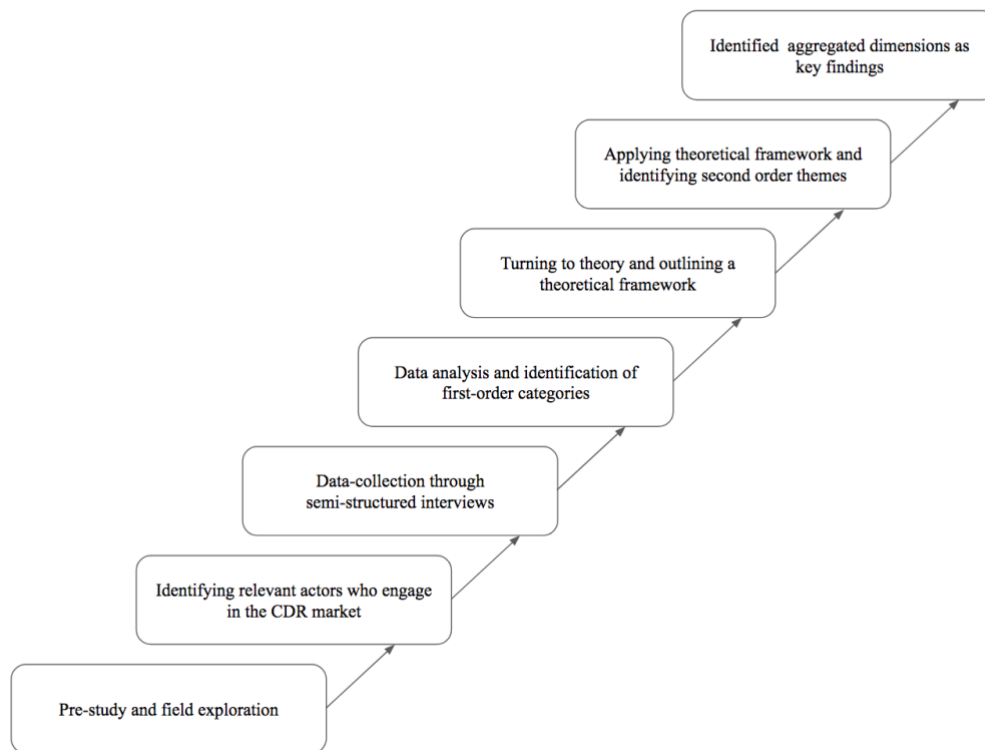


Figure 4 - Visualisation of the research process

3.3 Data collection

3.3.1 Interview sample

In our main study, we interviewed a total of twelve representatives of corporations committed to net-zero that are currently investing or planning on using CDR (See Table 3). Our target was sustainability managers or even climate specialists at these multinational corporations. Pinkse & Kolk (2012) suggest future research of how firm-specific dimensions related to climate change affect multinational corporations. The respondents had to be senior enough to have a holistic picture of the corporation's overall sustainability strategy, but still knowledgeable about CDR.

The interview sample was sufficient due to reaching a point of empirical saturation. After the tenth interview, the answers started to become repetitive and no new information was retrieved from the last two interviews, Respondent 11 and Respondent 12. In fact, the last interviews merely confirmed the other ten. Hennink and Kaiser (2021) confirm that qualitative research often reaches saturation at relatively small sample sizes if the objective of the study is narrowly defined. Our objective can be considered as narrowly defined as the purpose of our thesis is to explore the drivers and implications for the novel subject of CDR.

Main study

Respondent	Position	Location	Interview type	Date
<i>Respondent 1</i>	Sustainability Manager	Helsinki, Finland	Teams-meeting	12-10-2021
<i>Respondent 2</i>	Head of Sustainable Business Development	Stockholm, Sweden	Teams-meeting	14-10-2021
<i>Respondent 3</i>	Environmental Advisor	Gävle, Sweden	Teams-meeting	15-10-2021
<i>Respondent 4</i>	Senior Environmental Management Specialist, VP	Zurich, Switzerland	Teams-meeting	15-10-2021
<i>Respondent 5</i>	Environment & Climate Manager, Corporate Sustainability	Copenhagen, Denmark	Teams-meeting	19-10-2021
<i>Respondent 6</i>	Global Sustainability, Climate Resilience Lead	Gothenburg, Sweden	Teams-meeting	19-10-2021

<i>Respondent 7</i>	Climate Change Action Program Manager	Stockholm, Sweden	Teams-meeting	19-10-2021
<i>Respondent 8</i>	Sustainability Analyst	Stockholm, Sweden	Teams-meeting	21-10-2021
<i>Respondent 9</i>	Head of Sustainability Management	Stockholm, Sweden	Teams-meeting	21-10-2021
<i>Respondent 10</i>	Chief Sustainability Officer	Stockholm, Sweden	Teams-meeting	26-10-2021
<i>Respondent 11</i>	Head of Sustainability	Stockholm, Sweden	Teams-meeting	28-10-2021
<i>Respondent 12</i>	Sustainability Manager	Stockholm, Sweden	Teams-meeting	29-10-2021

Table 3 - List of interviews and respondents

3.3.2 Interview design

The interview protocol (See Appendix B for an interview protocol example) was based on a combination of our pre-study findings and early literature review. However, to stay inductive, the interview protocol was constructed using general, open-ended questions that were continuously adapted throughout the process to allow for discovery and surprises (Gioia et al., 2013). We choose to begin each meeting with several warm-up questions, intending to make the respondents feel comfortable. They got to tell us about their professional background and current position, but also their personal view on corporate sustainability. The ambition was to discover what was top of mind for the respondents to steer the interview in such a direction and adopt their terminology. Thereafter, we began to ask questions related to their net-zero targets, around the decisions behind the target and concrete plans for achieving it. During the second part of the interview, we deep dived into their view and experience of CDR in their corporate context. Depending on how extensively they were adopting CDR in the corporation's

sustainability strategies, the interview questions were adjusted. After asking several questions about this main topic, we finished the interview by letting the Respondent speak freely by providing the opportunity for them to add any additional information.

3.3.3 Interview process

Most interviews were conducted through virtual meetings and spanned from 45 to 60 minutes. Due to the ongoing pandemic, most respondents felt most comfortable meeting virtually. Further, several of our respondents were located outside of Sweden.

All interviews were digitally recorded once approved by the respondent. We started each interview by confirming confidentiality and anonymity, to create an open environment and encourage honest answers. Both authors participated in all interviews with one taking a more active role and the other taking a more supportive role, to enable a smooth conversation. Within three days of each interview, the recordings were transcribed, allowing us to have a good memory of non-verbal cues and other observations of interest. Further, all transcribed materials were sent for approval to the respondents after the interview, allowing them to address any confusion or clarifications needed.

3.4 Data analysis

After all transcribed materials were approved by our respondents, we coded the interviews using Microsoft Excel. The coding process was executed in four steps and in correspondence with the Gioia et al., (2013) methodology. Firstly, the interviews were open coded based on the empirics alone, using descriptive codes (Gioia et al., 2013), meaning using the respondents' terms and expressions when naming them. In this first-order analysis, we made limited attempts to filter categories resulting in over 150 first-order categories. For example, the statement "*So we are very, very clearly focused on reducing actual emissions in the near term.*" (Respondent 5) was coded as "Focus on internal reductions".

Secondly, due to a large number of first-order categories, we started mapping out similarities and differences that could be spotted for the first-order categories which enabled us to reduce the number of categories to 42, still using the Respondent terms. Using our previous example,

the category “*Focus on internal reductions*” was categorised as “*Reduction as the main priority*” along with other, similar descriptive codes.

In the next step, we used these categories to conduct a second-order analysis where we continuously moved between data and theory to create more specific themes (Gioia et al., 2013). The resulting 13 second-order themes were a result of an interpretive process in which theory began to emerge from the data analysis. For instance, “Strategic aim of innovation” could be derived from our previous example.

Lastly, from the second-order themes, we were able to extract five aggregated dimensions explaining the key findings derived from our study. For instance, our second-order theme “Strategic aim of innovation” could be grouped with two other second-order themes and create the aggregated dimension “*Companies have the strategic intent to innovate and reduce, before compensating and remove*”. All steps are illustrated in the coding trees below (See Figure 5).

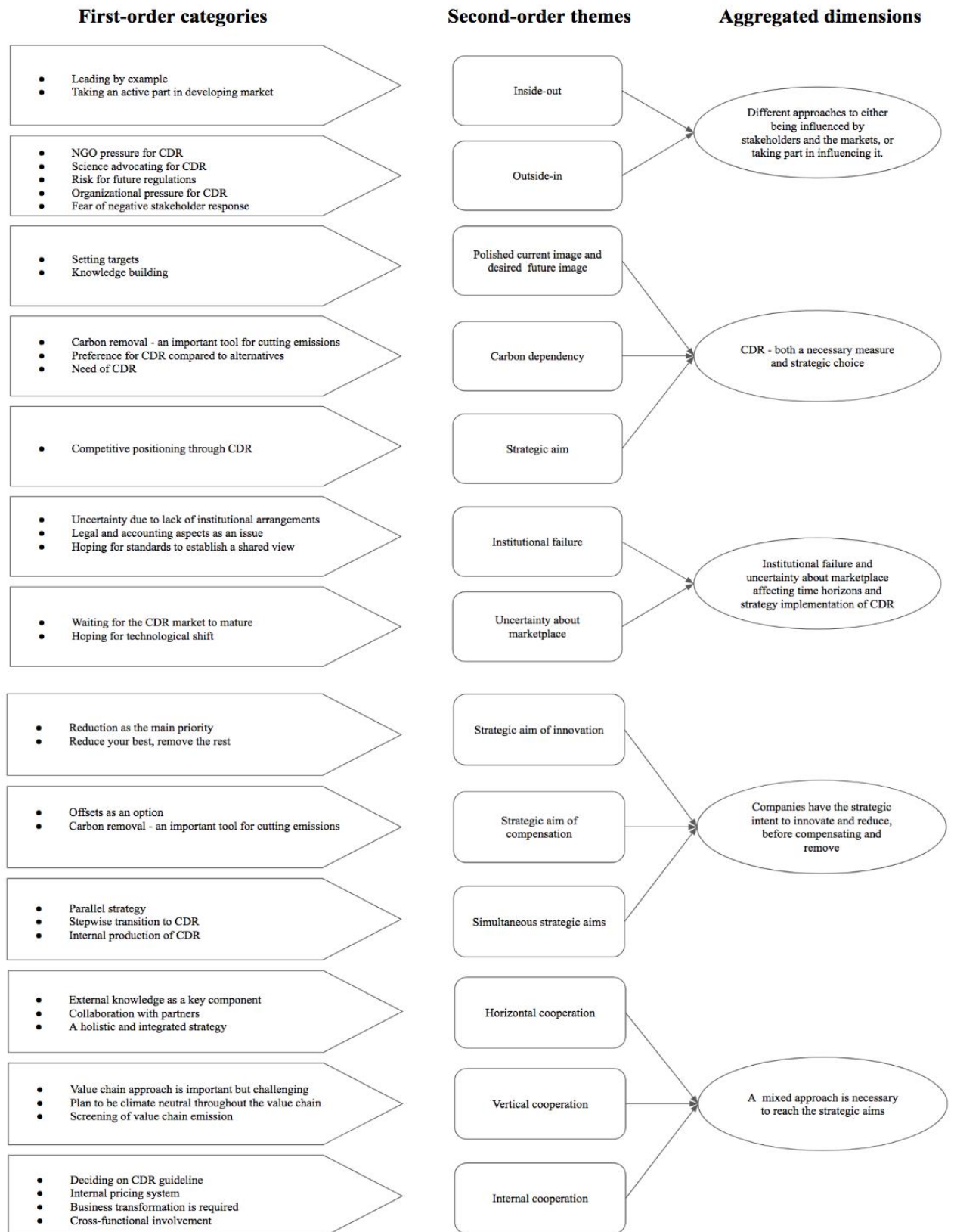


Figure 5 - Coding trees

3.5 Quality of study

To ensure trustworthiness, we aimed to secure qualitative collection, analysis and interpretation of data, throughout our process (Yin, 2015). The study's quality assessment will be made through criteria that are specific to qualitative research, including credibility, transferability, dependability and confirmability (Guba, Lincoln, & Denzin, 1994; Lincoln & Guba, 1985).

3.5.1 Credibility

Credibility in qualitative research refers to the level of confidence in the data collected, to which extent the findings represent reality (Yin, 2015). Considering that our qualitative research approach involves studying the social reality of our subjects, it was of the essence that we performed our study in good practice and confirmed our understanding throughout the process (Bell, Bryman, & Harley, 2018). Thus, we ensured that the data collected was interpreted correctly by sending all transcribed materials for review, as well as asking clarifying follow-up questions if there was ever any uncertainty in the data evaluation.

3.5.2 Transferability

Using a qualitative approach and studying a smaller sample in-depth entails contextual uniqueness and significant aspects of the social world we are studying (Guba et al., 1994). However, by extracting transferable principles and concepts (Lincoln & Guba, 1985), our findings can address a larger audience. In fact, across domains, many processes and concepts are structurally equivalent (Morgeson & Hofmann, 1999). We follow the proposition that if a study generates principles and concepts that have clear relevance to other domains, it is possible to generalise from smaller samples (Gioia et al., 2013). Corporations committed to net-zero are to a certain extent in need of CDR to achieve their target (IPCC, 2018). Further, the uncertainty and challenges facing the nascent CDR market (Shue, 2017), affect all companies who are looking to invest (Lang et al., 2019). Thus, such circumstances could be considered “principles that are portable” to other settings (Gioia et al., 2013).

3.5.3 Confirmability

Confirmability refers to the reassurance of the researchers having acted in good faith (Lincoln & Guba, 1985). Meaning, that it should be clear that the researchers have allowed neither

theoretical inclinations nor personal values to manifestly influence the research or its findings (Bell, Bryman, & Harley, 2018). By relying on a pre-study rather than a thorough literature review when formulating our early research questions and interview protocol, we avoided letting theoretical propositions influence our inductive approach.

4. Empirical Findings

In this section, we will present the empirical findings from the study which will be divided into two main parts. First, factors affecting corporations' decision to include CDR in their net-zero strategies will be presented (4.1). Second, corporations' internal and external strategies will be presented, focusing on the role and effects of CDR (4.2).

4.1 Factors affecting corporations' take on CDR

4.1.1 Stakeholder pressure to reach net-zero

A theme frequently addressed by our respondents was the pressure from various stakeholders to minimise emissions and take responsibility for their corporate footprint. All respondents referred to their emission targets as being in line with the Science-based Targets. The Science-based Targets initiative is a joint effort by several NGOs aiming to enable the private sector to set emissions targets and decarbonisation pathways in line with the IPCC report published in 2018, stating that global warming needs to be limited to 1.5 degrees Celsius (Science-based Targets, n.d.). One of the respondents referred specifically to the eye-opening effect that the IPCC report had on the corporate sector.

“IPCC published a 1.5 degree report and everybody was like, oh gosh.. So that helped a lot, although in the assessment report it was all over that the models cannot cope with the climate targets without negative emissions. But nobody paid attention back then, but in October 2018 people started to pay attention.” - Respondent 4

Furthermore, many of the interviewees mentioned that the reason behind the decision to set those targets was due to the importance of listening to science and sending a message of corporate responsibility for climate change.

“We have based a lot of our decisions on science and both our vision and values always prone ourselves to be scientifically based. It's an engineering organisation, we believe

in science, we are science and innovation so without not thinking about those targets as well, it will be contradictory.” - Respondent 7

Besides NGOs, respondents describe pressure from other stakeholders such as employees, customers, suppliers, top management, the board of directors and investors to reach net-zero emissions. The pressure experienced from these stakeholders was often related to being perceived as an attractive and relevant company and thus to have a long-term viable business. However, some respondents rather expressed the concern of negative response from stakeholders, often expressed regarding the risk of potential greenwashing accusations when communicating about CDR due to its novelty and debated reliability.

“So, from a branding perspective, as a company, you have to protect the brand and I think you know that the greenwashing risk is super high in the CDR area.” - Respondent 1

Further, the debate around CDR and its reliability were many times stated as a polarised topic among stakeholders due to the bad reputation of offsets projects. There seems to be a knowledge gap about what “new” offsets can offer due to its heritage of “bad” projects influencing the overall reputation for both traditional offsets and CDR.

“So, either people think offsets are a terrible thing, or they don't and it's kind of polarised. There's a real lack of subtle understanding of what is possible, and the range of the market because there obviously are bad projects out there. But one bad project tends to cause problems for the whole market, even though there are very good projects out there that deserve money to support them.” - Respondent 11

4.1.2 CDR a key component to reach net-zero

The diverging response from stakeholders affects the choice of when and to what extent corporations plan to use CDR to reach net-zero. However, regardless of whether the

respondents are investing in CDR today or plan to invest in the future, they all agree that corporations will not reach net-zero for the complete value chain without the use of CDR.

“We will never get to zero, even though our aim is to zero. So with absolute reductions, that is gonna take even longer than one or so nine years time. So there is a need for CDR.” - Respondent 1

Respondents using CDR today emphasise that it is a tool in a toolbox for mitigating company emissions and reaching emission targets. Furthermore, it is also enabling corporations to reach their targets faster as some emission-reducing activities are not possible to achieve short-term. For such activities, CDR can be a good compensation alternative until the full effect of that reduction activity has taken place.

“I just want to enhance, it's one tool in a toolbox. That's the connotation and it's not something we can live on. And so, the absolute reduction of emissions has to be the priority number one in our operations, but also in our supply chain.” -Respondent 1

From a long-term perspective, all respondents plan to use CDR to compensate for their emissions residual after maximum reduction activities have taken place.

4.1.3 Lack of regulations creating market uncertainties

At present, there are no clear standards or regulations established for CDR. As such, corporations are themselves deciding if they want to invest in CDR and which technologies to consider. The decision often depends on the corporate policy in combination with recommendations from different institutions influenced by climate change research.

Most respondents expressed that studying the CDR market and deciding when CDR might be needed is a type of risk management for potential sharpened regulations that the corporation might face. Respondents talking about CDR in terms of risk management of potential regulations and standards are concerned with timing and feasibility.

“And I think we also see the transition risk into a low carbon economy, where we will see legal pressure on emissions, perhaps carbon tax as well. So if we can reduce, internally to start with, that's going to be a good financial aspect as well over time, if we make the right assumption for the future. So it's kind of risk management as well.”

-Respondent 6

Moreover, respondents that are yet not investing in CDR but plan to do so often point at different factors related to the lack of guidance from institutions. Some factors are national differences and regulations, unclear definitions for the net-zero concept and requirements for CDR are making the governance aspect difficult, auditing concerns, legal obstacles, certificate and external validation.

Additionally, other respondents also acknowledged the lack of institutional guidance but instead of looking at it from a risk management perspective, they viewed this uncertainty as a potential opportunity.

“To my knowledge, nothing has been commercialised yet. But we're looking for an opportunity if we can be an early adopter somehow to help that industry develop.” -

Respondent 6

4.1.4 CDR as a competitive advantage

Certain respondents explain that investing in the nascent CDR technology provides opportunities in terms of being a future-proof company and gaining a competitive advantage. Not only future-proofing from a regulatory perspective but also being attractive in the eyes of certain stakeholders. In addition, by integrating the cost for CDR today the business will make better long-term decisions.

“Some of the opportunities include being a little bit of head of regulation, for example. There's always the benefit of that and having your eyes open to what's happening as we go along. And being a little bit ahead of the competition and being able to explain that to consumers. We hope it is an advantage, as well. But integrating the cost of this into

our business forces us to make decisions that in the long term are going to be better. When there is more regulation and that kind of stuff, then it sets you up to face what we think is going to be a more tightly controlled situation in the future for companies which use carbon in some way.” - Respondent 11

Currently, the demand for CDR is greater than the supply. For the CDR technology to scale and meet future demand, early investments are required. Further, this will also contribute to lower CDR prices.

“We cannot wait until 2029 and then think ah cool those removal capacities they come there naturally, somebody else made sure that they are there right. I have to invest now if I want them to be there and at that cheaper cost in 2030.” - Respondent 4

Furthermore, investing in CDR is an attempt from corporations to motivate others to follow the same path. Leading by example and being a responsible corporation further incentive the use of CDR.

“But I think that shows to the customers or the other stakeholders, investors, etc, that we are making that extra investment possible. And we are willing to take that cost so it shows leadership.” - Respondent 7

“We knew that we have to come up with commitments we have to come up with implementation plans, and also motivate others to do the same, which is an important layer of that of that climate action journey” - Respondent 4

4.1.5 Waiting for the CDR market to mature

The novelty of the CDR market entails a lot of uncertainties. When asking respondents that have not yet invested in CDR for reasons behind that decision, they state that they are waiting for the market to mature. There are too many uncertain variables today about the actual output from investing in CDR. This in combination with the price of carbon is making certain

respondents concerned with accountability and wasting resources on something that does not have a guaranteed impact on corporate emissions.

“We're kind of waiting to see how the definitions are going to go, right? We've set these targets, but it's actually very unclear what the rules are around it. Which is never a comfortable place for businesses to be. Businesses like to have a rule and then we can follow it.” - Respondent 2

Many of the respondents that are not investing in CDR today are waiting for clarified standards. From this point of view, corporations are waiting for a specified framework for what to include in the net-zero targets and which CDRs qualify as removal technologies and have a negative emissions impact.

“You don't have the standards on the market. So you don't really have a negative emission carbon market. And I think this is the problem, you also need to first have the standards that support it so you can take that into your strategy. So you know that the marketing you do, the targets you achieve is a part of that global strategy and standardisation process. And when you have that, then I think, of course you need to then do the investments and for those solutions.” - Respondent 7

Another reason why certain respondents are waiting to invest in CDR is because they want the technologies to scale and develop before investing in them. The main contrast between the respondents that are willing to drive the development of CDR and those waiting for the market to mature is that the latter are much more concerned with the cost of CDRs and their impact on business profitability. So even though they are aware of their dependence on CDR in the long run they hope for the market to mature and at more reasonable prices.

“We are dependent on technologies in order for us to reach our targets for sure. We need technical development on not least the feedstock side.” - Respondent 9

“As we started talking about what sustainability is, right, it needs to be financially sustainable as well for the company or otherwise, it's difficult in the long run.” - Respondent 9

4.2 The role of CDR in carbon management

4.2.1 Reduce our best, remove the rest

A common theme spotted in our respondents' responses was emphasising that their main priority was internal reductions, before turning to CDR options. All respondents agreed that the ultimate goal was to reduce their own emissions to as much as possible.

“It's absolutely the slogan that I said, do our best, remove the rest, or in other ways, it's reduce, reduce, reduce, remove the rest. And on top help others to reduce their emissions as well...” - Respondent 4

Furthermore, all respondents viewed CDR as being a strategic component for reaching their emission targets going forward. They all expressed moving to zero as a difficult task with a lot of strategic changes throughout the organisation.

“We will never, as transparent to be here, we will never get to zero, even though our aim is zero. So with absolute reductions that is going to take even longer than one or so nine years time. So there is a need for CDR.” - Respondent 1

However, whether CDR should be used simultaneously or solely after maximal reduction efforts have been made, differed between the respondents. While some argued that both efforts are needed now to reach net-zero emissions, others expressed some concern regarding reliance on CDR to cause less incentive for internal reductions.

“So it's pretty dire, and there is no way to achieve the climate targets that science tells us should keep us at the safe warming level still safe warming level without having both

extreme reductions wherever possible, complemented not instead by removals.” - Respondent 4

“In the very short term, we need everybody to focus on real reduction. So they don't think that you know, the two people in the logistics team don't think they can just buy whatever transport they want, and then offset it. So it's a bit about sending that message internally as well.” - Respondent 5

4.2.2 Simultaneous strategies

Although a few respondents shared the latter concern and viewed CDR as an option further down the line, most commonly, corporations were using a simultaneous strategy focusing on reductions but complementing with CDR. Many of those respondents mentioned taking a stepwise approach to CDR. For example, starting with using CDR for decarbonising specific categories and product lines, or simply launching pilot projects to navigate the field.

“We are only using them on one product line. So we have a line of it's called [...], we have the products certified as a carbon neutral product. So there are CDRs to offset the footprint of that product.” - Respondent 5

Or similarly, if currently relying on other kinds of traditional offsets, successively substituting those for CDR as the market continues to grow.

“But our kind of strategies, we will offset all of our emissions as we go along. But to get to net-zero, 100% of that must be removal, right. And so, if you go onto our website, you'll see a very basic triangle chart that tries to explain that a little bit, that we'll have offsetting, and that the percentage of that offsetting will grow to 100% removal over time. So, we'll transition that as we go along. So just know it's a smaller percentage. By the time you get to net-zero, it has to be 100%.” - Respondent 11

4.2.3 Value chain perspective

When asked about the implementation aspect of their strategies for reaching net-zero emissions, all respondents talked about their approach to decarbonising their entire value chain, not only operational emissions. Their strategies not only included cutting emissions caused by their operations, but also their suppliers and customers. In fact, several respondents expressed negative opinions about corporations only including their operational emissions into their strategies and targets.

“And we said that the new ambition was carbon zero in operations by 2025. Scope one and two, and carbon negative emissions in the total value chain by 2030.” - Respondent 6

“All other climate commitments include the full value chain. I mean, today, if any company that makes stuff is only including their own operations, it's pure greenwashing. When I do our carbon footprint and you can look at our sustainability report to find that the numbers on our operations are like 5%- 6%, when you include the supply chain” - Respondent 11

Therefore, each corporation spent substantial time and resources on screening the entire value chain and calculating an overall carbon footprint caused by its corporate activity.

“And with the announcement of the goal, we obviously had our first screening of the value chain emissions. So, trying to understand where the big buckets are and focusing on your own operations is crucial, but in the big value chain, it is less than 10% of the emissions in our own. And that we have been working heavily on for the past couple of years.” - Respondent 1

Furthermore, certain respondents emphasised that when the entire value chain is included in the net-zero strategy, CDR becomes a necessity. For example, Respondent 9 discussed how emissions stemming from the supply chain and transportation areas, caused a need for them to include CDR in their strategy.

“That's why our scope one and two is so much more short term. Because we see what we can do that quickly, but when it comes to the supply chain and transportation, that's one where we don't see that we can make the absolute reductions in time. And therefore, CDRs will be necessary in that regard.” - Respondent 9

4.2.4 Internal considerations when investing in CDR

When discussing the implementation aspect of a net-zero strategy and CDR in particular, the respondents mentioned a variety of considerations and decisions that they had to make internally. Firstly, deciding on guidelines for CDR was a common consideration mentioned in the interviews. All respondents regarded CDR quality to be an important aspect and set high standards internally which were used to evaluate the CDR projects prior to investing. Further, CDR price seemed to be the most important signalling of CDR quality and certain corporations even spent time on setting an internal price for carbon to achieve a high-quality carbon portfolio.

“Today we have 10% removals, high quality removals and 90% high quality avoided certificates. Last year we paid 100% of our unweighted footprint, we compensated with high quality avoidance certificates, and we paid more than \$10 per tonne which is crazy. In the US we paid 10 cents for an avoidance certificate. If you don't care about quality. And we said our narrative should be we are facing high quality removals that can cost several hundreds of dollars and we phase out high quality removals that cost \$10. And together we can blend avoidance and removal of certificates and of different types, such that at the end of the year we arrive at the average price or cost for the certificates that corresponds to our carbon steering level, so we can source this year on average for \$100 per tonne certificates. Next year, we can source for \$112 per tonne. In 2023 we can source for 143. So we go linearly up, and our emissions will come down at the same time.” - Respondent 4

Although having an internal carbon pricing system was in the pipeline for many corporations, few respondents had implemented such a system and were not actively using it in their strategy today.

In addition, paying the premium price also seemed to be a risk mitigation strategy, as several respondents expressed concerns about being associated with low-quality CDR.

“So for us, if it's 10 euros more per tonne, that's nothing in terms of money, compared to the risk of taking a shortcut.” - Respondent 5

Other strategic considerations frequently discussed, were cross-functional involvement and having a commitment from all levels of the organisations. Multiple respondents claimed that although having support from top management, you would need to go through all levels of the organisation since lower levels are critical for a successful implementation.

“But you will have to go through the entire value chain or say no, it's a food chain rather because the middle management is who you must convince, those are the ones with the hard economic targets in the MBO, the top management can easily say or like the idea and a bit of climate activism is screwed for the reputation. [...] So you have to go through the middle management to achieve what you want to achieve.” - Respondent 4

4.2.5 Collaborating with external actors

When asked about whom in the corporation was responsible for exploring CDR investments and where the competence lied for this novel area, several managers emphasized the importance of both internal and external expertise. While corporations felt a need to build and attain knowledge internally, they also relied on experts and external providers for certain areas of CDR.

“And so there are a few out there that you can work with if you need to bring in that expertise and get external advice, particularly advice on what's coming. What our governments are discussing, what's going on, what are the upcoming targets going to

be? So it's always good to have expertise internally but also have somebody to bounce ideas off of.” - Respondent 11

In addition to working with industry experts to attain knowledge and advice, many managers valued the importance of collaborating with the CDR vendors or marketplaces offering CDR supply. Engaging in long-term agreements and partnerships for securing CDR supply was a common strategy.

“To set up good deals, so to say, and make that part of longer term deals, and make them understand that those are the kinds of supplies we want to work with in partnering. Because we can't solve this alone, we are really depending on them as well to find the right partners to help us with this.” - Respondent 6

5. Discussion

In the following section, we will discuss the empirical findings in light with relevant literature. We organise our discussion in two main parts. The first part analyses the empirics in relation to our first research question on why corporations are investing in CDR (5.1). The second part is focused around our second research question on how CDR as an external emission strategy affects internal emission strategies such as internal reductions (5.2).

Many of our discussions will be centred around two different groups identified in our empirical findings. First, the Early Adopters who are currently investing in CDR. Second, the Followers who are planning on using CDR in the future but are currently not investing. These terms are retrieved from Pinkse and Busch (2013), who categorise corporations that are adopting carbon norms in an early or later stage.

5.1 Drivers for CDR

5.1.1 Committing to net-zero and the role of CDR

Corporations are setting targets to reach net-zero emissions throughout their value chains. Reaching this target will depend on CDR to a certain extent. Further, committing to net-zero and exploring the immature CDR market can be viewed as a type of business adaptation to climate change. Climate-related drivers such as regulatory changes, product and technology innovation, reputation and financial risk can explain why companies are adapting to climate change (Gasbarro et al., 2017).

There is an expectation among corporations that the regulations for carbon emissions and the use of CDR will be sharpened. However, it is uncertain when such regulations will come into play and how they will apply. Setting emission targets is a way of future-proofing the business even though the roadmap for reaching such targets is uncertain. This corresponds with the findings of Wittneben and Kiyar (2009), stating that being prepared for new regulations will increase a corporation's ability to pursue growth and profitability. Most of the respondents thought that sustainability and profitability are not mutually exclusive. On the other hand, a

few respondents expressed concern for the balance between profitability and the cost of cutting emissions. The absence of regulations decreased the initiative to reduce emissions as fast as possible as it would compromise profitability.

Moreover, the degree of engagement and preparation for potential regulations can also bring a competitive advantage compared to ill-prepared competitors (Boiral, 2006; Hoffman, 2005; Schultz & Williamson, 2005). In the present study, this was conflicted. The use of CDR was mentioned as a competitive advantage among Early Adopters. It offers a way of impacting market development and building knowledge as a preparation for the future. On the other hand, Followers believe that the risks outweigh the opportunities and are therefore waiting for the markets to mature as well as become more regulated before investing in CDR.

This study illustrates that corporations had different views on using CDR in their net-zero strategies. If regulatory changes for climate change are viewed as a risk or opportunity can according to Kolk and Pinkse (2004) be related to the industry. More specifically, corporations operating in higher emitting industries tend to interpret regulations as a risk compared to those operating in less emitting industries (ibid). In the present study corporations from a wide variety of industries, including pharma, oil and gas, retail, telecom and insurance were represented. In contrast to Kolk and Pinkse (2004), it was not possible to identify that corporations operating in high emitting industries viewed regulations for CDR riskier than those operating in less emitting industries.

Existing carbon constraints entail that corporations can exploit new market opportunities through product and technology innovation (Porter & Reinhardt, 2007). Further, these opportunities can appear wherever in the carbon reduction hierarchy (avoid, replace, reduce and remove) (Hejbøl Jense, Feb 19, 2021). The Followers' focus is to first reduce before exploring potential market opportunities within the innovation of CDR. The Early Adopters also emphasise the importance of focusing on reductions, but stress that for CDR to be feasible and meet future demand, they need to invest now. Further, by investing early on they can spur increased know-how and bring competitive advantages. According to Gasbarro et al. (2016)

investing in know-how and innovation for developing markets connected to climate change can result in a competitive advantage.

Another driver applicable to our findings is brand and reputation (Gasbarro et al., 2017; Lash & Wellington, 2007; Wittneben & Kiyar, 2009). Followers talked specifically about brand and reputation while expressing concern around the contradictory opinions from stakeholders, making them vigilant to invest in the immature CDR market. As a result, brand and reputation seem to be a driver for avoiding CDR investments for Followers. On the other hand, Early Adopters are investing in CDR to motivate others to follow suit and are not as concerned with negative stakeholder responses. Corporations can leverage the reputational risk by portraying themselves as good citizens (Lash and Wellington, 2007).

In addition, Followers are concerned about the high CDR prices, making them more prone to wait until the prices are more favourable. On the contrary, Early Adopters stress that for the prices to fall, they need to invest now and help scale the nascent technologies. Thus, financial risk affects the decision on whether to invest in CDR (Wittneben & Kiyar, 2009).

For corporations to reach net-zero throughout the value chain, collaboration with stakeholders is necessary. Accordingly, Reyers et al. (2011) believe that involving stakeholders is vital for the successful implementation of climate change actions. Notably, our findings also indicate that pressure from a variety of stakeholders is influencing corporations' efforts in both reducing their emissions and investing in CDR. Including pressure from NGOs, investors, employees and customers (Herold & Lee, 2019). Our findings correspond with the findings of Yunus et al. (2020), emphasising that stakeholder pressure has a significant influence on a corporation's tendency to implement carbon management strategies and CDR in particular.

5.1.2 CDR and drivers for carbon management

According to Okereke (2007), motivations regard the factors that are related to the "innate concern of business for profit and comparative advantage" (Okereke, 2007, p.475), while drivers regard the "factors that are rooted in wider societal pressures and concern for the environment" (Okereke, 2007, p.475). In contrast, our findings do not support a division of

these two categories considering that engaging in the voluntary offset market is optional. In fact, the lack of institutions for CDR can explain why this division is not as distinct.

For the Followers, several motivational factors argued by Okereke (2007) are rather motivational factors to wait. For example, the price is high for quality CDR and the novelty of the market makes it difficult to verify the effective output from using CDR to reduce emissions, so Followers expressed the fear of negative financial impact and non-credibility. On the other hand, Early Adopters did not state profit as a motivational driver. However, they believed that by being an Early Adopter of CDR they could gain a competitive advantage (Okereke, 2007; Yunus, 2017). Our findings support corporations having an objective of carbon competitiveness (Damert et al., 2017). By engaging in activities such as stakeholder engagement (Eberlein & Matten, 2009) corporations aim to gain a competitive advantage or legitimacy as a company engaging in climate change mitigation (Damert et al., 2017).

Moreover, Early Adopters are motivated by being responsible and leading by example. Thus, indicating a sense of fiduciary obligation to commit to net-zero and hence investing in CDR (Okereke, 2007).

Further, driving factors for carbon management can be a market shift, regulation and governments directives and technological change (Okereke, 2007). These factors are not yet established for the CDR market, it is rather something that is expected to happen in the future to enable net-zero emissions. Hence, the driving factors explained by Okereke (2007) might be more applicable for mature carbon management strategies and are therefore not applicable to our respondents' view on CDR in their carbon management strategy.

5.1.3 CDR as a carbon norm

Adhering to a carbon norm is an attempt by corporations to position themselves in the climate debate where an institutional framework is lacking (Pinkse & Busch, 2013). From a granular perspective, the role of CDR can be viewed as a part of the net-zero carbon norm. The role of CDR is not straightforward, both institutional failure and market uncertainties can affect the timeframe for when companies plan to implement CDR. Pinkse & Busch (2013) suggest that

the main purpose of carbon norms is to create a strategic position in terms of image and aim, as well as managing constraining factors such as carbon dependency and stakeholder influence. However, how corporations experience and perceive these factors affects the role of CDR even if the same general carbon norm, net-zero, is applied.

A constraining factor affecting the applied carbon norm is stakeholder influence, both in terms of outside-in and inside-out influence (Pinkse & Busch, 2013). The Followers expressed inconclusive outside-in stakeholder influence for CDR, where fear of negative stakeholders' response is one factor explaining their decision to wait with investing in CDR. On the contrary, Early Adopters had more of an inside-out perspective with aiming to lead by example and to motivate others to do the same. Moreover, this inside-out influence can attract funding and early investments which is essential to drive the market development towards the commercialisation of CDR. In contrast to Pinkse and Busch (2013), the carbon impact was not a main determinant whether outside-in or inside-out stakeholder influence was dominating. Instead, when viewing CDR as a carbon norm, the corporation's technological belief in CDR had a more determining impact rather than the corporation's carbon dependency.

Another constraining factor that corporations can deal with through adopting carbon norms is carbon dependency (Pinkse & Busch, 2013). In this study, no matter the corporation's carbon dependency, internal reductions including the whole value chain were stated as the main priority and CDR was viewed as a complementary tool to reach net-zero. Pinkse and Busch (2013) state that the degree of carbon dependency is related to the corporation's ability to reduce emissions in a cost-efficient and credible way over time. It was found that corporations with higher carbon dependency were more prone to be Early Adopters of CDR. For corporations with high carbon dependency, CDR can act as a complementary tool increasing the ability to reduce emissions at a faster pace, adding firm credibility to reach the net-zero target. Conversely, corporations with lower carbon dependency can risk decreased credibility if too much attention is put on CDR as they have a greater ability to reduce their emissions. The credibility aspect is a crucial consideration to avoid getting accused of greenwashing (Delmas & Burbano, 2011).

In contrast to Pinkse and Busch (2013), cost-efficiency was not emphasised as a main reason for using traditional offsets or CDR. Regarding traditional offsets, the legitimacy problem (Bumpus & Liverman, 2008; Dhanda & Hartman, 2011) was brought up as a reason to not rely on it to reach net-zero. Moreover, the current price for CDR is often high due to its high-quality categorisation and the future price is difficult to predict at this nascent stage. Hence, CDR is often not the most cost-efficient alternative to reduce emissions, instead, corporations investing in CDR are akin to drive market development and increasing the feasibility to use CDR on a larger scale.

Besides using carbon norms to deal with constraining factors, corporations can use carbon norms to create a strategic positioning in terms of image and aim (Pinkse & Busch, 2013). Committing to net-zero is a way to describe a desired future image, but due to a lot of uncertainties, the exact roadmap to reach this future image is difficult to predict. Both Early Adopters and Followers believed that CDR will be required to reach net-zero. The vision of a desired future can generate a debate for how to accomplish these targets, which is typical when a low-carbon future is not yet commercialised on a scalable level (Pinkse & Busch, 2013). Early Adopters believe that investing in CDR can motivate others and increase the feasibility of CDR as a part of reaching net-zero.

Along with creating a strategic image, companies use carbon norms with different strategic aims, either to differentiate from competitors or to standardise business practices within the industry (Pinkse and Busch, 2013). Early Adopters expressed the strategic aim as being both to differentiate from competitors as well as being part of the standardisation process. Whereas the Followers had the strategic aim of waiting for the market to mature and the standardisation to fall in place before investing in CDR. In other words, CDR is positioned in terms related to a desired future and a more active position will be relevant when the technology is further developed.

5.1.4 Synthesis of Drivers for CDR

Based on the above discussion, we suggest an extension to the framework of Pinkse and Busch (2013) (see Figure 6). First, adding a contextual layer focusing on technology and corporations'

belief in CDR can further explain why Early Adopters and Followers adopt different carbon norms for CDR. The former believes that early investments are required to drive commercialisation of the CDR technology and for the market to grow. The latter is more hesitant to invest in CDR due to an absence of institutions and market uncertainties, leading to a postponed time horizon for CDR. Followers are relying on the CDR development to happen without them engaging in the market and will invest when the market is more regulated and commercialised. As such, adding a contextual layer allows for a more comprehensive analysis of CDR as a carbon norm.

Second, the four factors described by Pinkse and Busch (2013) appear to be more interlinked than suggested in the original framework. By viewing the factors as interlinked rather than isolated, allows for added complexity when reviewing the role of CDR in corporations' net-zero strategies from a carbon norm perspective. For example, the Followers stated that outside-in stakeholder influence and the risk of negative responses affect their strategic position in terms of image. Thus, recognising the link between image and stakeholder influence can explain why Followers have a focus on creating a desired future image rather than leading by example, in contrast to the Early Adopters.

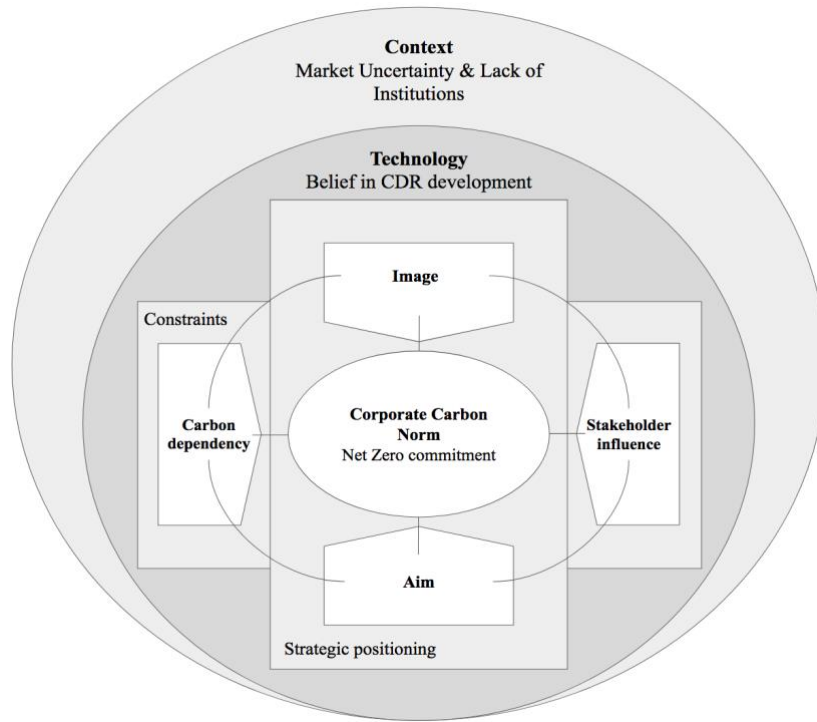


Figure 6 -Extended Carbon norms framework for CDR.

Adopted from Pinkse, J., & Busch, T. (2013). *Corporate Carbon Norms: A framework*. Figure. *Thunderbird International Business Review*, 55(6), p633-645, Figure found on p637, <https://doi.org/10.1002/tie.21580>

5.2 CDR as a key component to net-zero strategies

5.2.1 Simultaneous strategic aims

In our study, corporations were found to have internal reductions as the main priority and emphasised the importance of focusing on internal efforts, over investing in external mitigation measures such as CDR. The extant literature treats emission strategies as divided into two categories, internal and external strategies (Jeswani et al., 2008; Lee & Klassen, 2016; Weinhofer and Hoffmann, 2010). Thinking in terms of internal and external strategies for reducing emissions, with a focus on internal, is also becoming a common theme in practice.

Having a focus on internal strategies for reduction can be referred to as having the strategic aim of innovation (Kolk & Pinkse 2004). This can be illustrated by the extensive attempts by

corporations to work with creating less emission-intensive processes or looking for new innovative products that can be carbon neutral.

Although focusing on innovation and improving internal processes seems to be the priority for corporations, they are simultaneously using various offsetting options, including CDR. This can be referred to as having the strategic aim of compensation (Kolk & Pinkse 2004). In fact, there is a consistent view among respondents that the corporations will never reach net-zero without using CDR. As such, having simultaneous strategic aims, rather than focusing solely on innovation or compensation, seems to be the case. Continuously focusing on cutting internal emissions but compensating with CDR for the remaining emissions. Thus, implementing both strategies at the same time, or as we refer to it, simultaneously.

The study conducted by Kolk and Pinkse (2004) found that corporations' strategies for compensating their emissions were limited because of the immature market for offsets. Given the offset market's exponential development over the last couple of years (Sankar, 2020) and the growth of CDR, combined with increased net-zero commitments (Zhongming et al., 2020), our findings indicating that corporations are moving more towards compensation may not be too surprising.

In addition, our study found similarities with the Kolk and Pinkse (2005) extended typology which included clustering of six different profiles. In our study, a distinction between Early Adopters and Followers could be spotted, but it seems as though the two groups can adhere to one or several of the six profiles simultaneously. Where Followers can be both emergent planners and cautious planners, and Early Adopters can be internal explorers, horizontal explorers, vertical explorers, and emissions traders.

Furthermore, considering corporations' confidence in such a simultaneous approach long-term, there does not seem to be a temporal difference in using these strategies as proposed in the framework of Weinhofer & Hoffman (2010). In their framework, carbon compensation is considered a short-term strategy that aims of balancing the emissions until total reduction has been achieved in a long-term scenario referred to as carbon independence. Our findings oppose

such temporal aspects for two reasons. First, corporations argue that they will never achieve net-zero emissions, or carbon independence, without CDR. Second, while they prioritised internal reductions, they were all using or planning on using CDR simultaneously, long-term.

Conversely, our findings indicate that CDR should not be viewed as a separate strategy, nor as a short-term strategy that is isolated from general reduction strategies. Rather, it is a tool in a toolbox along with other recognised strategies. Agreeing with the view of Damert et al. (2017).

5.2.2 Simultaneous degree of cooperation

Working with partners is a key factor for success when including CDR in one's net-zero strategy, both for building knowledge but also securing development of supply and collaboration for market development. Engaging beyond one's value chain to reach the corporate objectives, can be referred to as a horizontal degree of cooperation (Kolk & Pinkse, 2004). On the other hand, taking a value chain approach to strategy is an equally important consideration. Including activities such as screening of value chain emissions and setting emission criteria for suppliers. This indicates a vertical degree of corporation (Kolk & Pinkse, 2004). Further, setting internal targets and control measures such as footprint accounting and internal guidelines are usually done in parallel. Thus, indicating an internal degree of cooperation (Kolk & Pinkse, 2004).

Like our findings regarding the simultaneous strategic aims, the lines within the other dimension, degree of organisation, developed by Kolk & Pinkse (2004), seems to have become vaguer as well. In this instance too, corporations are using a simultaneous approach.

According to our findings, no corporation looked internally only, all of them included their value chain. Although the first step was to set internal standards and targets, in a later stage these would become applicable to all levels of the value chain, including suppliers. The same applies for corporations going beyond their value chains and collaborating horizontally with partners when exploring CDR. However, besides having internal and vertical standards and targets, corporations complement by using external market mechanisms, such as CDR suppliers, in parallel. The realisation of never achieving net-zero independently and the need

for collaboration with actors driving the market and co-invest in new technology is noticeable among corporations. All things combined, corporations no longer distinguish as much between the different degrees of corporations and seem to be working at each level, although at varying degrees.

5.2.3 CDR effects on internal reductions

Although scholars have argued that CDR can have a negative impact on global decarbonisation (Kaya et al., 2019; Honegger et al., 2021) and corporate reduction efforts (Anderson & Peters, 2016; Fuss et al., 2014), our findings indicated that all corporations prioritised internal reductions over CDR investments. In other words, the respondents have the main strategic intent to innovate and reduce, before compensating and removing. Further, they made clear that their usage of CDR was only applicable to the business areas in which they could not reach net-zero without it. In addition, Followers afraid of CDR substituting reduction initiatives and sending the wrong message internally, instead choose to wait with implementing CDR before they had reached their reduction targets.

As such, the debate may be fighting the friend instead of the foe, as several of the Early Adopter also expressed. Companies need to start removing already emitted carbon to reach their net-zero emission targets (Bushell et al., 2015) and viewing CDR as an opportunity instead of a threat will enable corporations to get to zero faster.

5.2.4 Synthesis of CDR as a key component to net-zero strategies

Considering the above discussion, a third dimension of the framework can be suggested, in which the strategic aim of innovation and compensation can be used simultaneously, as well as the various degrees of cooperation (See Table 4).

Organisation	Aim		
	Innovation	Compensation	Simultaneous
Internal (company)	Innovation	Compensation	Simultaneous
Vertical (supply chain)	Innovation	Compensation	Simultaneous
Horizontal (beyond the supply chain)	Innovation	Compensation	Simultaneous
Simultaneous	Innovation	Compensation	Simultaneous

Table 4 - Third dimension of Climate Change Strategies

Adopted from Kolk, A., & Pinkse, J. (2004). Market strategies for climate change. European Management Journal, 22(3). Table found on p311. DOI:10.1016/j.emj.2004.04

For example, a few respondents mentioned that they were aiming to achieve less carbon-intensive products, while also working in CDR suppliers to compensate for emissions in current, more carbon-intensive areas. Additionally, the degree of cooperation can vary within the same strategy because of different targets for reduction and removals. In fact, many respondents were working on setting reduction targets for reaching their internal reductions, while also working horizontally for reaching their external removal targets.

Such a framework can be argued to be more in line with the growing usage of such external strategies (Blaufelder et al., 2021), due to the more mature offset market with higher quality options (Kriegler et al., 2013) as well as the net-zero movement in which companies are encouraged to remove carbon from the atmosphere (IPCC, 2018).

6. Conclusions

The purpose of our study was to explore the drivers behind, as well as the role of, CDR investments in corporations' efforts to reach net-zero emissions.

Our results indicate six potential drivers for investing in CDR, (1) being prepared for future regulations, (2) fiduciary obligation, (3) gaining a competitive advantage, (4) brand and reputational, (5) financial risk and (6) stakeholder pressure.

Although corporations agree that CDR will be an important aspect for their future ability to reach net-zero commitments, there are different approaches when it comes to how active they are in influencing the market. Either companies are taking an inside-out approach and thus are active in developing the CDR market by investing and influencing others to follow suit, or an outside-in approach where they are rather responding to external pressures and being influenced by their stakeholders and the market.

There is a consensus among corporations that CDR will be vital to remove the last emission residual. Even if all possible reduction efforts are made, a certain degree of emissions will still occur. Hence, CDR will be an important tool to cut residual emissions or achieve a faster decarbonisation transformation. In addition, relying on nascent and uncertain CDR technologies to reach ambitious emission targets, is a way for corporations to illustrate a desired future state. Further, for Early Adopters, CDR is used with a strategic aim to both differentiate as well as impact the standardisation of the CDR market. However, for Followers, the strategic aim is not as established yet since they are waiting for the market to mature.

The investment time horizon and when to implement CDR varies among corporations. We found two main factors that are affecting such time horizons, (1) institutional failure and (2) uncertainty about the CDR market. First, Followers experience an increased level of uncertainty due to the lack of institutional arrangement which delays investment decisions. On the other hand, Early Adopters are institutionalising the CDR market by investing and exploring CDR to gain a competitive advantage. Second, waiting for the CDR market to mature

and the technology to develop are also delaying investments for Followers. Thus, Followers are awaiting reduced uncertainty. On the contrary, in Early Adopters' attempts of institutionalising the CDR market, they help decrease the market uncertainties and increase the feasibility to meet future CDR demand.

In order to reach net-zero emissions, corporations prioritise the strategic intent to innovate and reduce, before choosing to compensate and remove. However, they are using all tools available to reach such ambitious targets and agree that CDR will be a necessity. This is blurring the lines between the traditional division of external and internal strategies for climate change, suggesting a trend in moving towards using a simultaneous approach. Further, corporations are working at various levels at the same time, working with internal efforts, having a value chain perspective, as well as working with external partners. As such, also indicating a trend in using a simultaneous approach for this dimension.

Although working simultaneously with internal reductions and CDR, the priority for corporations is internal reductions. CDR will mainly be used to remove the emission residual and accelerate the reduction pace. Moreover, our findings suggest that CDR is not a separate strategy for corporations, nor is it a short-term strategy. It is a tool in a toolbox.

7. Contributions and future research

7.1 Theoretical contributions

The findings from our thesis contribute to carbon management scholarship in two ways. First, it extends the view of the categorisation of carbon mitigation strategies by not only confirming the categorisation of internal and external strategies (Jeswani et al., 2008; Lee & Klassen, 2016) but adding a third categorisation, simultaneous, to Kolk & Pinkse (2004) typology for climate strategies. This added categorisation emphasises that the strategic aim of innovation and compensation can be used simultaneously, as well as the various degrees of cooperation.

Second, our study contributes to the literature stream for carbon norms, confirming the factors outlined by Pinkse and Busch (2013). Further, adopting the framework to the complex CDR market by adding two components. First, a contextual layer for belief in technology development can explain the different implementation horizons applied by corporations. Second, by viewing the four factors as interlinked rather than isolated and thus adding a level of complexity better suited for the CDR market. Such a framework aims to explain the various approaches of reaching net-zero among corporations and is adopted for the nascent CDR market.

7.2 Empirical contributions

In addition to the theoretical contributions outlined above, the findings from our thesis make empirical contributions to extant literature. First, our findings contribute to the unexplored area of why corporations are investing in CDR despite the ongoing concern of its limited effects and nascent stage. It provides empirical evidence of which drivers apply for corporations investing in CDR.

Second, our findings provide insights into the unexplored area on potentially harmful effects of CDR for accelerating internal emission reductions (Anderson & Peters, 2016; Fuss et al., 2014; McLaren et al., 2019; Dyke et al., 2021; Kaya et al., 2019; Honegger et al., 2021). Thus,

indicating that the ongoing academic debate on the harmful effects of CDR on internal emission reductions, might be overlooking the simultaneous aspect of strategy implementation.

7.3 Limitations

We identified three limitations to our thesis. First, our respondents were limited to sustainability managers or climate specialists, we did not interview employees at any other area within the corporations. Considering that a net-zero commitment will require changes to the entire corporation, engaging more senior executives or business units such as strategic planning and finance could have helped provide a more holistic view.

Second, the small sample size of twelve corporations could be regarded as a limitation to our study. Although we experienced empirical saturation after the tenth interview and gained no further insights from the last two respondents, it would have been interesting to investigate the effects of a substantially larger sample.

Third, although our respondents were representatives from multinational corporations, they were all located in Northern Europe. Thus, our study is limited to this context. As such, expanding the scope to include different regions could potentially allow for local practices, adaptation levels and trends to be considered.

7.4 Future Research

While research on CDR is in a nascent stage, there are many interesting areas for future researchers to explore. However, we could identify three areas for future research connected to our study. First, expanding the scope to include not only sustainability managers or climate experts would allow for richer insights and a more holistic view of CDR strategies. Second, due to the nascent phenomenon of CDR, no delimitation to a specific industry was made. However, it could be interesting to narrow the scope to one specific industry once the market has matured and investigate whether there are any industry-specific drivers for CDR. Third, our study focuses on corporations that are Early Adopters or Followers. Expanding the scope to include corporations who are opponents of CDR would add an additional perspective and potentially nuance the findings.

8. References

- Alvarez, I. G. (2012). Impact of CO2 emission variation on firm performance. *Business Strategy and the Environment*, 21(7), 435-454.
- Anderson, K., & Peters, G. (2016). The trouble with negative emissions. *Science*, 354(6309), 182-183.
- Andonova, L. B., Betsill, M. M., & Bulkeley, H. (2009). Transnational climate governance. *Global Environmental Politics*, 9(2), 52-73.
- Backman, C. A., Verbeke, A., & Schulz, R. A. (2017). The drivers of corporate climate change strategies and public policy: A new resource-based view perspective. *Business & Society*, 56(4), 545-575.
- Bellassen, V., & Leguet, B. (2007). The emergence of voluntary carbon offsetting. ().auto-saisine. Retrieved from <https://hal.archives-ouvertes.fr/hal-01190163>
- Berrutti, P. (2021). We need to talk about net zero bullsh*t. Retrieved September 16, 2021, from <https://www-responsible-investor-com.ez.hhs.se/articles/we-need-to-talk-about-net-zero-bullsh-t>
- Blaufelder, C., Levy, C., Mannion, P., & Pinner, D. (2021). A blueprint for scaling voluntary carbon markets to meet the climate challenge. Retrieved from <https://www.mckinsey.com/business-functions/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge>
- Boiral, O. (2006). Global warming: Should companies adopt a proactive strategy? *Long Range Planning*, 39(3), 315-330. doi:10.1016/j.lrp.2006.07.002

- Boysen, L. R., Lucht, W., Gerten, D., Heck, V., Lenton, T. M., & Schellnhuber, H. J. (2017). The limits to global-warming mitigation by terrestrial carbon removal. *Earth's Future*, 5(5), 463-474. doi:10.1002/2016EF000469
- Busch, T., & Hoffmann, V. H. (2007). Emerging carbon constraints for corporate risk management. *Ecological Economics*, 62(3-4), 518-528.
- Bushell, S., Colley, T., & Workman, M. (2015). Investing in negative emissions. *Nature Climate Change*, 5, 971-973. doi:10.1038/nclimate2726
- Crane, A. (2000). Facing the backlash: Green marketing and strategic reorientation in the 1990s. *Journal of Strategic Marketing*, 8(3), 277-296.
- Creswell, J. W. (2021). *A concise introduction to mixed methods research* SAGE publications.
- Dahlmann, F., Branicki, L., & Brammer, S. (2019). Managing carbon aspirations: The influence of corporate climate change targets on environmental performance. *Journal of Business Ethics*, 158(1), 1-24.
- Damert, M., & Baumgartner, R. J. (2018). Intra-sectoral differences in climate change strategies: Evidence from the global automotive industry. *Business Strategy and the Environment*, 27(3), 265-281. doi:10.1002/bse.1968
- Damert, M., Paul, A., & Baumgartner, R. J. (2017). Exploring the determinants and long-term performance outcomes of corporate carbon strategies. *Journal of Cleaner Production*, 160, 123-138. doi:10.1016/j.jclepro.2017.03.206
- Delmas, M. A., & Burbano, V. C. (2011). The drivers of greenwashing. *California Management Review*, 54(1), 64-87.
- Doh, J. P., Howton, S. D., Howton, S. W., & Siegel, D. S. (2010). Does the market respond to an endorsement of social responsibility? the role of institutions, information, and legitimacy. *Journal of Management*, 36(6), 1461-1485.

- Dyke, J., Watson, R. & Knorr, W. (2021). Climate scientists: Concept of net zero is a dangerous trap. Retrieved September 17, 2021, from <http://theconversation.com/climate-scientists-concept-of-net-zero-is-a-dangerous-trap-157368>
- EASAC. (2018). EASAC policy report 35 - negative emission technologies: What role in meeting paris agreement targets? ().European Academies' Science Advisory Council.
- Eberlein, B., & Matten, D. (2009). Business responses to climate change regulation in canada and germany: Lessons for MNCs from emerging economies. *Journal of Business Ethics*, 86(2), 241-255.
- Fossey, E., Harvey, C., McDermott, F., & Davidson, L. (2002). Understanding and evaluating qualitative research. *Australian & New Zealand Journal of Psychiatry*, 36(6), 717-732.
- Freeman, R. E. (2010). *Strategic management: A stakeholder approach* Cambridge university press.
- Frynas, J. G., & Yamahaki, C. (2016). Corporate social responsibility: Review and roadmap of theoretical perspectives. *Business Ethics: A European Review*, 25(3), 258-285.
- Fuss, S., Canadell, J. G., Peters, G. P., Tavoni, M., Andrew, R. M., Ciais, P., . . . Nakicenovic, N. (2014). Betting on negative emissions. *Nature Climate Change*, 4(10), 850-853.
- Galbreath, J. (2010). Corporate governance practices that address climate change: An exploratory study. *Business Strategy and the Environment*, 19(5), 335-350.
- Gasbarro, F., Iraldo, F., & Daddi, T. (2017). The drivers of multinational enterprises' climate change strategies: A quantitative study on climate-related risks and opportunities. *Journal of Cleaner Production*, 160, 8-26.
- Gasbarro, F., Rizzi, F., & Frey, M. (2016). Adaptation measures of energy and utility companies to cope with water scarcity induced by climate change. *Business Strategy and the Environment*, 25(1), 54-72.

- Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the gioia methodology. *Organizational Research Methods*, 16(1), 15-31.
- Glienke, N., & Guenther, E. (2016). Corporate climate change mitigation: A systematic review of the existing empirical evidence. *Management Research Review*,
- Gończ, E., Skirke, U., Kleizen, H., & Barber, M. (2007). Increasing the rate of sustainable change: A call for a redefinition of the concept and the model for its implementation. *Journal of Cleaner Production*, 15(6), 525-537. doi:10.1016/j.jclepro.2006.05.018
- Guba, E. G., Lincoln, Y. S., & Denzin, N. K. (1994). *Handbook of qualitative research*. Califonia: Sage, , 105-117.
- Hejbøl Jense, M. (Feb 19, 2021). How to calculate a company's carbon footprint? Paper presented at the How to Remove Corporate Emissions with CORCs? - Puro.Earth Webinar, Retrieved from <https://puro.earth/how-to-remove-corporate-emissions-with-corc>
- Herold, D. M., & Lee, K. (2019). The influence of internal and external pressures on carbon management practices and disclosure strategies. *Australasian Journal of Environmental Management*, 26(1), 63-81. doi:10.1080/14486563.2018.1522604
- Hoffman, A. J. (2005). Climate change strategy: The business logic behind voluntary greenhouse gas reductions. *California Management Review*, 47(3), 21-46.
- Hoffmann, V. H., & Busch, T. (2008). Corporate carbon performance indicators: Carbon intensity, dependency, exposure, and risk. *Journal of Industrial Ecology*, 12(4), 505-520.
- Honegger, M., Michaelowa, A., & Roy, J. (2021). Potential implications of carbon dioxide removal for the sustainable development goals. *Climate Policy*, 21(5), 678-698.
- Hopwood, B., Mellor, M., & O'Brien, G. (2005). Sustainable development: Mapping different approaches. *Sustainable Development*, 13(1), 38-52. doi:10.1002/sd.244

- Hörisch, J., Freeman, R. E., & Schaltegger, S. (2014). Applying stakeholder theory in sustainability management: Links, similarities, dissimilarities, and a conceptual framework. *Organization & Environment*, 27(4), 328-346.
- Husted, B. W. (2003). Governance choices for corporate social responsibility: To contribute, collaborate or internalize? *Long Range Planning*, 36(5), 481-498.
- Ingram, P., & Silverman, B. S. (2000). Introduction: The new institutionalism in strategic management. *The New Institutionalism in Strategic Management (Advances in Strategic Management, Vol.19)*, Emerald Group Publishing Limited, Bingley, 19, 1-30. Retrieved from [https://doi.org/10.1016/S0742-3322\(02\)19001-2](https://doi.org/10.1016/S0742-3322(02)19001-2)
- IPPC. (2018). Global warming of 1.5°C. (). Intergovernmental Panel on Climate Change. Retrieved from https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf
- Ivanaj, S., Ivanaj, V., McIntyre, J. R., & Da Costa, N. G. (2017). MNEs and climate change: Implications for future research. *MNEs and Climate Change: Implications for Future Research*,
- Jeswani, H. K., Wehrmeyer, W., & Mulugetta, Y. (2008). How warm is the corporate response to climate change? evidence from pakistan and the UK. *Business Strategy and the Environment*, 17(1), 46-60.
- Kaya, Y., Yamaguchi, M., & Geden, O. (2019). Towards net zero CO₂ emissions without relying on massive carbon dioxide removal. *Sustainability Science*, 14(6), 1739-1743.
- Ketokivi, M., & Choi, T. (2014). Renaissance of case research as a scientific method. *Journal of Operations Management*, 32(5), 232-240.

- Kolk, A., Levy, D., & Pinkse, J. (2008). Corporate responses in an emerging climate regime: The institutionalization and commensuration of carbon disclosure. *European Accounting Review*, 17(4), 719-745.
- Kolk, A., & Pinkse, J. (2004). Market strategies for climate change. *European Management Journal*, 22(3), 304-314.
- Kolk, A., & Pinkse, J. (2005). Business responses to climate change: Identifying emergent strategies. *California Management Review*, 47(3), 6-20.
- Kollmuss, A., Zink, H., & Polycarp, C. (2008). Making sense of the voluntary carbon market: A comparison of carbon offset standards. WWF Germany, , 1-23.
- Kramer, M. R., & Porter, M. (2011). Creating shared value FSG.
- Kriegler, E., Edenhofer, O., Reuster, L., Luderer, G., & Klein, D. (2013). Is atmospheric carbon dioxide removal a game changer for climate change mitigation? *Climatic Change*, 118(1), 45-57.
- Lang, S., Blum, M., & Leipold, S. (2019). What future for the voluntary carbon offset market after paris? an explorative study based on the discursive agency approach. *Climate Policy*, 19(4), 414-426. doi:10.1080/14693062.2018.1556152
- Lash, J., & Wellington, F. (2007). Competitive advantage on a warming planet.
- Lee, S. (2012). Corporate carbon strategies in responding to climate change. *Business Strategy and the Environment*, 21(1), 33-48.
- Lee, S., & Klassen, R. D. (2016). Firms' response to climate change: The interplay of business uncertainty and organizational capabilities. *Business Strategy and the Environment*, 25(8), 577-592.

- Levin, K., Cashore, B., Bernstein, S., & Auld, G. (2012). Overcoming the tragedy of super wicked problems: Constraining our future selves to ameliorate global climate change. *Policy Sciences*, 45(2), 123-152.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry* sage.
- Marshall, C., & Rossman, G. B. (2014). *Designing qualitative research* (6th ed.) SAGE Publications, Inc.
- McLaren, D. P., Tyfield, D. P., Willis, R., Szerszynski, B., & Markusson, N. O. (2019). Beyond “Net-zero”: A case for separate targets for emissions reduction and negative emissions. *Frontiers in Climate*, 0 doi:10.3389/fclim.2019.00004
- Montiel, I., & Delgado-Ceballos, J. (2014). Defining and measuring corporate sustainability: Are we there yet? *Organization & Environment*, 27(2), 113-139.
- Morgeson, F. P., & Hofmann, D. A. (1999). The structure and function of collective constructs: Implications for multilevel research and theory development. *Academy of Management Review*, 24(2), 249-265.
- Morrow, D. R., Buck, H. J., Burns, W. C. G., Nicholson, S., & Turkaly, C. (2018). Why talk about carbon removal? doi:10.17606/M6H66H
- North, D. C. (1991). Institutions. *Journal of Economic Perspectives*, 5(1), 97-112.
- Okereke, C. (2007). An exploration of motivations, drivers and barriers to carbon management: The UK FTSE 100. *European Management Journal*, 25(6), 475-486.
doi:10.1016/j.emj.2007.08.002
- Okereke, C., & Russel, D. (2010). Regulatory pressure and competitive dynamics: Carbon management strategies of UK energy-intensive companies. *California Management Review*, 52(4) Retrieved from https://journals.sagepub.com/doi/pdf/10.1525/cmr.2010.52.4.100?casa_token=_IyuiHVrAkY

AAAAA:A7fcmudPXMq-C3BQ1_UnXtJMjrHE9Ap7Q060rGEj7CLvqlA5XEBjr-
dmGf_6omZ9OAq9uXwfYp2GFbY

- Peters, G. P., & Geden, O. (2017). Catalysing a political shift from low to negative carbon. *Nature Climate Change*, 7(9), 619-621.
- Pinkse, J. (2007). Corporate intentions to participate in emission trading. *Business Strategy and the Environment*, 16(1), 12-25.
- Pinkse, J., & Busch, T. (2013). The emergence of corporate carbon norms: Strategic directions and managerial implications. *Thunderbird International Business Review*, 55(6), 633-645.
- Pinkse, J., & Kolk, A. (2009). *International business and global climate change* Routledge.
- Pinkse, J., & Kolk, A. (2010). Challenges and trade-offs in corporate innovation for climate change. *Business Strategy and the Environment*, 19(4), 261-272.
- Pinkse, J., & Kolk, A. (2012). Multinational enterprises and climate change: Exploring institutional failures and embeddedness. *Journal of International Business Studies*, 43(3), 332-341.
- Porter, M. E., & Kramer, M. R. (2006). Strategy and society: The link between competitive advantage and corporate social responsibility. *Harvard Business Review*, 84(12), 78-92, 163.
- Porter, M. E., & Reinhardt, F. L. (2007). A strategic approach to climate. *Harvard Business Review*, 85(10), 22-26. Retrieved from <http://ez.hhs.se/login?url=https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip&db=buh&AN=26554521&site=ehost-live>
- Prince, M. J., & Felder, R. M. (2006). Inductive teaching and learning methods: Definitions, comparisons, and research bases. *Journal of Engineering Education*, 95(2), 123-138.
- Puro.earth. (2021). Accelerating the carbon net-negative economy. Retrieved September, 12, 2021, from <https://puro.earth/about-us/>

- Rasi, Raja Zuraidah Raja Mohd, Abdekhodae, A., & Nagarajah, R. (2014). Stakeholders' involvements in the implementation of proactive environmental practices: Linking environmental practices and environmental performances in SMEs. *Management of Environmental Quality: An International Journal*,
- Reyers, M., Gouws, D., & Blignaut, J. (2011). An exploratory study of motivations driving corporate investment in voluntary climate change mitigation in south africa. *South African Journal of Economic and Management Sciences*, 14(1), 92-108.
- Rugman, A. M., & Verbeke, A. (1998). Corporate strategies and environmental regulations: An organizing framework. *Strategic Management Journal*, 19(4), 363-375.
- Sankar, G. (2020). Supply and demand evolution in the voluntary carbon credit market. Kleinman Center for Energy Policy, Retrieved from <https://kleinmanenergy.upenn.edu/wp-content/uploads/2020/11/KCEP-Supply-and-Demand-Evolution-Singles.pdf>
- Savaresi, A. (2016). The paris agreement: A new beginning? *Journal of Energy & Natural Resources Law*, 34(1), 16-26.
- Shen, Y., Su, Z., Huang, G., Khalid, F., Farooq, M. B., & Akram, R. (2020). Firm market value relevance of carbon reduction targets, external carbon assurance and carbon communication. *Carbon Management*, 11(6), 549-563. doi:10.1080/17583004.2020.1833370
- Shue, H. (2017). Climate dreaming: Negative emissions, risk transfer, and irreversibility.8(2), 203–216. Retrieved from <https://www.elgaronline.com/view/journals/jhre/8-2/jhre.2017.02.02.xml>
- Silverman, D., & Marvasti, A. (2008). *Doing qualitative research: A comprehensive guide* Sage.

- Sneddon, C., Howarth, R. B., & Norgaard, R. B. (2006). Sustainable development in a post-brundtland world. *Ecological Economics*, 57(2), 253-268.
doi:10.1016/j.ecolecon.2005.04.013
- Spector, P. E., Rogelberg, S. G., Ryan, A. M., Schmitt, N., & Zedeck, S. (2014). Moving the pendulum back to the middle: Reflections on and introduction to the inductive research special issue of journal of business and psychology. *Journal of Business and Psychology*, 29(4), 499-502.
- Sprenkel, D. C., & Busch, T. (2011). Stakeholder engagement and environmental strategy—the case of climate change. *Business Strategy and the Environment*, 20(6), 351-364.
- Stockman, L., Rowell, A., & Kretzmann, S. (2009). Shell's big dirty secret. insight into the world's most carbon intensive oil company and the legacy of CEO jeroen van der veer.
- Tang, Q., & Luo, L. (2014). Carbon management systems and carbon mitigation. *Australian Accounting Review*, 24(1), 84-98.
- Tolhurst, N., & Embaye, A. (2012). Carbon offsetting as a CSR strategy. *Responsible business* (pp. 279-288) John Wiley & Sons, Ltd. Retrieved from
<https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119206156.ch19>
- Voyko, A. V., Sycheva, E. A., & Glisin, A. F. (2020). Decarbonization as a factor of sustainable corporate development within climate change. Paper presented at the Innovative Economic Symposium, 67-75.
- Weinhofer, G., & Busch, T. (2013). Corporate strategies for managing climate risks. *Business Strategy and the Environment*, 22(2), 121-144.
- Weinhofer, G., & Hoffmann, V. H. (2010). Mitigating climate change—how do corporate strategies differ? *Business Strategy and the Environment*, 19(2), 77-89.

- Windolph, S. E., Harms, D., & Schaltegger, S. (2014). Motivations for corporate sustainability management: Contrasting survey results and implementation. *Corporate Social Responsibility and Environmental Management*, 21(5), 272-285. doi:10.1002/csr.1337
- Wittneben, B. B., & Kiyar, D. (2009). Climate change basics for managers. *Management Decision*,
- World Economic Forum. (2021). The global risks report 2021 16th edition. ().World Economic Forum.
- Yin, R. K. (2015). *Qualitative research from start to finish* Guilford publications.
- Yunus, S. (2017). Drivers of corporate carbon management strategy (CMS) adoption and its impact on firm performance: Australian evidence
- Yunus, S., Eljido-Ten, E. O., & Abhayawansa, S. (2020). Impact of stakeholder pressure on the adoption of carbon management strategies: Evidence from australia. *Sustainability Accounting, Management and Policy Journal*,
- Yunus, S., Eljido-Ten, E., & Abhayawansa, S. (2016). Determinants of carbon management strategy adoption: Evidence from australia's top 200 publicly listed firms. *Managerial Auditing Journal*,
- Zhongming, Z., Linong, L., Wangqiang, Z., & Wei, L. (2020). Accelerating net zero: Exploring cities, regions, and companies' pledges to decarbonise.

9. Appendices

Appendix 1 - Expert interview protocol example

Briefing

Starting with a short presentation of the interviewers and thesis subject. Followed by the interview procedure that will follow including confidentiality, structure, duration, recording and possibility to review transcribed material.

Warm-up questions

Q: Could you please provide us with an introduction yourself?

Q: Could you please provide us with an introduction to the company?

Main questions

Q: How does the overall CDR market/landscape look like for these services?

Q: What type of industries do your customers operate in?

Q: Do customers seem knowledgeable to you or where does the competence lay within the company?

Q: What kind of agreements do you have with your customers? Short-term or long-term? Partnership or one-time buy etc?

Q: What are your thoughts on the future of CDR?

Q: Anything you want to add?

Appendix 2 – Main study protocol example

Briefing

Starting with a short presentation of the interviewers and thesis subject. Followed by the interview procedure that will follow including confidentiality, structure, duration, recording and possibility to review transcribed material.

Warm-up questions

Q: Could you please provide us with a brief introduction yourself and your role at XX?

Q: What does a sustainable company mean to you?

Q: How does XX work with sustainability?

Main questions

Q: Could you elaborate on XX's emissions commitments and targets?

Q: What does the plan look like to reach these targets and commitments?

Q: Why do XX feel the need to reach that goal?

Q: Could you tell us about XX view on CDR?

Q: How are XX using CDR in their strategy today?

Q: Going forward, what role do you think CDR will play?

Q: Is there anything you would like to add regarding CDR investments by XX?