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Catch it if you can

A bottom-up study about the future for CCS in Sweden, by examining the drivers and barriers for climate strategies of high emitting companies.

Abstract

Global, as well as Swedish scenarios of how to reach the goals stated in the Paris Agreement all point towards Carbon Capture and Storage (CCS) as a part of the solution. Although several high emitting companies in Sweden pose the opportunities to implement CCS, there are still no full-scale CCS installations in Sweden today. Nevertheless, how these actors plan and prioritize for the future will have implications for how the future unfolds. This qualitative study invites the Swedish actors' perspective to the CCS debate and explores their climate strategies to enhance the understanding of whether there is, or is not, a future for CCS in Sweden. Semi-structured interviews were conducted with 22 actors with large point sources of emissions (>100 ktons CO_2/ year) within the energy, industry, and waste sectors. The results were analysed through three theoretical perspectives to understand the drivers and barriers behind actors' climate strategies: institutional theory, resource-based theory, and resource dependency theory. The findings from this study imply that actors with fossil emissions tend to have innovative climate strategies, and companies with biogenic emissions tend to have compensatory strategies. Innovators prioritise CCS as means to reach their climate goals. These actors are influenced by norms and cognition and are driven by their perceived role as having great responsibility to contribute to Sweden's climate goals. In contrast, actors with a compensatory strategy do not feel the same pressure and responsibility and are thus willing to contribute voluntarily. For actors with the ability to acquire the right resources, there seems to be a future for CCS in Sweden. Although it hinges upon institutional factors to create the conditions for a successful implementation. If sufficient regulations to create a negative emissions framework are in place, innovators will most likely implement CCS in the near future (before 2030). Compensators will most likely wait until their cognitive pressure increases or until the general discussion about carbon emissions also includes biogenic emissions. By then, if innovators have implemented CCS, the compensators can mimic their behaviour.

Keywords: Carbon capture and storage, Bioenergy with carbon capture and storage, Climate strategy, Net zero

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Glossary

BECCS: Bioenergy with carbon capture and storage

Biogenic carbon dioxide (CO_2): Emissions of CO_2 as a result of combustion or decomposition of organic material, that is, material part of the natural carbon cycle, e.g. biomass

CCS: Carbon capture and storage

EU Emission Trading System (ETS): An EU trading scheme for GHG emissions including fossil (and not biogenic) CO_2 emissions

Fossil carbon dioxide (CO_2): Emissions of CO_2 as a result of combustion or evaporation of non-organic material that has been excavated from below ground, e.g. coal or oil

Greenhouse Gas (GHG) Protocol: Categorizing emissions into three scopes, which are now the international standard for measuring and classifying emissions from a company's operations. Scope 1: Direct company owned/controlled emissions, Scope 2: Emissions associated with the energy production consumed by the company, and Scope 3: Indirect emissions associated with company activities from sources not owned or controlled by a company

Intergovernmental Panel on Climate Change (IPCC): A UN body that prepares scientific reports based on published research to assess climate changes and provide guidance for decision making

Net Emission Technology (NET)/Greenhouse gas removal technologies: Technologies that allow for removing GHG, often carbon dioxide, from the atmosphere. BECCS is one type of NET

Net Zero: A scientifically based concept where committing to net zero means working actively to reduce GHG emissions and/or ensure that emissions released into the atmosphere are balanced by removal. Actors aiming at becoming net zero should cover all three scopes from the GHG Protocol in their strategies

Paris Agreement: A legally binding international treaty on climate change presented by the UN. Signed by 196 parties and entered into force in November 2016. The goal of the agreement is to limit global warming well below 2 °C, preferably limited to 1.5 °C, compared to pre-industrial levels

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1. Introduction

The world is currently facing a number of major challenges. One of the most pressing issues today is climate change. Rising temperatures, natural disasters and more extreme weather make the question more urgent than ever. According to the World Economic Forum (2019), the two greatest risks to the global economy are climate change mitigation and adaptation, and extreme weather events. To meet the target set in the Paris Agreement (limit global warming well below 2 °C), drastic reductions in CO_2 emissions must be achieved. And time is short - emissions must decrease to zero by 2050. This means working actively to reduce greenhouse gas emissions and/or ensuring that any emissions that are realized into the atmosphere are balanced by removal (Oxford Net Zero, n.d). Sweden is a prominent country when it comes to climate ambitions and has committed to a target of achieving net zero greenhouse gas emissions by 2045, and thereafter achieving negative emissions (SOU 2020:4). Although territorial emissions have decreased in recent years, the current rate of reduction is not sufficient. The need for additional measures is evident (Ministry of the Environment, 2020). Thus, initiatives to both mitigate and reduce emissions need to scale up faster.

The fact that countries are committing to the Paris agreement has large implications for companies (Daddi et al., 2019). Companies are facing increased pressure from regulators, consumers, and public opinion to take action (Weinhofer & Hoffman, 2010). In particular, companies operating in high emitting sectors such as steel, cement, waste and energy, and heat (Beiron et al., 2021; Braunreiter & Bennett, 2017; Johnsson & Kjärstad, 2019; Mandova et al., 2019). In 2018, the industry sector accounted for approximately a third of Sweden's total emissions, while the electricity, heating and waste sectors together accounted for approximately 14% of the total greenhouse gas emissions (Ministry of the Environment, 2020). There is currently a portfolio of measures that companies in these sectors can adopt in their climate strategy to reduce emissions. Carbon Capture and Storage (CCS) represents one of these measures. CCS is a technology that can be installed at large point sources of CO_2 to capture both fossil and biogenic CO_2 emissions and store it in suitable locations to avoid or remove the CO_2 from reaching the atmosphere.

Global, as well as Swedish climate ambitions, relies on CCS for both fossil and biogenic emissions as a part of the solution to reach net zero commitments (Fuhrman et al., 2019; IPCC, 2018; Ministry of the Environment, 2020; SOU2020:4). According to some scenarios presented by the IPCC, approximately 55% of the necessary decrease in carbon emissions will have to come from the use of CCS (Herstad Norin, 2021). Thus, it is highly unlikely to achieve the climate goals of the Paris Agreement without CCS on both fossil and biogenic emissions (McLaren & Markusson, 2020). In addition, the recent COP26 meeting in Glasgow calls for countries to limit and reduce the carbon in the atmosphere, which according to some experts could be in favour of CCS projects (Sheppard, 2021). High emitting sectors have been pointed out by research as having the greatest potential to utilize CCS at their facilities (Johnsson & Kjärstad, 2019), and for some companies, e.g. in the cement industry, CCS could potentially be the only way to reduce CO_2 emissions (Johnsson & Kjärstad, 2019). Furthermore, for

companies within these sectors, CCS could be important from both a climate and an economical perspective. With increasing prices of carbon emissions, CCS could lead to a stronger competitive advantage (Herstad Norin, 2021).

Although the importance of CCS to reach the climate targets is clearly stated by policy and researchers, there are no full-scale CCS installations in Sweden operating today. The longer time the deployment takes, the more important CCS technologies will become (Fuss & Johnsson, 2021). CCS projects are urgent, but the implementation is not yet widespread, policy mechanisms are still under investigation, risk allocation is not yet sure, and collaboration between parties is not yet established (Kapetaki & Scowcroft, 2017).

1.1 Problematization

Previous studies of CCS usually take a top-down perspective, investigating the feasibility of the technologies used (Martinez Castilla et al., 2021), the costs associated with the technology and its infrastructure (Johnsson et al., 2020; Kjärstad & Johnsson, 2021; Roussanaly et al., 2021), and the proper political incentives to stimulate CCS (Fridahl et al., 2020; Fridahl & Lundberg, 2021). Furthermore, research has concluded that how industries in the respective industry sector prioritise among different mitigating technologies will have clear implications on the future role of these technologies (Johnsson & Kjärstad, 2019; Rootzén et al., 2018). As an example, CCS projects on biogenic emissions must be initiated in the time 2020-2029 for the technology to contribute to reaching our climate goals in 2045 (SOU 2020:4). However, the actor's perspective in the CCS debate has only been examined by a few scholars (Braunreiter & Bennett, 2017; Rodriguez et al., 2021) and limited research have focus on the climate strategies of these actors nor applied a theoretical lens to seek an explanation for why these actors are prioritising as they do. Nevertheless, theories could provide useful tools of analysis to explain important connections between a company and the different internal and external factors that shape their strategic response (Daddi et al., 2019; Wittneben et al., 2012). For instance, according to institutional theory, the institutional environment and stakeholder influence can impact the firm's responses to climate change (Cavalcanit et al., 2017). Therefore, it becomes important to understand regulatory and normative instruments in order to incentivise further climate actions (Daddi et al., 2019).

Another interesting lens is the resource-based view which implies that firms form their climate responses if the firm-level resources can generate competitive advantage (Backman et al., 2015). Therefore, the fact that climate change is often considered a strategic issue (Okereke & Russel, 2010) and the fact that CCS could require a change within those business strategies (Braunreiter & Bennett, 2017), urges even more for a bottom-up approach for examining the actors' climate strategies (Möllersten et al., 2020). Empirical climate strategy research has concluded that there are several strategic responses to climate change, ranging from reactive to proactive on different classified scales (Jeswani et al., 2008; Kolk & Pinkse, 2005; Lee, 2012). Although such empirical research helps classify corporate climate strategies and provides an understanding of firm behaviour, it gives no in-depth explanation of why the strategies are formulated in a certain way (Daddi et al., 2019; Goodall, 2008; Winn et al., 2011).

While high emitting companies have an important role to play in contributing to decreasing emissions, little knowledge exists regarding how and why Swedish companies respond to the current environmental challenges. Given the urgency of these issues, the actions of today will determine the future of tomorrow. Thus, understanding the reasoning behind climate strategies is crucial to understanding the future role for CCS.

1.2 Purpose and research questions

The purpose of this study is to explore the future for CCS and answer the focus question of this paper:

"How will the future for CCS in Sweden unfold?"

The decisions of high emitting companies in Sweden today will be determinant for how the future unfolds. Therefore, to understand the future for CCS it is of importance to first, identify, and second, understand how companies' climate strategies are driven or hindered, which will indicate their future climate actions. The overarching question is answered by exploring and analysing the two following research questions:

- *"What are the climate strategies of high emitting companies?"*
- *"Why/why not are some companies prioritising CCS?"*

1.3 Scope

A climate strategy is usually a part of a firm's overall sustainability strategy, which can include social and financial aspects as well. As the urgency of the climate crisis has become more evident, we have chosen to focus on the climate strategy only. Second, climate strategies and means to reach national and global climate goals can involve several emissions mitigating and emissions removal technologies. This study will limit its focus to CCS, as this technology plays a major part in net zero and net negative scenarios presented by the IPCC and the Swedish government (IPCC, 2018; Ministry of the Environment, 2020; SOU2020:4). Furthermore, since CCS technology has the most potential at large emission sources (Fuss & Johnsson, 2021; Johnsson & Kjärstad, 2019), the study will be limited to the climate strategies of actors with more than 100 kton CO_2 emissions/year within the industry, energy and heat, and waste sectors. The study will further be delimited to a Swedish context due to consistency, as actors within the same country are operating in the same regulatory and policy landscape. Furthermore, previous research has shown that Sweden has favourable conditions for CCS on both fossil and biogenic emissions (Fuss & Johnsson, 2021; Garðarsdóttir et al., 2018; Kjärstad & Johnsson, 2021).

1.4 Research outline

This thesis is divided into eight sections. Section one seeks to emphasize the relevance of the chosen research topic and the purpose of the study. Section two aims to provide a contextual background to the researched phenomenon. Section three sheds empirical and theoretical light

on the phenomenon and presents relevant literature and a demonstration of the knowledge gap. Section four includes a justification and explanation of the chosen method and methodological approach. Section five presents the results of this study. Section six consists of an analysis of the results in connection to the theoretical framework. Section seven consists of a discussion of the future for CCS based on the findings of this study. Section eight presents the conclusions and contributions of this study.

2. CCS and the Swedish context

To understand the researched phenomenon, it is important to understand the technological and regulatory complexities that the investigated companies are facing. Therefore, this chapter provides a background to Sweden's climate policy (2.1), and Carbon Capture and Storage (2.2).

2.1 Sweden's climate policy

In 2017, Sweden committed to a target of achieving net zero greenhouse gas emissions by 2045 and thereafter achieving negative emissions. This overarching goal was divided into three important milestones, with 1990 as base year:

- 40% lower greenhouse gases in 2020
- 63% lower greenhouse gases in 2030
- 75% lower greenhouse gases in 2040

(SOU 2020:4)

These milestones should eventually lead to a long-term goal of 85% lower emissions in 2045. Carbon reductions can be achieved through several mitigating measures, for example:

- A transition from fossil to renewable raw materials and energy carriers
- Increased use of bio- and waste fuels in heating production
- Improved resource- and process efficiency
- Reduced landfill of organic waste
- Increased electrification
- Implement technologies for carbon capture and storage (CCS)

(Ministry of the Environment, 2020)

However, some emissions are hard to abate unless the source of these emissions shuts down. To reduce the remaining 15% of carbon emissions in Sweden's net zero-strategy, and eventually to reach negative emissions, so-called supplementary measures can be utilized:

- Increase the uptake of carbon dioxide emissions in Swedish forests and land
- Investment in emission reductions in countries outside of Swedish borders
- Negative emission technologies such as Carbon Capture and Storage of biogenic carbon emissions (BECCS)

(SOU 2020:4)

The above-stated targets and milestones only apply to emissions outside the *EU Emissions Trading System* (EU ETS). EU ETS is an EU-wide system of emission allowances that include fossil CO_2 emissions from combustion installations and industries that are energy-intensive (mineral oil refineries, coke ovens, the iron and steel industry, the pulp and paper industry and the minerals industry) (Ministry of the Environment, 2020). The number of allowances decreases linearly where 50% are allocated without charge and the remaining 50% are auctioned off. In addition, each country can decide if they want to include other sectors under the emission trading system. In Sweden, the government has decided to include the waste sector, leading to approximately 760 facilities included in the system in Sweden today (Naturvårdsverket, n.d). Although these facilities are not included in the Swedish national

climate target, the number of emission allowances will decrease over time, and therefore they still have incentives to decrease their emissions. The price of carbon permits has increased dramatically during 2021, with an increase of ~139% from January, to the price of €79 per tonne of CO_2 in December 2021, see Appendix A (Trading Economics, 2021).

Other instruments used in Sweden's climate policy to incentivise carbon reductions are:

- *The Industrial Leap* (Industriklivet): a funding programme for the industry sector in measures to reduce emissions or attain negative greenhouse gas emissions
- *Fossil Free Sweden* (Fossilfritt Sverige): an initiative to foster dialogue between actors on how they are planning to reach zero emissions
- *Carbon tax*, based on the fossil content of the fuel (1,2 SEK per kg carbon dioxide emissions in 2020)
- *Energy tax*, based on the use of electricity and fuels used for heating
- *Reversed auctions*: in November 2021, Sweden announced a support system for BECCS. The company that can deliver a BECCS to the lowest cost will receive state aid covering 100% of the costs during a 15-year period. The first auction will take place at the end of 2022

(Ministry of the Environment, 2020; ER2021:xxx)

2.2 Carbon Capture and Storage

Carbon Capture and Storage (CCS) is a relatively old technology but has gained more attention in recent years. It is a three-step process (capture, transportation, and storage), illustrated in Figure 1. The CO_2 emissions from large industrial and energy point sources are first *captured* (1) and separated from other gases by compressing the CO_2 into liquid form. The liquid is then *transported* (2-3) by train, truck, or pipes to the coast and finally by boat (4-5) to geologically suitable locations for permanent *storage* (6).

Figure 1: Illustration of the CCS process. Source: Göteborgs Hamn (2021).

The implementation of CCS is limited to stationary sources (such as plants) but could be applicable to several different types of industries, e.g. fossil-fuel-based processes such as cement manufacturing, mining, chemical, steel/iron or hydrogen, or biomass-based productions

such as pulp and paper (Fuss & Johnsson, 2021). Criticism directed towards CCS on fossil emissions argues that it risks extending the uptake of fossil fuels, i.e. continuing business as usual without fundamentally transitioning business practices (Budinis et al., 2018). Applying CCS to fossil or biogenic emission sources results in different effects, why the emissions are accounted for differently. When applying CCS to fossil emissions, the CO_2 emissions are netted to zero. When applying CCS to biogenic emissions, the CO_2 gases that are already in the natural cycle could be removed from the atmosphere. The latter process is called Bio-energy with Carbon Capture and storage (BECCS) and provides a possibility to achieve negative emissions (illustrated in Figure 2). However, the technology used is the same for CCS and BECCS (Nordic Council of Ministers, 2021), thus, there is no need to separate the two when discussing its potential large-scale implementation. In contrast, it can be beneficial to view CCS and BECCS in an integrated manner to understand and learn about the scale-up (Fuss & Johnsson, 2021). Thus, this thesis will use the abbreviation CCS for both types of emission sources.

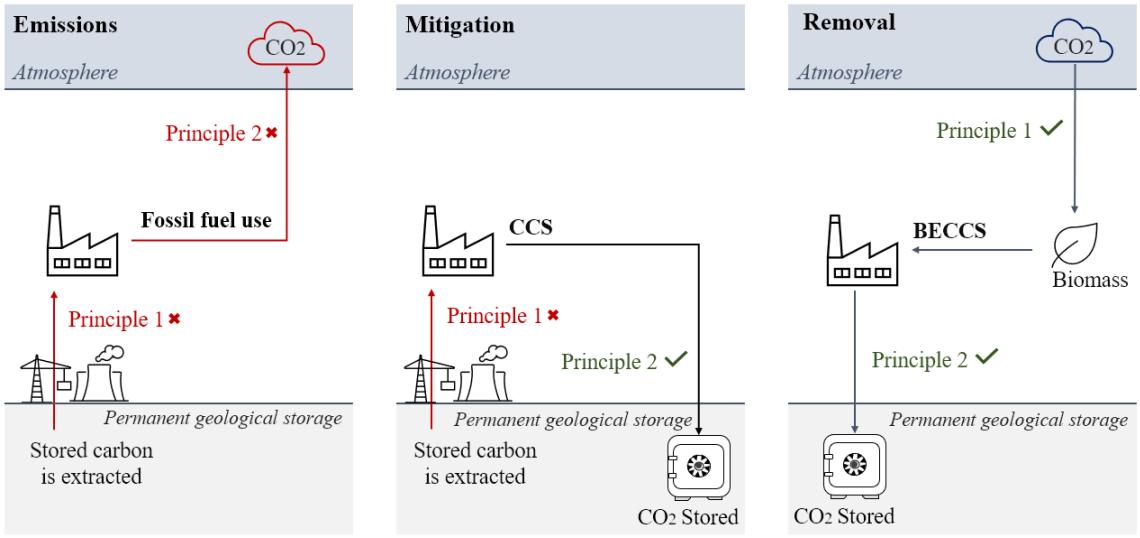

Figure 2: Effects of applying CCS to fossil or biogenic emissions. Source: Puro Earth (2021).

There are currently only a few large pilot projects running in Sweden. For example, the infrastructure project, CinfraCap, with the potential of transporting two million tons of CO_2 (Port of Gothenburg, 2021) and other pilot projects financed by the Ministry of Energy (Energimyndigheten, 2021). One challenge with CCS is related to the high costs (Nordic Council of Ministers, 2021). Installation of CCS facilities is characterised with high upfront investment costs (CAPEX) as well as high operating costs (OPEX) due to the energy-intensive process, maintenance and labour (Johnsson et al., 2020). In the transportation stage, the location of the plant will impact transportation costs. Industries located by the coast, and located near a storage point, have better opportunities for CCS due to lower transportation costs (Onarheim et al., 2015). The different transportation options, such as pipeline, truck, railway, or boat also affect the cost. A potential way to reduce the costs for CCS throughout the value chain is to collaborate and share infrastructure. In the CinfraCap project, clusters of plants along the Swedish west coast have managed to reduce the cost by coordinating and optimising the infrastructure for CCS (Herstad Norlin, 2021). In terms of storage, the Northern part of the North Sea is the best option (Johnsson & Kjärstad, 2019).

3. Theoretical framework

In the following chapter, we begin presenting the findings from empirical climate strategy research (3.1) to understand climate strategy characteristics. Secondly, we introduce the selected theoretical perspectives (3.2) to understand the reasoning behind climate strategies. Lastly, we present a summary of how the chosen theoretical perspectives interrelate in our study (3.3) and how it relates to our knowledge gap.

3.1 Empirical climate strategy research

In short, a firm's strategy can be defined as the actions deemed most appropriate based upon the changing reality in which the company is present (March, 1994). A firm's strategy to reduce carbon emissions from operations can be defined in different ways, one of them being articulated by Lee (2012, p.34) as "*a firm's selection of the scope and level of its carbon management activity in response to climate change*". This definition can imply multiple strategic options. In a paper by Kolk & Pinkse (2005), the strategic market-oriented options available to respond to climate change were examined. The researchers distinguish between innovation and compensation strategies. The former is an active approach aimed to improve companies' assets and knowledge base. This by cooperating throughout the value chain to reduce emissions and/or develop new technologies to lower emissions by forming partnerships and interacting with competitors. The latter, compensation strategies, is a passive approach aimed to reduce emissions while remaining in the existing technological and knowledge base. This by transferring their emissions using technologies developed by other actors. Kolk & Pinkse (2005) found that, out of the 227 companies investigated using a survey, six different climate strategies were identified, ranging from passive to active climate strategies. The most common strategies were the more passive (compensating) strategies. The least common strategies were the active (innovation) strategies.

In a study by Lee (2012), the carbon activities that companies prioritize and to what extent resources are allocated to those priorities were examined. Six strategy types were presented for identifying the carbon strategy at a company, ranging from a "wait-and-see" approach to an "all-around explorer" approach. The author found that the degree of stakeholder pressure from regulatory bodies, financial institutions, the public and the media, resulted in different carbon strategies. In a study by Weinhofer and Hoffmann (2010), the authors found that similar to Kolk & Pinkse (2005), climate strategies can be of compensatory nature (e.g. carbon trading or climate compensation project), of reducing nature (e.g. changing fuels used, improving efficiency) or complete carbon independence (e.g. transforming business practices and investing in carbon-free production). However, they link the three strategy types to represent a focus on different time horizons. A compensating strategy is most short-term, whereas reduction is long-term, and carbon independence is even more long-term. Weinhofer & Hoffman (2010) showed that, while some companies only adopt one of these strategies, large companies that face more pressure to reduce their emissions are more likely to choose a combination of climate strategy measures to meet the increasing demands. This is similar to the findings by Lee (2012). In line with this, but with further focus on carbon strategies between different countries (UK and Pakistan) and different high emitting sectors, Jeswani et al. (2008)

examine the main factors influencing the choice of emission-reducing and energy-efficiency strategies in the two countries. Instead of classifying carbon-reducing strategies as innovating or compensating (Kolk & Pinkse, 2005), Jeswani et al. (2008) expand the innovating strategy and identify internal and external activities as two strategic dimensions. Internal activities focus on increasing energy efficiency or switching from fossil to bio-sources of energy, whereas external activities focus on participation in research projects or cooperating with competitors to reduce emissions. The extent to which companies are incorporating internal or external activities in their carbon strategies were classified into four categories, ranging from "Indifferent" to "Active". Indifferent companies are either unaware or not concerned about integrating emission-reducing activities and active companies are integrating internal and external activities in their overall business strategy to a large extent. Further, in terms of stakeholders, it was primarily owners, management and regulatory agencies that had a strong influence on environmental activities. Other stakeholders such as employees, competitors, customers, or NGOs seemed to have less influence on actual actions taken. The most important drivers to adopt climate strategies for all types of companies (ranging from "indifferent" to "active") were cost savings opportunities, a commitment from management to reduce emissions, climate targets formulated by the company and to comply with regulations (Jeswani et al., 2008).

To our knowledge, even though incorporating CCS or other technologies into industrial processes requires changes in the overall business strategy, only two studies have approached CCS from an actor's perspective (Braunreiter & Bennett, 2017; Rodriguez et al., 2021). Beauneriter & Bennett (2017) conducted a study on corporate perceptions and decision making for CCS where they interviewed eight CCS representatives from multinational gas and coal mining companies. The results from the interviews showed that the fossil fuel companies believe that CCS is the only option for energy-intensive sectors to achieve necessary and urgent emission cuts. However, no interviewee believed that the CCS pathways outlined in global scenarios of reaching 2 °C were realistic, as investing in CCS does not add any value for these companies and were rather looked upon as "charity". The fossil companies were reluctant to change their existing business models but rather willing to increase renewables in the product mix, which reduced the interest for integrating CCS technologies in their operations and value proposition. Some companies did include CCS as a part of their climate strategies, however, they did not show signs of a willingness to large-scale commercialisation of the technology, but rather to signal preparedness to shareholders, and take part in the policy process from regulators (Beuneriter & Bennett, 2017).

In another recent qualitative study, Rodriguez et al. (2021) examine Nordic actors' perspectives about CCS on biogenic emissions. By conducting 20 semi-structured interviews, the researchers identified four tensions present in the discussion about BECCS, specifically: (1) absence of reliable long-term policies for negative emissions which decrease incentives, (2) limits to companies' climate change responsibility, (3) technical trade-offs of carbon capture, and (4) no customer demand for negative emissions. Interestingly, companies in the study do not view themselves as the cause of the problem, which might impact their motivation for contributing to the solution. They rather point towards other actors, such as cement and steel,

to first take responsibility for their emissions, before negative emission technologies should be prioritised. However, as this study was conducted 1,5 years ago, there is a reason for us, the authors of this paper, to believe that some things have changed since then, especially in terms of actor perspectives and policies. Further, the paper excludes the views of CCS on actors with fossil emissions, which limit the sample of actors that actually have the potential to use the technology. Third, the researchers (Rodriguez et al., 2021) did not use any theoretical framework to interpret their results.

3.2 Theoretical perspectives

Much of climate strategy research has been examined by researchers using a practical and descriptive approach, rather than a theoretical one (Daddi et al., 2018). Thus, providing an empirical understanding of the strategy and behaviour of different companies and therefore, limiting the dimensions in which climate strategy and actions can be understood by using theoretical models (Cavalcanti Sa de Abreu et al., 2017). The following section aims to address this gap by presenting three complementary theoretical perspectives that can be used to understand companies' climate strategies.

3.2.1 Institutional theory

Institutional theory suggests that organisations do not exist in silos, they are social structures interacting with the environment. The reason for this theory being particularly interesting for our research is the emphasis on the institutional pressures that influence how companies act, respond, and adapt to specific circumstances (Scott, 1995). The institutional theory presents three types of institutional pressures: regulatory, normative, and cognitive (Scott, 1995). Organisations adjust to these pressures to be perceived as legitimate by the external environment and to reduce uncertainties, which will allow them to pursue and grow their business objectives (DiMaggio & Powell, 1983). Therefore, businesses in similar environments faced with the same institutional pressures will likely behave in similar ways. One empirical research by Amran et al. (2012), explored climate change mitigation measures by applying an institutional theoretical perspective and found that, despite the companies operating in different industries, similar institutional pressures impacted the companies to take similar mitigation measures. However, there are several questions and interrelations left unanswered that have received scarce attention in this field of research so far, more specifically, how the three types of institutional pressure affect corporate climate response (Daddi et al., 2019).

3.2.1.1 Regulatory pressure

Regulatory processes are coercive mechanisms. This means that some entities can constrain and enable organisations' behaviours by policies and regulations. For example, rules with the legal possibility to enforce sanctions if these are not followed, or establishing regulations that can enable and empower actions, e.g. granting licenses or assigning special authority to certain actors (Scott, 1995). In terms of climate strategies, regulatory pressure is often considered by scholars to be the most important pressure (Levy & Kolk, 2002; Levy & Egan, 2003). Okereke & Russel (2010) found that both current regulations and the belief of future regulatory developments are the most important factors that affect climate strategies. Similarly, Hoffman

(2006) and Kolk & Pinkse (2004) found that potential regulatory threats are one of two critical factors that are driving climate mitigation efforts. Furthermore, when comparing different institutional pressures to determine if this affects companies' early or more reactive voluntary actions, early movers seem to be more affected by the institutional and political pressure than later movers (Delmas & Montes-Sancho, 2010). However, it should be noted that while companies need to understand international policies and climate-related regulations, which might impact their operations in different ways and thus their strategies, governments alone are limited in how much they can affect climate change simply by laws. Corporate responses to climate change are often voluntary actions. Regulations should also aim to allow for flexibility and create incentives to build sustainable climate strategies, rather than determining a level of climate performance (Daddi et al., 2019; Porter & Van der Linde, 1995). Too strict regulations may discourage companies to pursue climate mitigation actions since it increases the litigation risks (Amran et al., 2016).

3.2.1.2 Normative pressure

Normative systems are prescriptions of how actors should act. They are based on the perceived appropriate actions and expectations from society. These normative expectations are held by external actors, thus the actor itself experiences this as external pressures (Scott, 1995). The norms and values are impacted by professional standards, practices and networks (Daddi et al., 2019; Scott, 1995). Daddi et al. (2019) found that companies with higher perceived normative and cognitive pressure are more climate change sensitive. According to Palthe (2014), companies that experience normative pressure feel an obligation or a moral responsibility to change or behave in a certain way. Companies that are considered early movers are also more affected by peer pressure from different trade associations, compared to companies that had a more reactive approach (Delmas & Monte-Sanco, 2010).

3.2.1.3 Cognitive pressure

The third institutional pressure is cognitive pressure. Cognitive beliefs, or frames, affect how companies make sense of the surrounding environment, e.g. how information is processed and organized, and thus how evaluations, judgements and predictions are made (Scott, 1995), which can further form our understanding of reality (Hoffman, 2001). Symbols, words and gestures play an important role since they are shaping the shared concept and belief systems around how companies should act to obtain legitimacy. Further, cognitive pressure can result in mimetic behaviour, which is when organisations strive to imitate other organisational behaviour (Scott, 1995). Particularly when not sure about what strategy to use, organisations tend to imitate other successful organisations, with a belief that this would be beneficial and a safe way to proceed forward (Daddi et al., 2019). In contrast to regulatory pressure, this is more voluntary in nature. As such, regulations can be used to affect some behaviour, but they are not sufficient on their own, they should also work to encourage and result in further voluntary actions by mimicking others (Daddi et al., 2019). When beliefs and values are internalized, organisations in general, and employees in particular, can feel a sense of wanting to support certain behaviour, without any connection to regulations or norms (Palthe, 2014). Hoffman (2001) found that the choice

of climate action is both formed by an understanding of the external reality outside of the organisation as well as the culture within the organisation.

3.2.2 Resource dependency theory

External resources are important both from a tactical and strategic perspective. The resource dependency theory is often applied to explain how organisational behaviour is affected by its external resources, more specifically how companies act to reduce uncertainty and interdependence. According to resource dependency theory, companies lack the resources and abilities they need to achieve their objectives and they are therefore dependent on external resources. This implies a risk of uncertainties of unforeseen events or other contingencies in the future. These uncertainties influence sequential actions taken (Pfeffer & Salancik, 1978; Hillman et al., 2009). For example, since the interdependencies that exist between the company and its environment will affect the outcomes, companies may try to hedge uncertainties by forming partnerships with actors that possess resources that the company itself is not in direct control of (Hillman et al., 2009; Jajja et al., 2017). Pfeffer & Salancik (1978) present five options to reduce dependencies to the environment: (1) mergers/vertical integration, (2) joint ventures and other inter-organisational relationships e.g. buyer-supplier relationship, (3) size and composition of the board of directors that can help gain valuable resources to the firm (4) political actions such as trying to shape governmental regulations towards a certain favourable direction (5) replacing executive directors (Hillman et al., 2009). Resource dependency theory has been considered to have a strong future within management research studies, however, scholars are encouraged to continue to build on and add to its foundation, especially by integrating it with other theoretical perspectives which could lead to interesting new insights (Hillman et al., 2009).

3.2.3 Resource-based view

The resource-based view is a central framework in strategic management used to understand exploitation possibilities for competitive advantage, based on the firm's internal resources. Accordingly, since firms have different resources, they will implement different strategies. The framework focuses on the internal resources that are non-substitutable, inimitable, and difficult to acquire, because such resources possess the possibility of delivering superior competitive advantage and enhancing business performance (Barney, 1991). Resources can be both tangible and intangible, e.g. financial resources, technology, innovation processes, reputation, organisational learning as well as capabilities for pollution prevention (Amran et al., 2016; Aragon-Correa & Sharma, 2003). It has been empirically found that resources are particularly important when shaping business strategies as a response to climate change (Aragon-Correa & Sharma, 2003; Bansal, 2005). In addition, according to Backman et al., (2015), climate change strategies are only adopted proactively by companies if the firm-level resources can generate a sustainable competitive advantage, thus higher returns.

Hart (1995) argued for an expansion of the resource-based view, claiming that it ignores the natural constraints in the environment in which companies are operating and that activities throughout the whole value chain will impact the environment. Firms are influenced by the

limitations and constraints in their surrounding environment when they are developing new resources and knowledge. Hart (1995) highlights three main key resources that result in different competitive outcomes: continuous improvements in own production to lower costs, stakeholder integration throughout the value chain to preempt competitors, and a shared vision that is widely understood among the company which is communicated to stakeholders to reduce uncertainties and secure a future position. All three competitive outcomes are interconnected and sequential.

3.3 Synthesized theoretical framework

Based on the previous empirical research we see some patterns emerge. First, a firm's climate strategy can be classified into different categories, ranging from proactive to reactive (Jeswani et al. 2008; Kolk & Pinkse, 2005; Lee, 2012; Weinhofer & Hoffmann, 2010). In our thesis, we will use the definition by Kolk & Pinkse (2005): innovation and compensation strategies. Second, each category implies different actions taken by these firms. Proactive actions include efforts to become carbon independent (Weinhofer and Hoffmann, 2010), collaborate with actors throughout the value chain (Kolk & Pinkse, 2005) and engage in both internal and external activities (Jeswani et al., 2008). In contrast, compensatory strategies include actions that remain in the existing technological knowledge base of the firm (Kolk & Pinkse, 2005), emission-reducing activities (Weinhofer & Hoffman, 2010) or little/no use of internal and external activities (Jeswani et al., 2008). This previous research can help us understand what the climate strategies of high emitting companies in Sweden are.

The intended outcome of analysing climate strategies from an institutional, resource dependency and resource-based perspective, is to provide a more nuanced understanding of *why* different strategies are formed and thus why CCS is, or is not, prioritized. The resource dependency theory and the resource-based view are valuable complements to the institutional theory since the latter focuses on homogenous influences, while companies are also faced with heterogeneous influences, which can cause variation in business strategies. Although companies would want to act in similar ways as others, they might be constrained by their resources. Thus, to understand climate strategies, the resource dependency theory and the resource-based view provides a valuable complement by emphasizing external and internal differences between companies within the same institutional setting (e.g. Amran et al., 2016; Cavalcanti Sa de Abreu et al., 2017). For instance, the institutional environment could impact the external uncertainty and dependencies to resources by regulation or other institutional pressures (Amran et al., 2016; Daddi et al., 2019; Lee, 2012). Cavalcanti et al., (2017) used a combination of resource dependency theory and institutional theory to explain how carbon management practices are affected by climate change risks, that is, dependency on nature (resource dependency theory) and to explain how stakeholders influence a firm's actions and climate responses (institutional theory). Bansal (2005) found that both institutional and resource-based factors influence corporate sustainable development. Finally, resource dependency theory and the resource-based view are valuable complements to each other. Comparing these two theoretical frameworks may provide explanation and insights into an organisation's strategy, i.e. how they assess key resources needed and how they act to obtain

these. It may give insights into how these resources create competitive advantage, and how the organisation then takes sequential actions towards the external environment because of these critical resources. In fact, sustainable initiatives would most likely not be possible without sufficient resources (Hillman, 2009).

When combining these theoretical perspectives with empirical findings, we seek to provide interesting insights to how and why the actors plan and prioritize for the future. By understanding drivers and barriers behind climate strategies we can explore the future for CCS. See Figure 3 for an illustration. To our knowledge, no study has analysed CCS actors in an integrated manner (combining perspectives from actors with both biogenic and fossil CO_2 emissions) or from a bottom-up perspective. Furthermore, limited research has examined the climate strategies of high emitting companies within the geographical context of Sweden, from the theoretical perspectives; institutional theory, resource-based view, and resource dependency theory. Thus, the theoretical framework will help us answer our research questions:

- *"What are the climate strategies of high emitting companies?"*
  - *"Why/why not are some companies prioritising CCS?"*

And then finally the focus question: *"How will the future for CCS in Sweden unfold?"*

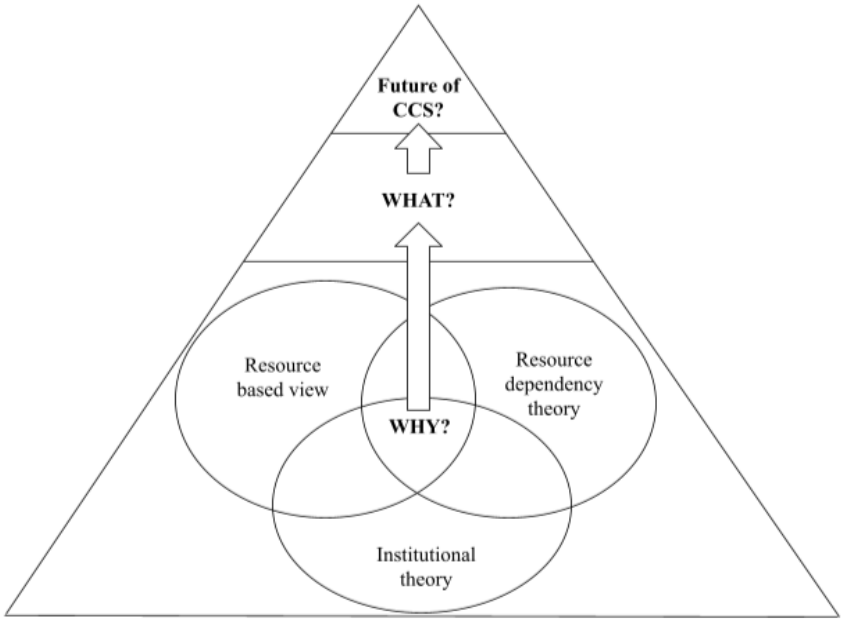

Figure 3: An illustration of the overall theoretical framework and its application to the research questions in this thesis.

4. Methodology

In the following chapter, we describe the process of writing this thesis. First, we present the arguments for choosing a qualitative approach to investigate the future for CCS (4.1). Second, we describe our research approach (4.2). Third, we elaborate on how data was collected (4.3) and analysed (4.4). Finally, we argue for the data quality (4.5).

4.1 Methodological fit

This research has an exploratory purpose that seeks to explore what is going on around a phenomenon and assess it to gain new insights (Saunders et al., 2009). Our research questions aim at exploring the future for CCS in Sweden by examining climate strategies and understanding why these are formed. We consider a qualitative study based on semi-structured interviews to be the most appropriate way to collect data that can explain our research questions due to three main reasons: First, our research questions are open-ended questions about a particular and complex phenomenon, which should be studied with a qualitative method (Edmondson & McManus, 2007). Second, the companies' climate strategies could vary greatly, thus the chosen research approach should allow for flexibility and further exploration when needed to interpret meaning and identify patterns about the phenomenon (Edmondson & McManus, 2007). Third, previous studies in the field of CCS have also taken a qualitative approach with semi-structured interviews and urge for increased qualitative studies in the area (Braunreiter & Bennet, 2017; Rodriguez et al., 2021). As semi-structured interviews leave room for flexibility in terms of questions asked by the researchers and allow respondents to speak freely to capture their perspectives (Kallio et al., 2016), this was considered a suitable data-collection method.

Qualitative approaches come with some limitations, for instance, it can sometimes be difficult to create generalizable insights based on the data derived. However, this is not always the aim, as qualitative research aims to go deep and distil the complexities around a phenomenon. It can nevertheless provide insights that are useful in other samples than the one examined (Denny & Weckesser, 2018). Our qualitative study aims to go deep into the reasoning and prioritizations of climate strategies in our sample but can still provide insights that are useful for understanding other companies' climate strategies. We agree with researchers such as Chamberlain (2006), who argue that qualitative studies are more suitable in the field of understanding reasoning for business strategies.

4.2 Research approach

The thesis applied a qualitative abductive approach that allowed for a constant back and forth between theory, empirical findings, and analysis to reflect, re-assess and adjust assumptions and theories (see Figure 4 for process illustration). This allowed us to investigate the truly important issues of the phenomenon throughout the research process, in contrast to seeking a justification for a theory as in deductive studies, which could introduce bias to the conducted research (Chamberlain, 2006). The purpose of this thesis was not to test the existing theory, but rather to use it to understand the development of different climate strategies and why climate

strategies are formed, therefore an abductive approach was most suitable. In addition, abductive studies are especially suitable in research about business strategy formation, as the research field lacks commonly applied frameworks and construct definitions (Chamberlain, 2006).

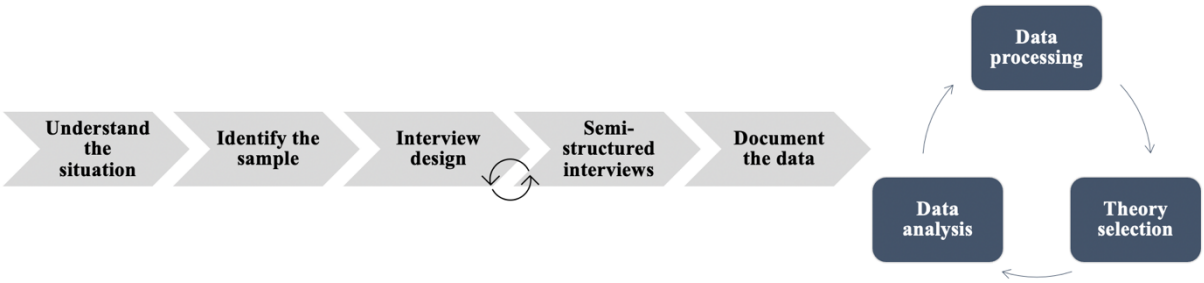

Figure 4: Visual description of the research process.

4.2.1 Considerations

This thesis was written in collaboration with Siemens Digital Industries. The overarching research field of CCS was solicited by Siemens, however, all subsequential decisions have been made by us, the authors, including the identified research gap, the research questions and the method and methodological approach.

4.3 Data collection

Empirical data for this qualitative study has been collected by semi-structured interviews in the process described below.

4.3.1 Understanding the problem

We, the authors, have a background in business and economics and were investigating a phenomenon mostly studied by engineers. To be able to fulfil the purpose, it was important that we first understood the technology and its potential implications better. To do so, a small preparatory study was conducted. First, by reading articles, reports, and research papers about CCS. Second, two interviews were conducted with two leading Swedish research scholars within the field. This enabled a better understanding of the phenomenon. Finally, one interview was conducted with a representative from the Swedish Environmental Protection Agency (Naturvårdsverket), to better understand Sweden's climate policy and the EU regulations. The preparatory study also ensured that our questions and topics in the interview guide (see more in section 4.3.3) would be accurate and relevant.

4.3.2 Identifying the sample of high emitters

To identify the largest point sources of CO_2 emissions in Sweden, the Swedish Environmental Protection Agency's database was used. Following Rodriguez et al. (2021) and sorting out the point sources with CO_2 emissions (both fossil and biogenic) exceeding 100 kton/year, 90 facilities operated by 54 companies were identified. Following Jeswani et al. (2008), we did not only look at one sector, rather, companies from a variety of sectors were selected (industry, energy & heat, and waste sectors).

The 54 companies were contacted by email or phone where they were asked to participate in an interview to discuss their climate strategies in general and their thoughts on CCS. Of the 54 contacted companies, 22 participated in an interview (one via email). See a list of participating companies in Table 1. Later in our empirical result, we have anonymized the actors and given them code names related to their source of emissions. B1-B12 for companies with large point sources of biogenic emissions, F&B1-F&B5 for companies with large point sources of both fossil and biogenic emissions, and F1-F5 for companies with large fossil emissions. The numbers are not in alphabetical order but randomized to guarantee anonymity for the companies.

To reach a sufficient amount of data, a sufficient number of respondents should be interviewed. Our intention with the interview sample was to conduct interviews until we reached saturation. This can be defined as the point where incoming data from interviews provide limited or no new useful information to the purpose of the study (Greg et al., 2020). When 22 interviews had been conducted, we considered that point to be reached. The final two interviews primarily confirmed what previous respondents had already said and no new codes could be derived. Therefore, we made no effort to reach out again to the companies that had not replied the first time, which would have been necessary and possible otherwise. However, we acknowledge that the saturation point can be difficult to determine, and often requires judgment and experience by the researcher. In this thesis, the 22 companies interviewed represent ~41% of the total population, which we considered a relatively large proportion.

Company	Sector	Emission source	Date	Length
Anonymous	Pulp & Paper	*CO2 bio >500 ktons*	2021-10-20	40 min
Anonymous	Energy	*CO2 bio >100 ktons, <500 ktons*	2021-10-06	e-mail
Boliden	Metal production and treatment	*CO2 fossil >100 ktons, <500 ktons*	2021-10-05	45 min
Bomhus Energi	Energy	*CO2 bio >100 ktons, <500 ktons*	2021-10-15	60 min
E.ON	Energy	*CO2 fossil >100 ktons, <500 ktons & CO2 bio >100 ktons, <500 ktons*	2021-10-06	60 min
Falu Energi och vatten	Energy	*CO2 bio >100 ktons, <500 ktons*	2021-10-11	40 min
Göteborg Energi	Energy	*CO2 bio >100 ktons, <500 ktons*	2021-10-04	20 min
Jämtkraft	Energy	*CO2 bio >100 ktons, <500 ktons*	2021-10-12	30 min
Karlstads Energi	Energy	*CO2 bio >100 ktons, <500 ktons*	2021-10-05	40 min
Lidköping Energi	Waste	*CO2 bio >100 ktons, <500 ktons*	2021-10-12	35 min
Mälarenergi	Energy	*CO2 fossil >100 ktons, <500 ktons & CO2 bio >500 ktons*	2021-10-05	50 min
Mölndal Energi	Energy	*CO2 bio >100 ktons, <500 ktons*	2021-10-05	30 min
Nordic Paper	Pulp & Paper	*CO2 bio >500 ktons*	2021-11-13	50 min
Nordkalk	Mineral	*CO2 fossil >100 ktons, <500 ktons*	2021-10-22	60 min
Outokumpu Stainless	Metal production and treatment	*CO2 fossil >100 ktons, <500 ktons*	2021-09-27	45 min
Preem	Refinery	*CO2 fossil >500 ktons*	2021-10-08	60 min
Renova	Waste	*CO2 fossil >100 ktons, <500 ktons & CO2 bio >100 ktons, <500 ktons*	2021-10-20	40 min
Stl	Refinery	*CO2 fossil >500 ktons*	2021-10-18	50 min
Stockholm Exergi	Energy	*CO2 fossil >100 ktons, <500 ktons & CO2 bio >500 ktons*	2021-10-11	60 min
Stora Enso	Pulp & Paper	*CO2 bio >500 ktons*	2021-10-06	40 min
Tekniska Verken	Waste	*CO2 fossil >100 ktons, <500 ktons & CO2 bio >100 ktons, <500 ktons*	2021-10-07	45 min
Vattenfall Heat	Energy	*CO2 bio >100 ktons, <500 ktons*	2021-10-04	50 min

Table 1. The participating companies in the study. 12 companies with large biogenic emissions, five companies with both large biogenic and large fossil emissions and five companies with large fossil emissions.

4.3.3 Interview design

Before the interviews, we created an interview guide to be used during the interviews (see Appendix B for a detailed view) to set focus on the interview topics and act as guidance, rather than strict manuscript (Gill et al., 2008). This allowed for flexibility and elaboration on areas that were not previously known or thought of by the researchers. The interview guide consisted of three main themes: climate strategies, Sweden's climate targets and technologies to reach climate goals (CCS specifically). Questions that were deemed easier were asked first, such as a description of their role at the company. This initial question was used to open a discussion and to get to know the interviewee better. Questions requiring more reflection were asked later in the interview (Adams, 2015). The first theme in the interview guide concerned the company and their climate strategy. Here we wanted to get a clearer understanding of how the company had developed their strategies and what its focus areas were. Also, check if the strategy had changed over time and what the main drivers were behind the strategy. Then, the questions focused more on a second theme, i.e. how they viewed their responsibility to contribute to Sweden's climate goals. The last theme included questions aimed at discussing the company's perceptions and/or experience of CCS. However, throughout the interviews, the sequence of questions and the follow-up questions varied depending on the respondents' answers, to make sure that the conversation would feel natural so that the respondent would feel comfortable. Furthermore, the interview guide was refined after conducting the first interviews, and questions were added or re-ordered if necessary (Adams, 2015).

4.3.4 Conducting the semi-structured interviews

The semi-structured interviews were performed either in person or virtually via the application *Microsoft Teams* during October and November 2021. The interviews ranged from 30-60 minutes, the average lasting 45 minutes. The time limit was set to one hour to decrease the risk of fatigue (Adams, 2015). Furthermore, the respondents were ensured that their participation would remain anonymous, to ensure as truthful answers as possible. Interviews were recorded (if accepted by the respondent) to make sure that no valuable information would be missed and to allow for more engagement in the conversation (Adams, 2015). Since all participants were fluent in Swedish, and to avoid miscommunication as well as make participants more comfortable to speak freely, the interviews and transcriptions were conducted in Swedish. Quotations used in the following chapters have been translated to English by us, the researchers.

Representatives from the companies ranged from e.g. CEO, Sustainability manager, Energy manager or Strategist. All interviews were held with both researchers and one representative from the company (five interviews included more than one representative). The participation of only one representative from a company might have impacted the outcome of the analysis as questions could have been answered based on their personal opinion rather than grounded in the organisational strategic standpoint. Further, one representative with knowledge in one area (e.g. climate strategy), might not be the same person that is in charge of the technical projects. Thus, risking that the interview would not provide the whole picture of the company's view. However, as we clarified the questions of interest prior to scheduling interviews, the respondents that were not experts in one of the areas of interest made sure to bring a colleague

to the interview with that competence, alternatively discuss the questions with a colleague prior to the interview. Further, the respondents made it clear during their interviews by separating what was the opinion of the company, and what was their personal opinions.

4.3.5 Documenting the data

Throughout the interview period, the researchers took turns in responsibility. One being responsible for leading the discussion, and the other being responsible for note-taking. Transcription of the interview was manually performed by the person taking notes. This was performed within 24 hours after the interview.

4.4 Data processing and analysis

For open-ended questions such as the research questions in this study, the goal of data analysis is to break down rich data and identify patterns. A suitable data processing method is a thematic content analysis by coding the data (Edmondson & McManus, 2007). Thematic analysis is useful for understanding different perspectives and finding similarities and differences among them. Furthermore, it offers an approach that makes a large set of data manageable due to its clear structure (Braun & Clarke, 2006). The data processing was conducted in different stages using the qualitative analysis software tool *Nvivo*.

In the first stage, we individually went through the material line-by-line and thematically coded all the data to label the most interesting parts in the data (Braun & Clarke, 2006). After each transcript, we subsequently discussed codes to find agreements on the most suitable codes for the data. This procedure was inductive, as this stage did not include theory to categorize the codes. It was rather a bottom-up approach with the empirical data as a starting point. This first stage ended with discussions on which data to look further into in the next stage, where an agreement was made that if a code was not used more than three times, it should not be included in stage two. This was to ensure that the most relevant codes were the basis of analysis.

The second step included finding a suitable theoretical framework that could be used to explain the insights derived from the empirical data. At this stage, institutional theory, resource dependency theory and resource-based views were identified. The third step included taking a step back and looking at the data from a top-down perspective in order to identify patterns across the data and organising it into wider themes (Braun & Clarke, 2006). Thus, this process was more deductive by trying to pair themes with previously derived codes from the empirical data. The reason was our aim to explain climate strategies based on theoretical concepts. However, at this stage, we noticed that the codes from the previous stage were not exclusive nor exhaustive. To avoid this issue, we went through the transcripts again and re-coded the data, which resulted in 35 codes (see Figures 6,7 & 8). This allowed us to better pair it with the 16 themes derived from theory. A data example with code, theme and perspective is shown in Figure 5. Finally, the themes and codes could be analysed. See a detailed overview of our coding in Appendix C.

It should be noticed that the process above is explained to create a better understanding of how data processing and analysis was conducted. However, it gives a rather simplified picture of the process. In reality, the process was more iterative and included a lot of back and forth between raw data, codes and themes. For example, transcripts were re-read several times to ensure that respondents' interpretations and quotations were correct.

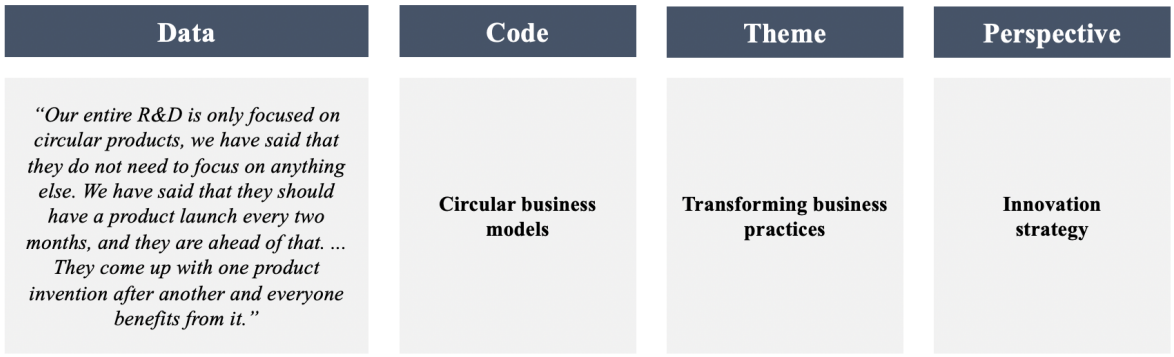

Figure 5: *Example of the data analysis process.*

4.5 Quality of study

The quality and rigour of this qualitative study are discussed in terms of reliability and validity.

4.5.1 Reliability

Reliability of the data in this study concerns to what degree errors might occur, and whether other researchers would have come to the same result (Gibbert & Ruigrok, 2010). This is also referred to as dependability (Klenke et al., 2016). Although it is hard for research to take place without any underlying assumptions, we have adopted several precautions to increase the reliability while collecting and documenting the data. First, reliability was assured as both researchers were present in all interviews and that all interviews (except one interview) were recorded. Second, all data were first transcribed word by word, and then processed by both researchers separately line by line multiple times, to ensure that no data was overlooked or missed. Third, all codes were discussed between both researchers to reach a consensus on the most suitable codes for the data.

4.5.2 Validity

To assure that conclusions in this study are rigorous, the internal validity of this study was considered important (Gibbert & Ruigrok, 2010). This is also referred to as credibility (Klenke et al., 2016). First, all cases were analysed equally, meaning that although several companies had not looked at CCS technologies, their answers were as thoroughly analysed as answers of companies that had looked at CCS technologies. Thus, the results and analysis of this study aim to avoid "anecdotalism" (Silverman, 2017) by including negative sampling (Klenke et al., 2016), meaning that the results are not only based on a few chosen examples picked by the researchers. This is important to provide a comprehensive understanding of under which scenarios or circumstances companies choose or choose not to invest in CCS technologies. Further, by using several theories, the data is looked upon from different theoretical

perspectives. This is referred to as “theory triangulation”, i.e. to interpret the findings from different angles (Gibbert & Ruigrok, 2010).

External validity refers to the extent to which the findings in this study are generalizable, or specifically, analytical generalizability between the process from empirical data to theory (Gibbert & Ruigrok, 2010). This is also referred to as transferability (Klenke et al. 2016). The above sections have specified the rationale behind how we have identified the companies and how the study was conducted. For example, by specifying details of the sampled companies and how the data was collected, including what positions at the company we talked to and the length of the interview for each company. This provides a basis for future research.

5. Empirical results

In this chapter, empirical data from the 22 conducted interviews are presented. The chapter follows a structure based on the two research questions in the thesis by first presenting the identified themes and codes related to descriptive explanations of the companies' climate strategies (5.1), second, the themes and codes related to drivers for climate activities (5.2) and third, themes and codes related to barriers for climate activities (5.3).

5.1 Formulation of climate strategies

The following section presents empirical findings of high emitting companies' climate strategies and mitigation efforts. The section is divided into the two identified perspectives: Compensation strategy (5.1.1) and Innovation strategy (5.1.2). See Figure 6 for an illustration.

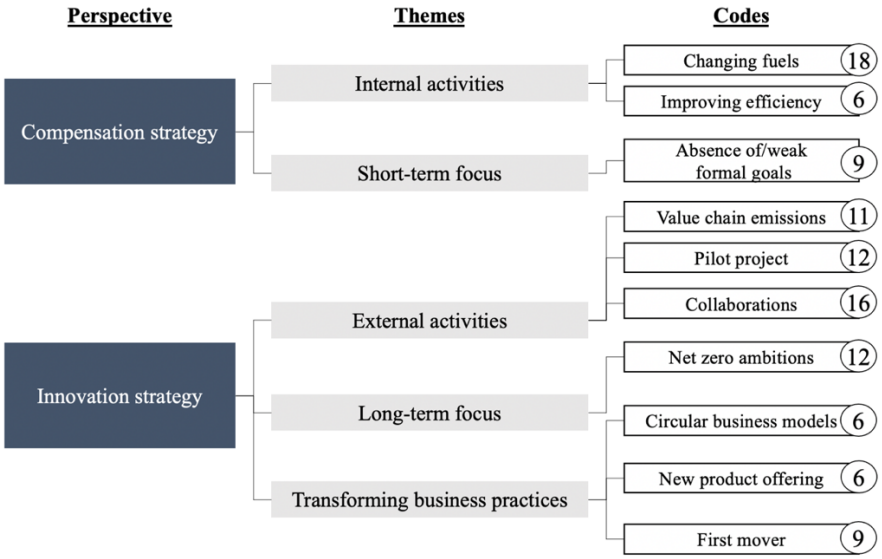

Figure 6: Perspectives, themes, and codes for climate strategies. The numbers to the right represent number of respondents for each code.

5.1.1 Compensation strategy

The empirical findings of climate actions showed that companies primarily focused on *internal activities*, which includes mitigation efforts to reduce carbon dioxide emissions primarily in scope 1, i.e. in-house improvements. This was apparent in the discussion with all companies, regardless of emission source and industry. As an example, *changing fuels* from fossil to biogenic sources was mentioned by 18 companies. For some companies, this had resulted in a new investment or rebuilding of current boilers into bio-boilers (B6, B9). Another activity that several companies had focused on was *improving efficiency* in their processes to decrease energy consumption or resource usage (B5, B7, B10, B12, F5, F&B4).

"*When looking back, we have invested in boilers for fossil-free fuels, and we are planning on facing out the last parts by incorporating fossil-free fluid fuels, such as biofuel, biodiesel.*" (B6)

In terms of climate goals, mainly companies with biogenic emissions indicated an *absence of or weak formal goals*. For example, six companies had no established formal climate goals (B2,

B3, B7, B11, F1, F3), and a few companies had formal goals but with a short-term focus on reductions (B1, B6, B10).

"We have some climate goals connected to the strategic plans, but they are not quantifiable, they are rather pursuable ambitions." (B3)

5.1.2 Innovation strategy

In contrast to a compensation strategy, some companies expressed that they worked with additional measures in their climate strategies, thus combining *internal activities* with *external activities*. External activities were more focused on *value chain emissions*, by demanding suppliers to decrease their emissions (B1, B4, B10) or enabling emission reductions to their customers downstream the value chain (B8, B12, F1, F2, F&B1, F&B2, F&B3, F&B4). Further, 12 companies, mainly with fossil only or a combination of fossil and biogenic emissions, mentioned that they were testing climate technologies in pilot projects. The majority of these projects involved CCS (B5, B8, F1, F2, F4, F&B1, F&B2, F&B3, F&B4, F&B5). However, some companies were looking at different technologies in parallel, such as CCU or hydrogen (B4, B9, F1, F5, F&B3, F&B5). Several companies mentioned that the future for the CCS pilot projects is still uncertain, but they still believe that they will have CCS facilities running in 2025 (F&B2), 2030 (B8, B9, F4, F&B3, F&B4) or some years after 2030 (B5, F2).

"*I think that by 2030 we will have a CCS facility, but that's because I want to believe it. This is what we need to do according to basically all scenarios by the IPCC, in order for us to reach 1.5 if even 2 °C, we need to have CCS*." (F&B4)

Other external activities that 16 companies mentioned, regardless of emissions source, were *collaborations* with external actors and to share knowledge about climate activities and information in industry unions or other initiatives.

"We need more initiatives, we believe that solutions will require collaborations. We have a continuous dialogue with actors that we want to cooperate with." (B12)

Some companies were working beyond their existing business model with activities that would *transform their business practices*, by developing *circular business models* (F2, F4, F&B1, F&B3, F&B4, F&B5) or developing a completely *new product offering*, e.g. fossil-free versions of their core product (F1, F2, F5) or offering a negative emission certificate (B8, F&B2). One company showed the combination of a new product offering in a circular business model (F4):

"Our entire R&D is only focused on circular products, we have said that they do not need to focus on anything else. We have said that they should have a product launch every two months, and they are ahead of that/.../They come up with one product invention after another and everyone benefits from it." (F4)

Nine companies mentioned climate activities as a *first-mover strategy*. Some companies have a history of pioneering new technologies and innovations (B1, B3, B4) and some companies are even more predominant in today's setting and are actively driving the transformation towards net zero. For example, being first in order to inspire others (F4), or not being limited by what is currently available, rather creating the pieces missing themselves, e.g. a market for negative emissions (B10, F1). One company mentioned a strong wish to be at the forefront of the sector (F&B2).

"A lot of people might say that there is no market for negative emissions, well, then you might have to create it yourself. That's not a relevant objection for CCS." (B10)

In terms of climate goals, companies with an innovation strategy had a more long-term focus. Several respondents, regardless of industry and emission source, had *net zero ambitions* (B4, B12, F2, F4, F5, F&B1, F&B5) while others had climate positive ambitions (B8, F&B2). For companies with biogenic emissions, some plan to reach their targets by continuously phasing in biofuels and using renewable energy (B4, B9, B12). For actors with fossil emissions stemming from either their raw material or from waste combustion, reaching net zero is impossible without CCS (F&B1, F&B3, F&B4, F&B5).

5.2 Drivers for choosing climate strategy

The following section presents empirical findings for factors driving high emitting companies' climate strategies. The section is divided into the six identified themes: Competitive advantage (5.2.1), External resources as a driver (5.2.2), Internal resources as a driver (5.2.3), Regulative pressure as a driver (5.2.4), Normative pressure as a driver (5.2.4) and Cognitive pressure as a driver (5.2.5). See Figure 7 for an illustration.

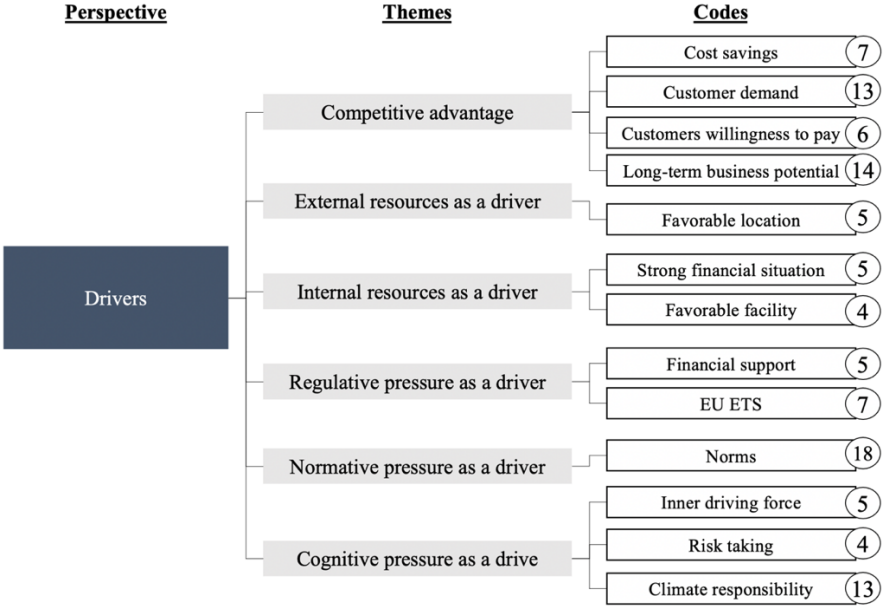

Figure 7: Themes and codes under the perspective "drivers". The numbers to the right represent number of respondents for each code.

5.2.1 Competitive advantage

Competitive advantage was considered a driver by several companies to implement climate activities. One important factor, mentioned by mainly biogenic actors, was *cost savings*. For instance, switching from fossil oil to biofuels were primarily driven by the lower costs that it entailed (B7, B10, B11, F3, F&B4). For some companies, being more resource-efficient also came down to cost savings (B5), or simply that the main reason for being sustainable is that it is cheaper in the long run (B9). A second driver for competitive advantage was *customer demand*. The companies mentioned that the customer demand for low carbon products is increasing (B3, B4, B5, B8 F&B1, F&B4), and many companies are facing increased pressure from customers and their end-consumers to disclose the product's carbon emissions and work continuously to lower them (B1, B11, F3, F&B5). Being responsive to customer demands and offering low carbon dioxide products can create a competitive advantage and an attractive offering (B5, B11, F5, F&B2). One company clearly stated that customers are their most important driver, and in order to serve customers they have to continuously improve their climate performance (F4). Some companies felt the increased demand especially from larger and international companies (F&B1, F&B2).

"There is a lot of pressure from customers. For each product you should present your carbon footprint - it becomes a competitive advantage." (B11)

Furthermore, a third competitive advantage mentioned by six companies was the perception that customers to some extent were *willing to pay* for net zero or climate positive products. Companies described that they have observed differences among their customers, where some are willing to pay or have paid extra for climate-friendly services already (B4, F5, F&B2), while others are not willing to pay extra (B4, F3). One company believed that customers probably would accept the necessary increase in price that climate action entails (F4). There were mixed considerations of how much extra customers were willing to pay. One company stated that customers might be willing to pay some sort of premium, but it cannot be too large (B5), while another stated that customers can be willing to pay a lot (F&B2).

"Customers can be willing to pay as much as it takes for negative emissions and to achieve a 'wow'-factor, that would be to zero all historical emissions." (F&B2)

Climate activities as a *long-term business potential* were also considered a competitive advantage, as 14 companies with both fossil and biogenic emissions mentioned sustainable business models as crucial in order to secure a position in the future market. Climate change creates opportunities for businesses that can provide cost-efficient and renewable energy (B12), and it also drives customers' expectations, which is a key aspect to stay relevant in the future (B1, B10, F1, F2, F4, F5). However, some companies sensed the potential but were more uncertain what to focus on in the future (F&B5). If the right conditions were in place, eight companies saw a future business potential for CCS, both for fossil and biogenic emissions. Two companies mentioned that CCS on fossil emissions is the only option for them to remove emissions by 100%. This affected their climate actions since they believed that their current

fossil emissions would limit their business potential in the future (F&B3, F&B4). CCS on biogenic emissions was primarily driven by the potential opportunities that negative emissions imply, e.g. profitability in terms of selling negative emissions (B5, B8, B10, F&B1, F&B2).

"It is very important to keep up with expectations and to stay relevant, things can change quickly. We must constantly look at what is required to stay relevant to our customers and society." (B1)

5.2.2 External resources as a driver

Another driver mentioned by the companies was connected to *external resources* associated with a climate activity, primarily connected to the *favourable location* of the facility. For one company, their location enabled them to access cheap energy, which was considered favourable for producing synthetic fuels (B4). For another company, it influenced the decision of what climate activity to focus on, as their location enabled them to become more resource-efficient and build networks with other actors nearby the facility (B5). For the other companies, their location influenced the potential they saw in implementing CCS. These companies mentioned that they were located close to the harbour which made it more cost-efficient in the transporting phase (B8, F&B2, F&B4).

"*We are located right by the harbour, which is advantageous when it comes to CCS*." (F&B2)

5.2.3 Internal resources as a driver

Factors connected to the *internal resources* of the company were also considered as drivers for choosing climate strategies. First, five companies mentioned their own *financial situation* as a driver to investigate new climate activities. For example, having a budget that includes investing in, and testing new technologies (B8, F&B2, F&B4), or by continuing with their current business to get financial strength to invest in climate-friendly solutions (F1, F2).

"*In order to be able to invest in the solutions of the future, a cash flow is required, we get this through our current operations*." (F1)

Four companies mentioned that they had a *favourable facility,* which was considered an important condition when choosing a climate activity. For instance, the facility could be more or less easy to adjust, e.g. changing fuel to decrease emissions (F5). Another company mentioned that they were looking at climate activities that fit their modern and energy-efficient facility (B7). Similarly, two companies mentioned that their choice of looking further into CCS was influenced by the fact that the technology fitted their facility well and that they could integrate energy systems with CCS to make it more energy-efficient (B8, F&B2).

"*But by applying CCS technology to our operations/... /we can have significantly better energy integration, which makes the whole process efficient at the same time as it reduces the cost compared to other applications*." (B8)

5.2.4 Regulative pressure as a driver

Regulations were mentioned by several actors as a driver of their past and current climate strategies. Five companies mentioned that *financial support* had been a driver for them to invest in climate activities. One company mentioned that the state aid had pushed them to invest in renewable energy (B4). Three companies mentioned that it was cheaper for them to seek finance for green investments, especially due to the release of the EU Taxonomy (F2, F&B1, F&B5). One company said that they investigated CCS due to the development of state aid for the technology (B8).

"*It is easier today to get access to better financing if you have a green business operation with high sustainability credentials*." (F2)

Further, seven companies mentioned the *EU ETS* as a driver for implementing sustainability activities and lowering their fossil CO_2 emissions (B3, B4, B9, F3, F4, F5, F&B1). One company even mentioned that the EU ETS was the starting point when they invested in CO_2 reducing activities (B9). All seven companies emphasised that their belief in the rising prices of EU ETS was a huge driver for lowering their emissions, which was also driving their willingness to investigate CCS. They expected that the price of capturing would decrease at the same time as the price of emission allowances would increase.

"*And today it is said at pilot plants like this, it perhaps costs €110-120 per ton of carbon dioxide captured. But with more volume, you should be able to get to €70-80. We have said that if we come down to €80, then we invest. We really believe that the price of carbon dioxide will go up to 80 as well.*" (F4)

"*The biggest drivers are prices. It is the emissions trading that makes it possible to invest.*" (F5)

5.2.5 Normative pressure as a driver

Discussions about positive attitudes towards a certain climate action or increased pressure from various stakeholders resulted in *norms* as a driver for climate strategy. Historically, companies had taken specific actions based on the prevailing norms at the time. 18 companies mentioned one or several of these aspects as present today, and indicated that it would have an impact on their actions in the future. Several companies mentioned the intensification of the general climate discussion (B1, B5, B7, B9, B12, F&B1, F&B3) as well as the increased pressure and expectations from society (B1, B11, F1, F3, F4, F&B1, F&B5) and other stakeholders, e.g. owners (B8, F2), employees (F2, F&B1, F&B5) or media (F5). The discussion about biogenic emissions is also gaining more critical attention (B7). Furthermore, climate actions in general were perceived to contribute to a positive image amongst customers (B3, B4, B5, F4). One company claimed that climate-neutral products are becoming more and more of a hygiene factor (F&B4), which was supported by another actor, saying that society is no longer accepting that companies take no responsibility, and that this drives their actions (F4).

"The outside world does not accept that we have CO_2 in our product and 'do nothing'. It must be dealt with. There is a huge acceleration in that discussion. From our side, we have gone from being worried to being creative and seeing solutions." (F4)

In terms of CCS, acceptance from the local community before proceeding with a CCS-facility was important (F&B4) and could be used as a great carrier of an important message if communicated well (F2, B12). The image of CCS has both improved and has been considered more achievable recently (B1, B8, F1, F&B3). Some companies mentioned preconceptions about CCS, for example, the objection that CCS could be used as a way to continue emitting greenhouse gases. However, these companies also stated that this was not their intention with CCS (F1, F2, F&B5).

5.2.6 Cognitive pressure as a driver

Cognitive pressure was mentioned as driving the company's climate strategy in different ways. First, six companies had a strong *inner driving force*. Four companies mentioned their employees as an important contributor to this (B11, F2, F4, F&B1). For instance, both a strong awareness among employees and the management team, but also a wish to feel good about contributing to society (B11, F2). Others mentioned making employees proud by managing to become fossil-free (F4), or by always working continuously to become even greener (F&B1). By prioritizing climate action, it also attracted new employees and competence (F&B1, F&B2). Furthermore, one company mentioned their strong intention of doing the right thing and providing benefits for society (F&B2). One company explicitly mentioned a strong self-drive to keep down the usage of fossil fuel (B11).

"There is a strong drive from those who see it as a competition against themselves to keep the oil down/.../there is a feeling of wanting to stop using oil." (B11)

Second, four companies indicated *risk-taking* characteristics since they were investing large amount of money in CCS projects even though stakes were still uncertain (B8, F&B1, F&B2, F&B4). For example, one company had already invested billions of SEK in a virgin market without a clear business model in mind or a formal decision in place (F&B2).

"We take a risk. It's a virgin market. In ordinary cases, you build something and can calculate the direct income. Now we are building something that will cost even more money once we implement it, and we hope to get money from a market that does not yet exist. We are talking billions here. So, it's a brave move." (F&B2)

Third, companies mentioned their own *climate responsibility*, which reflected how the firms looked upon their own responsibility and role to play in the climate transition. The data showed nine companies having a significant role, that is, they believed they had a large and/or driving role to play (B8, B12, F1, F2, F3, F&B1, F&B2, F&B4, F&B5).

"As a company, we have a great responsibility/... /And we have a great awareness of this and we want to do something positive, to take responsibility, to make sure to help and contribute with our role to the change. Which we are obliged to do, but also actually want to do." (F&B5)

Ten companies looked upon themselves as having a supportive role, that is, being an important player for others' transformation towards becoming net zero. For example, producing a net zero product that other companies in various industries can use (F1, F2, F4, F5, B3), or by applying CCS on biogenic emissions to create a carbon sink that can help others reach zero emissions (B8, F&B2, F&B4). Five companies perceived themselves as both significant and supportive to others (B8, F1, F2, F&B5, F&B2).

5.3 Barriers for choosing climate strategy

The following section presents empirical findings of factors acting as barriers for high emitting companies' climate strategies. The section is divided into the four identified themes: External resources as a barrier (5.3.1), Internal resources as a barrier (5.3.2), Regulative pressure as a barrier (5.3.3), and Cognitive pressure as a barrier (5.3.4), see a detailed breakdown in Figure 8.

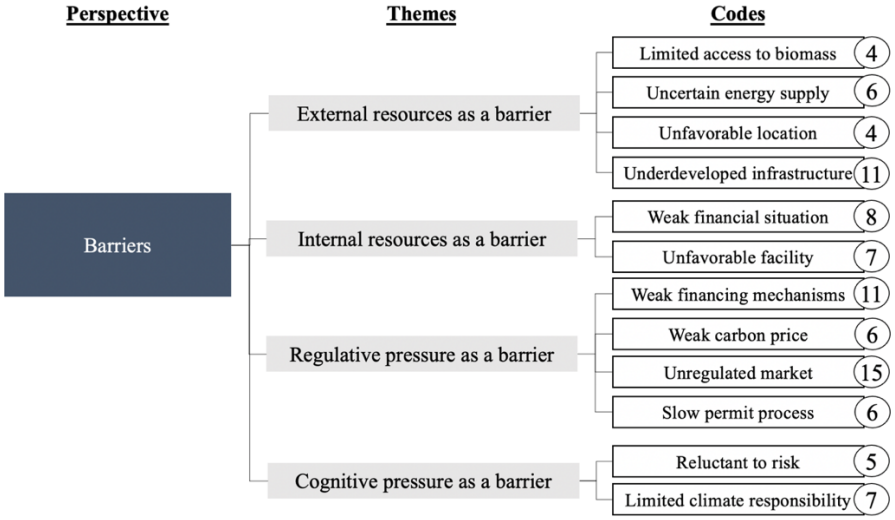

Figure 8: Themes and codes under the perspective "barriers". The numbers to the right represent number of respondents for each code.

5.3.1 External resources as a barrier

Some companies considered their *external resources* to be barriers to implementing certain activities in their climate strategies and investment decisions for CCS. For example, the *limited access to biomass* constrained companies in the investment decisions for new types of fuel (B6, B9, B12, F3), or some companies felt constrained by the *energy supply* and described it as 'uncertain'. The respondents mentioned that most climate solutions are energy-intensive, and when the whole country is transitioning, access to electricity becomes a problem (B5, B9, F2, F3, F5). The transition to renewable energy has thus created higher uncertainty in supply, and affected the price, making future plans more difficult to predict (B7, F3). This was also the case

for CCS, as it was described as an energy-consuming technology, which had affected the decisions to invest in CCS.

"*CCS requires a lot of energy, perhaps we can do the same climate benefit from making other actions instead. CCS is dependent on the price of electricity, which is very uncertain now.*" (B9)

Four companies mentioned their *unfavourable location* and described how this constrained them in implementing CCS. As the facilities were located too far away from a harbour, the overall costs of CCS would be more expensive (B3, B4, B10, F&B1). Another external factor that raised concern among several of the companies was the *underdeveloped infrastructure*. For example, eight companies mentioned the storage part of the infrastructure to be the main uncertainty (B8, B12, F3, F4, F5, F&B2, F&B3, F&B5) and five companies mentioned the transportation of carbon as their main concern (F2, F&B2, F&B3, F&B4).

"*..the most difficult part is the logistics chain. If we say like this, we have one boat with fuel in, then there should be 3-4 boats with CO_2 out/.../It's the difficult part. Because this logistics chain does not exist. There are many actors that have to be involved.*" (F&B4)

"*There are still long transport routes/.../ And then we have the disadvantage that we have to transport it on the train, then it becomes an extra step to first load up on the train and then to the port. There are many others who can just pump it out directly in the ship/.../We will not be able to be competitive at all.*" (B4)

5.3.2 Internal resources as a barrier

In addition to external barriers, several companies also described *internal resources* as a barrier to their climate strategy. For example, eight companies, primarily with biogenic emissions, described their *financial situation* as one of the main barriers for not investing in climate actions (B2, B3, B4, B6, B7, B10, B11, F&B3), despite having a technology in mind (B2, B3, B4, B6). One company described that they cannot justify investments in CCS or other climate actions, as they would not get a budget for such an investment (B11), or that the investments they have made to operate the current facility have been capital intensive, and that they only have room to make smaller investments in climate actions (B7, B10). Other companies described how their current payments to the EU ETS were destroying their cash flow and limiting the opportunities to invest in climate activities (B2, F&B3).

"*We are under the EU ETS…Which means that we lose huge sums, then we have no money left at all to do any other kind of investment in environmental improvement*." (B2)

Another barrier described by seven companies was the *unfavourable facility* (B1, B9, F3, F5, F&B4). Having an old facility limited companies' willingness to invest in new technologies until a new facility was built (B1, B10, B11), or the facility made it difficult to integrate new climate activities (F3). Three companies mentioned that their facilities were not optimal for

integrating CCS. For example, due to their processes and the difficulty to get optimal energy integration and gas fluids (B9, F3, F5) and that their facilities are not operating enough hours for it to become profitable (F&B4).

5.3.3 Regulative pressure as a barrier

Regulations, or lack thereof, were mentioned by several companies as they constrained them to take certain climate actions. First, 11 companies mentioned the *weak financing mechanisms* and stated that the financial support suggested by the state had not been enough so far. They want to see increased state aid for CCS for them to invest in the technology (B5, B8, B7, B9, B12, F1, F5, F&B1, F&B2, F&B4, F&B5). This was also true for other types of climate activities.

"*I believe in a market economy, but if we are to accelerate the climate, we need instruments that help not only companies but that help us citizens to make responsible decisions*." (F1)

Second, several companies also mentioned the lack of other regulatory incentives to motivate expensive climate activities such as CCS, primarily in terms of taxes and EU ETS pricing (*weak carbon price*) (B2, B4, B5, F5, F&B3, F&B4). For example, one company was awaiting higher taxes on fossil fuels to motivate an investment in a specific climate activity they had in the pipeline (B4). Another company stated that they only work with positive net present value investments, in order for CCS to become one, prices for emission rights must increase (F5).

Third, *unregulated markets* can make it too uncertain to take investment decisions (B1, B3, B5, B7, B8, B9, B11, B12, F1, F3, F4, F5, F&B1, F&B4, F&B5) climate solutions can not only come from the customer side, but it must also come from the legislation (B11). The rules and legislations present today are not in line with recent development in society (B12). For instance, one company believed that biogenic emissions should also be included in the climate legislation. This would ensure that actors are properly incentivised to make efforts to either reduce or remove their biogenic emissions (F4). Furthermore, the historical instability in the climate regulations has made the predictability of what actions to invest in uncertain. Several actors mentioned that more long-term regulations can reduce the uncertainty (B1, B3, B5, B7, B9, F3, F4, F5, F&B1, F&B5).

"*The forest industry emits enormous amounts of CO_2, but that does not count, they emit more than what the rest of us do together. But they use biofuels and then they get a free card. That is quite unfair*." (F4)

"It is such an unpredictable system, today biochar is biochar, in the future, you might say carbon as carbon." (F5)

In terms of CCS, five companies emphasise the importance of creating a regulated market for negative emissions, as the current lack of a standardised system makes it too risky for them to invest in CCS on their biogenic emissions. A regulated market would also minimise other risks,

such as the risk of double-counting emissions in negative emission certificates (B1, B8, F1, F&B2, F&B4). Finally, the current system for *permit processes* acted as a barrier in the climate transition as it prevented companies to act fast, both in terms of climate activities in general and in terms of CCS (B8, B9, B10, F2, F4, F&B5).

"*The sad answer is that what is time-limiting are the environmental permits - to be allowed to build something/.../So we could make investment decisions faster, but we have legislation and legal framework to relate to. If I were to say that we would have a CCS facility within 1 year, it is not possible.*" (B10)

5.3.4 Cognitive pressure as a barrier

Cognitive pressure relating to self-perception was also present among several of the companies. Five companies were *reluctant to risk* and mentioned the importance of profitability in every investment decision (B6, B7, B11, F5, F&B5).

"It feels like we who are relatively small should not go in the lead. Especially when there is unbroken ground when it comes to business models and so on. We should probably be quite careful." (B6)

Furthermore, seven companies with primarily biogenic emissions showed *limited climate responsibility*. For example, by resigning their responsibility towards Sweden's overall climate targets (B1, B2, B6, B7, B9, B11) and/or stating that their emissions derived from previous stages in their value chain and thus that it was out of their control (B2, F&B3).

"The way that I see it is that we are already doing far too much today, it is someone else that should do something. At least as it looks today." (B2)

In terms of CCS, five of these companies mentioned that they are not driving the transformation. These companies are looking at other actors and will only implement CCS when it has been commercialized and is scalable (B1, B6, B7, B9, B11). One company stated that a collaborative responsibility in Sweden as a whole would be necessary, it is difficult to demand too much of individual companies (B7).

"We hope to steal much of the technique from others and then fast forward our learning curve to catch up on the others since they have done so much already." (B9)

6. Analysis

In this chapter, the empirical data is interpreted and analysed using the theoretical perspectives described in section three. The first part (6.1) aims to analyse the climate strategies for the high emitting companies. The second part (6.2) aims to analyse the drivers and barriers for implementing CCS by contrasting the perspectives of innovating and compensating companies. Finally, a summary of the analysis is presented (6.3).

6.1 What are the climate strategies of high emitting companies?

The empirical literature review (3.1) aimed to describe characteristics of companies' climate strategies. Based on this, in this section, we seek to analyse how the actors plan and prioritise for the future by analysing their climate strategies. In line with previous climate strategy research (Jeswani et al., 2008; Kolk & Pinkse, 2005; Lee, 2012; Weinhofer & Hoffmann, 2010), our empirical data show that codes could be linked to innovation (11 companies) or compensation strategies (11 companies). Companies with five codes or more connected to innovation strategy were considered innovators.

The empirical data show that the 11 companies with a compensatory strategy (ten actors with only biogenic emissions) were focusing on internal activities by making smaller changes in their existing knowledge base, either by changing fuels or improving efficiency. This is in line with both Jeswani et al. (2008) and Weinhofer & Hoffmann (2010). Only two of the compensatory companies had been looking into CCS in their climate strategies. Furthermore, a short-term focus was evident in the climate strategies of the compensatory companies (Weinhofer and Hoffmann, 2010), as the majority of these companies did not have any long-term climate goals. These companies had rather formulated short-term goals (primarily reduction goals) or indicated a complete absence of formal climate goals or limited goals in line with Sweden's ambition. Further, four of the compensatory companies were actively collaborating to decrease their value chain emissions which, according to Kolk & Pinkse (2005) could indicate a more innovative strategy. However, as these actions were not combined with other innovation activities, it is not sufficient to be classified as having an innovation strategy.

When it comes to innovation strategy, our empirical data show that 11 companies fit into this category, both companies with fossil emissions and with a combination of fossil & biogenic emissions. They focused actively on both compensatory and innovative activities, thus choosing a combination of climate strategy measures (Weinhofer & Hoffmann, 2010). In line with Kolk & Pinkse (2005), these companies were looking beyond their existing knowledge base to improve their climate performance. A code that was brought up by several innovators, was a *first-mover strategy*. The companies had either a history of being at the forefront of innovations or showing clear signs of currently being at the forefront, even though they were not always certain about where they were heading. Furthermore, ten out of 11 companies had a long-term climate focus and had formulated goals to achieve net zero emissions or beyond, in line with Weinhofer & Hoffmann (2010). All the innovating companies except one had been looking into CCS technologies, some had already finished projects, while others had ongoing

or were planning for pilot projects at their facilities. This includes actors of both fossil and biogenic emissions.

In our sample, 50% of high emitting companies have an innovation strategy, indicating a proactive approach to climate strategy formulation. The even distribution between innovation and compensation strategy is in contrast with Kolk & Pinkse (2005), who showed a vast majority of companies in their research having a compensatory (passive) strategy. The empirical results further led to the finding that nine innovative companies were looking into CCS, whereas only two of the compensatory companies were looking into CCS. To understand why, the drivers and barriers for innovation and compensatory actors will be analysed using a triangulation of theories: institutional theory, resource dependency theory and resource-based view.

6.2 Drivers and barriers for CCS

In order to understand the future for CCS, it is important to understand the reasoning behind high emitting companies' different climate strategies, more specifically understand the drivers and barriers to why companies are prioritising and acting in different ways. Based on the theoretical framework, this would be dependent on the institutional environment, dependencies to external resources and companies' internal resources. Thus, the following section aims to analyse the empirical data of drivers and barriers for innovators (6.2.1) and compensators (6.2.2) in relation to our theoretical framework. This will provide a base for a discussion about the future for CCS (chapter 7).

6.2.1 Innovator drivers and barriers for CCS

To understand why innovator companies are looking into CCS, and what additional factors must be in place for them to take the next step, the drivers and potential barriers for innovators will be discussed in the following sections.

6.2.1.1 Drivers for innovators

In line with institutional theory, we can see that companies with high perceived normative pressure are more sensitive to climate change (Daddi et al., 2019). Specifically, normative pressure seems to be a driver that has significant influence for companies with fossil emissions and those with both fossil & biogenic emissions. Accordingly, these companies seem to be adjusting to the prevailing norms. The large majority of the innovative companies have already implemented more standardized measures such as changing fuels, and as the current norms are primarily centred around removing fossil CO_2 emissions, companies seem to be feeling a moral obligation to look for the next opportunity to improve (Palthe, 2014). For nine of these companies, CCS is currently the only way to remove their fossil emissions, thus the primary way to comply with the prevailing norms, and one of the main reasons why CCS becomes an important technology. The normative pressure in our findings derives from a society that does not accept continued fossil emissions, but also from other stakeholders, for example, employees or owners. Thus, in contrast to Delmas & Montes-Sanco (2010), pressure from peers is not as significant as other norms found in our results. Further, our findings are in line with other

empirical climate strategy research, such as Lee (2012), Jeswani et al. (2008) and Weinhofer & Hoffmann (2010), as they find that the more stakeholder pressure, the more climate actions a company will take to meet the increasing demands.

In line with Palthe (2014), companies sometimes feel that they ought to change based on the norm, regardless of if they agree or believe the change to be successfully implemented. However, according to the resource-based view, companies that take on proactive climate change strategies might also want to see competitive advantage and profitable returns (Backman et al., 2015; Hart, 1995). Our empirical results show that innovator companies do see a *competitive advantage* in terms of *long-term business potential* and *customer demands*. These codes are two of the most important drivers for an innovative climate strategy. In contrast to Braunreiter & Bennett (2017), our findings indicate that both fossil and biogenic companies see business potential in CCS and do show signs of willingness to large-scale commercialisation. The innovator companies (with both fossil and biogenic emissions) explicitly mentioned their strong belief in future opportunities for climate positive products. In contrast to Rodriguez et al. (2021) who found that companies do not see customer demand for negative emissions, innovators in our study see large potential in attracting new types of customers for different sectors that are *willing to pay* for negative emissions as a compensation method.

The reasoning behind CCS as a competitive advantage could further be supported by the findings from Okereke & Russel (2010), the belief about future institutional and regulatory developments will affect companies' climate strategies. Our empirical findings support this as several companies believe in the long-term potential for CCS, more specifically, to be able to offer climate neutral or climate positive products and sell negative emissions. They presume that institutional development will secure future return on investments in CCS, such as a belief in increasing prices of the *EU ETS* and in a regulatory development for a negative emissions market.

Cognitive pressure in terms of companies' beliefs, values, and social identity was shown to be another strong drive towards CCS implementation (Palthe, 2014; Scott, 1995). The innovator companies make sense of their environment and their role within it (Hoffman, 2006) as having a large *climate responsibility,* either by having a *significant* and/or a *supportive* role to play for Sweden to reach its climate goals. The innovator companies show a desire to contribute with positive impacts to the environment (Palthe, 2014). Both in terms of decreasing their emissions, but also helping other sectors decrease their emissions. CCS on biogenic emissions provides a tool to support other sectors in reaching net-zero. In addition, the empirical results show that the innovator companies communicated an *inner force,* primarily stemming from employees, that incentivised them towards more proactive climate strategies. This gives further support to how cognitive pressure affects companies' climate strategies. In line with Hoffman (2001), the increased awareness among employees seems to impact the companies' view of their role in the climate change transition. Four innovators also indicated *risk-taking* behaviour as they are taking large risks by heavy investments in CCS pilot projects, not because they are legally obliged to, but because they want to.

Finally, in comparison to compensatory companies, the innovators describe drivers in terms of *financial support* as an enabling regulation and *EU ETS* as a constraining regulation as they strongly believe in increased prices for the latter. Furthermore, having a *favourable facility,* a *strong financial situation* and favourable external resources such as a *favourable location* were not primarily expressed as strong drivers for the companies, rather, they provided the necessary conditions to further investigate in CCS. This implies that the companies are somewhat influenced by regulatory pressures as well as their internal and external resources when shaping business strategies in response to climate change (Backman et al., 2015; Hillman et al., 2009; Scott, 1995), indeed necessary to drive other sustainable initiatives (Hillman et al., 2009).

6.2.1.2 Barriers for innovators

Barriers for companies with an innovation strategy can be divided into two main categories: infrastructure and regulations. The strongest barrier among innovators for implementing CCS is the *underdeveloped infrastructure*. In line with resource dependency theory, companies will not achieve their objectives alone. This applies to the implementation of CCS as well. As described previously, the technology itself is not complicated or new, but the surrounding infrastructure for transportation and storage will be more complex and requires a new value chain. In fact, the companies currently investigating CCS mentioned this as a central uncertainty that needs to be solved (Hillman et al., 2009). Accordingly, the innovators in this study are collaborating with external parties to develop more knowledge about CCS and its infrastructure as a way to overcome the uncertainties (Jajja et al., 2017; Pfeffer & Salancik, 1978). Thus, the CCS infrastructure constitutes a barrier at this moment, however, it might not be a barrier for too long since the innovators are working towards collaborative solutions. An explanation for this could be that they face strong normative pressure and cognitive pressure to act and do more, and the fact that CCS could lead to a business potential.

Other barriers for companies with an innovation strategy are connected to the regulatory environment that they are in (Scott, 1995). The empirical result shows that one of the strongest barriers are *weak financing mechanisms.* While some companies with an innovation strategy did mention financial support as a driver, the majority indicated that it was currently insufficient, thus acting as a barrier at this moment. For example, several companies mentioned that they would need some sort of state aid in the beginning phase before they could be able to stand for the whole cost of CCS alone, as the *weak carbon price* is not providing a high enough alternative cost just yet.

Another barrier, in line with the findings from Rodriguez et al. (2021) is the *unregulated market*. Companies with an innovation strategy might want to implement negative emission credits or climate positive products, but due to limited regulations, they are constrained to do so. Without sufficient regulations that allow accounting for negative emissions, they have no guarantee that they will be able to sell these certificates, and thus their belief in a long-term business potential would fall. In addition to this, the *slow permit process* hinders companies to act as fast as they would like in order to adjust to the increasing customer demands. Approved

permission could take years to receive. Several of the innovator companies are therefore working actively to decrease such uncertainties by trying to impact politicians (Hillman et al., 2009) and decision-makers, for example by participating in industry organisational meetings or other forums.

The empirical results show that barriers to innovation strategies are primarily linked to resources and regulations in companies' external environment. Regulations should focus on creating incentives for voluntary actions (Daddi et al., 2019; Porter & Van der Linde, 1995), but they seems insufficient at this moment. Even though innovation companies see large potential for CCS, they still need more incentives to make the final investment decision. If the financial support were to increase, or the regulations for a negative emission market were to be established, this could create the extra regulatory incentives needed for the innovator companies to take the next step towards investing in CCS.

6.2.2 Compensators drivers and barriers

As compensators did not show clear signs of drivers to implement CCS, they discussed what had driven them historically to initiate climate actions. We raise their views in this analysis as it could help us understand what is needed for them to act on CCS.

6.2.2.1 Drivers for compensators

The answers from the compensatory companies were more fragmented as they were working with fewer actions in their climate strategy. However, they show some similarities on what they see to be the main drivers in their climate strategy: *cost savings*, *norms,* and *customer demand*. *Cost savings* were described to be the main driver for historical climate actions. Rising prices of oil and other resources have been driving them to become more efficient. This is in line with the findings by Jeswani et al. (2008), however, in our study, we find this as a great driver for compensating companies only and not for innovating companies whereas, as Jeswani et al. (2008) found that both categories were driven by cost savings. This finding can also be linked to the resource-based view, that continuous improvements in own production to lower the cost is the first step and driver of working with a climate strategy (Hart, 1995). *Norms* have also been driving compensation companies to a large extent in the past, such as the public perception of greenhouse gas emissions (mainly fossil), and how the debate has circulated around fossil energy sources and efficiency measures, which has made companies focus their efforts on these measures. This is in line with Daddi et al. (2019) who found that companies act when they perceive a high normative pressure. However, in comparison to the innovators, the compensators seemed to be willing to decrease their emissions, but not as pressured to go further and attain net zero or negative emissions. A possible explanation could be that they perceive their obligations to act on these norms differently, potentially driven by differences in cognitive beliefs (see 6.2.2.2) Some companies mentioned *customer demand* as a driver, as they have started to get demands from customers to disclose the climate impact of their products and/or services. However, only a few of the companies mentioned that they perceived their climate efforts to generate a long-term business potential.

6.2.2.2 Barriers for compensators

The compensatory companies were expressing several barriers for CCS. First, many companies did not see themselves as being first in line for using the technology but could consider looking into CCS if they saw that it started to become implemented at a large scale. This view links to cognitive pressure, or rather a lack of cognitive pressure, as these companies strive to imitate others behaviour, but are not willing to imitate their behaviour just yet (Daddi et al., 2019). This is in line with the findings by Jeswani et al. (2008), that compensatory companies tend to be unconcerned or unaware about integrating climate activities. Further, the compensation actors pointed to some external resources as barriers for CCS, such as *uncertain energy supply* in their area or *underdeveloped infrastructure* for transporting and storing CO_2. This is in line with resource dependency theory, as these companies' dependency on external resources created uncertainties which influenced their action to not look further into CCS (Pfeffer & Salancik, 1978; Hillman et al., 2009). However, these companies showed indications of being more reluctant to take risks and they did not show signs of working to reduce the uncertainties, for example by collaborating in joint ventures or shaping political actions, as the innovating companies were doing. The internal resource barriers that the compensatory companies stressed were their *weak financial situation* and that some believed that their *facilities were unfavourable* for CCS. As the companies mentioned that they did not have any budget for neither renewing their facility nor investing in pilot projects or expensive technologies, their decision on climate strategies and to not look at CCS were shaped by the lack of financial resources. Thus, they had no chance to act proactively (Aragon-Correa & Sharma, 2003; Bansal, 2005). In line with Amran et al. (2016), who emphasised that too strict regulations may discourage companies to pursue climate mitigation actions, our findings show that companies that have a weaker financial situation are paying their only excess cash flow till the EU ETS, thus having no money left to explore innovative climate actions.

In terms of regulatory pressures, the compensatory companies were consistent with the need for a stronger and more long-term policy landscape. They had a greater belief that the state had a leading role to play in the CCS-debate. Their awaiting approach to climate actions was mostly impacted by the fact that they did not see that they could receive financing for any CCS projects in the near term. They believed that the current suggestions were too weak in order to act. In line with Levy & Kolk (2002), regulatory pressure is the most important pressure for these companies to take action. An explanation to why the compensatory companies are awaiting regulations might be connected to the lack of self-perception, thus limited cognitive pressure, to take risks and have a role to play in the CCS development. However, in contrast to innovative companies and the findings by Okereke & Russel (2010), the compensatory companies did not act on beliefs about the future regulatory development. Instead of speculating about the future, these companies wanted to act when they had a clear vision of the regulatory landscape.

The cognitive pressure was also lacking for these companies, only a few of them expressed that they had a significant or supportive role to contribute to Sweden’s climate goals, instead, seven companies showed *limited climate responsibility* which is in line with the findings from Rodriguez et al. (2021). This supports Scott (1995), that cognitive beliefs affect how companies

make sense of the environment and subsequently how they act. These companies do not believe that they play an important role, indicating that the cognitive pressure put on these actors is either too weak or, in contrast, the cognitive pressure is not as important to them as regulatory pressure is. The latter would in that case contradict Daddi et al. (2019) as they argue that cognitive pressure is the most important pressure for climate action.

6.3 Summary of analysis

To summarise the analysis, strategies of high emitting companies can be divided into two broad categories: on the one hand, innovators, taking a more proactive role and sensing a strong responsibility for contributing to Sweden's climate goals. On the other hand, compensators, taking a more reactive role with a view of having no or limited role in contributing to Sweden's climate goals. The vast majority of the companies investigating and seeing potential in CCS are innovators. Further, the drivers and barriers for implementing CCS i.e., why/why not some companies are looking into CCS are different for the two categories. For innovators, primarily companies with fossil emissions, the strongest drivers are related to normative pressure, cognitive pressure, and competitive advantage (DiMaggio & Powell, 1983; Hart, 1995; Scott, 1995), which subsequently play an important role in forming innovative strategies. As society no longer accepts fossil products/emissions, these companies are willing to change, and they see it as both their obligation and an opportunity for a long-term business potential to act upon the increased customer demands. These firms see CCS as a competitive resource, and thus take sequential actions to decrease uncertainties for the investments (Hillman et al., 2009). However, for the innovator companies, uncertainties regarding the underdeveloped infrastructure, and an unregulated market represents barriers. For compensators, primarily companies with biogenic emissions, the drivers for their general climate strategies are often cost savings (Hart, 1995). Thus, since CCS is related to high costs and limited profits at this moment, they have limited incentives to look further into CCS. Compensation companies are also viewing themselves as constrained by their internal and external resources (Hart, 1995; Pfeffer & Salancik, 1978).

7. The future for CCS in Sweden

So, what does this imply for our focus question: *How will the future for CCS in Sweden unfold?*

7.1 Three main purposes for using CCS

First, our findings suggest that CCS is a technology that is prioritised in the long-term strategy, after several other measures have been implemented (Hart, 1995). A majority of the companies with a long-term strategy included CCS, whereas none of the companies with only a short-term strategy had done so. This implies that companies have historically, and will continue to focus predominantly on *compensatory measures*, such as changing fuels and improving efficiency before investing in CCS. This is in line with findings from Weinhofer and Hoffmann (2010) and Hart (1995), indicating that different strategy types represent different time horizons, where compensatory measures come first. Our findings suggest that CCS, although it could be a compensatory measure (i.e continue doing business as usual), shows signs of being a carbon independence measure. This means that actors that are willing to invest in CCS do it for three purposes: (1) actors that have fossil and biogenic emissions but can only become fossil free with CCS even after they have changed fuels, will use CCS as means to attain a goal of net zero. (2) Actors that currently have either biogenic emissions or actors with fossil emissions that can become fossil free after they have changed fuels, will use CCS on biogenic emissions to attain a goal of negative emissions. And/or (3) actors with biogenic emissions can help other actors attain negative emissions by selling negative emission certificates. This is an important finding since critics of CCS are claiming that it is an alibi for continuing business as usual (Budinis et al., 2018). However, this does not seem to be the case for high emitting actors in Sweden.

7.2 The role of internal and external resources

Furthermore, resources are important to consider when discussing the future for CCS as they provide the foundation for companies' competitive advantage and their sustainability initiatives (Hillman, 2009). Indeed, for innovative companies, their internal resources could be considered a competitive advantage for CCS implementation. Compared to peers, the innovator companies in this study have an appropriate facility and a favourable location. However, these were not expressed as their main drivers, rather as a prerequisite that influenced the development of new knowledge and resources (Hart, 1995). In addition, innovators see increased demands for fossil free and negative emission credits and long-term business potential for CCS. Thus, the majority of the innovator companies described that their resources enabled them to look further into CCS, but it was driven by the potential competitive advantage. Nonetheless, some existing uncertainties regarding external resources might still provide barriers in the initial stages. However, when this was the case, innovating companies acted proactively to overcome these uncertainties (Pfeffer & Salancik, 1978), which show reason to believe that these barriers will decrease in the near future. For compensators, on the other hand, they clearly expressed both internal resources and external resources as barriers to proceeding forward with CCS implementation, thus a lack of competitive advantage. This indicates that companies' future implementation of CCS will be dependent on how firms are able to acquire or secure access to necessary resources needed for large-scale implementation. However, CCS is not suitable for

all companies and should be implemented where it will have the most impact. That is, where the internal and external resources create the right preconditions for a successful implementation. For one company, this can include implementing CCS, for another company it might imply other climate actions. Thus, a systems view is crucial for CCS to successfully contribute to reaching Sweden's climate goals.

7.3 Self-perception and its impact on future CCS implementation

At the beginning of this thesis, we argued for taking a bottom-up perspective. Although top-down research of the price, technology and proper political incentives for CCS is needed (Johnsson et al., 2020; Fridahl et al., 2020), we do see that an actor's perspective can contribute to a more nuanced understanding of this discussion. For example, our findings show that, so far, only companies that are considered to be *innovators* are looking into CCS technologies. This finding coincides with their perception of their role as actors to contribute to Sweden reaching its climate goals (significant or supportive role), which is a form of *cognitive pressure*, i.e wanting to change and contribute to society. In contrast, we see that companies that are not looking into CCS technologies lack cognitive pressure. Meaning that they do not view themselves as having a leading role to contribute to attaining Sweden's climate goals. Our findings support Rodriguez et al. (2021), that actors with biogenic emissions only perceive a limited climate responsibility since they are compensatory in our thesis. On the contrary, our findings do not support Beuneriter & Bennett (2017) as we found that actors with fossil emissions do see CCS as a realistic option that they are willing to look further into. Our research further contributes with an additional perspective by also looking at actors with a combination both biogenic and fossil emissions, and showing that these feel greater responsibility and are willing to do more (i.e. to attain negative emissions) than the biogenic actors. Several companies mentioned that their own perception of CCS had changed to a positive view compared to just a few years ago.

7.4 Interrelations between institutional pressures and the importance of regulatory development

What is difficult to separate is if companies' cognitive pressure has been influenced by *normative* and *regulatory pressures*, or vice versa. How these pressures relate or influence each other in a climate strategy context is not described in theory, however, according to our findings, they are most likely interlinked and affecting each other. For example, both innovative and compensatory companies perceived that their strategies were affected by norms from different stakeholders, but the difference is that companies with fossil emissions (i.e. innovator companies) have been included in the climate debate for a longer time and have been faced with different *regulatory pressures* historically. Thus, it seems like the innovative companies have developed both an obligation and a willingness to contribute to a net zero society. Accordingly, the innovative companies that currently are looking into CCS are those under both high normative and cognitive pressures, which could explain their more proactive strategies (Daddi et al., 2019; Delmas & Montes-Sancho, 2010). This means that the

combination of these two pressures is important for actors to be driven to do more in terms of climate activities.

However, for a large-scale implementation to be realized, cognitive and normative pressures are not sufficient. *Regulatory pressure* must work supportively for these actors to reduce the uncertainties that an investment in CCS entails. In fact, increased *regulatory pressures* were deemed important from both innovative and compensatory companies for CCS to become implemented at a large scale. Specifically, regulations related to financing for CCS and regulations that could help create a market for negative emissions. The latter by providing a robust framework for the trade and measurement of negative emissions. For innovators who have cognitive pressure, some supportive regulations would incentivise them to take the final investment decision for CCS. For compensators who lack cognitive pressure, regulative pressure will only incentivise investments in CCS if the companies get full support for their investments. For example, the reversed auctioning on negative emissions that will take place in 2022, might have the potential to create cognitive pressure for compensatory companies. Although relevant critique towards the auctions claims that it is only being available for a few actors with biogenic emissions (probably the first mover, i.e innovative ones), it has been researched that such regulatory incentives can trigger market actions for other companies and create a mimetic behaviour (Daddi et al., 2019). Important to note is that the price of EU ETS has increased dramatically during 2021, especially during the fall after the COP26 meeting in Glasgow to a price currently at €78. As several actors have explicitly mentioned the EU ETS as a driver, this would be beneficial for the future of CCS. However, at the time of conducting our interviews, the emission price was at €58, and the scope of the reversed auctions had not been presented. Thus, we were not able to analyse whether innovators deem the auctions or the current emission price as sufficient incentives for CCS implementations. If they were, the necessary regulatory measure remaining for them is a framework for a negative emission market.

7.5 Synthetized discussion

What we have seen during the last couple of years, and what is confirmed by the actors, is that the discussion around climate is accelerating and that the prices of emissions continue to rise. Thus, we have no reason to believe or take existing climate discourse for granted, and the responsibility that the actors feel towards attaining climate goals might develop and change over time. For example, if the debate would go beyond talking about fossil emissions, and rather treat emissions as a whole, it is very likely that biogenic actors would experience increased cognitive pressure. This indicates an expected future commercialisation of CCS among several companies. Nevertheless, it cannot be neglected that the CCS requires large investments and operating costs. The innovators will go first as they perceive both stronger institutional pressures, primarily cognitive, and they have a competitive advantage in terms of internal resources and some of the external factors (Hillman, 2009). Additionally, since they can already see a long-term business potential for CCS and increased customer demand, both for fossil free products (current customers) and negative emission credits (new customers), this can justify future investments in the technology. Compensators expressed resources as a barrier and had a

stronger focus on cost savings. Thus, they must be faced with increased institutional pressure to change how they look upon their external environment and their role to play, before proceeding with CCS. More specifically, as the discourse around climate has been in the past, companies with fossil emissions have no choice but to change and innovate to remain relevant in a net zero future. Whereas companies with mainly biogenic emissions have not felt as targeted by the national climate ambitions. However, as the discourse might change and more emphasis is being put on biogenic emissions, these actors must also rethink their strategy to obtain legitimacy beyond 2045. This implies increased importance of CCS.

8. Concluding remarks

The purpose of this thesis was to explore the future of CCS and thus answer the focus question: *"How will the future for CCS in Sweden unfold?"* The purpose was to answer this question by first understanding what the climate strategies of high emitting companies in Sweden are, and why/why not some of them are prioritising CCS.

The empirical findings in this thesis show that high emitting companies in Sweden are either innovators or compensators when determining their climate strategies. Currently, the innovators are also the ones looking into CCS. The reasons why innovators are prioritising CCS are driven by the strong normative and cognitive pressure, while compensators lack the cognitive pressure. Furthermore, innovators have favourable internal and external resources and are driven by long term business potential. In contrast, compensators are constrained by a lack of the necessary resources needed to take further climate action. In the future, regulatory incentives must increase for innovators to take the next step, especially financial support and regulations for a negative emission market. Thus, the future for CCS is dependent on regulatory development. If sufficient regulations to create a negative emissions framework are in place, innovators will most likely implement CCS in the near future (before 2030). In terms of compensators, those who have the ability to acquire the right resources for CCS, will most likely wait until their cognitive pressure increases or until the general discussion about carbon emissions also includes biogenic emissions. By then, if innovators have implemented CCS, the compensators can mimic their behaviour. This would probably occur sometime after 2030. In the context of Sweden, this would provide greater chances to attain Sweden's climate goals.

8.1 Practical implications

This thesis has implications for both managers and policymakers. First, our thesis has concluded that there are several actors showing interest in CCS. This has implications for managers as it gives a direction for how and why actors within the examined industries are prioritising their climate strategies and can reduce the general uncertainty for the future for CCS. For managers in high emitting industries, this thesis can provide guidance on where the industry, in general, is heading, and thus work as a foundation to form a strategic response. For managers of companies that have the potential to position themselves in the value chain, our thesis can stimulate discussion of where in the CCS value chain the greatest need exists.

In addition, this thesis also has several implications from a policy perspective. First, as innovative firms are more likely to investigate CCS because they see their responsibility in contributing to Sweden's climate goals, this results in an active approach where firm-level resources are in place. Their barriers stem from external uncertainties, where policymakers should implement options that reduce the uncertainties regarding external resources, such as a regulatory framework for negative emissions. For compensatory firms, they have difficulty seeing their role in reaching Sweden's climate goals as well as lacking necessary resources such as capital. Thus, policymakers should implement options that facilitate their ability to invest in CCS, as well as take approaches to increase their cognitive pressure. As the debate around emissions evolves, it is likely that compensators need to take action to obtain their legitimacy.

Symbols, words and gestures from external stakeholders are important to increase the cognitive pressure, such as extending the fossil free debate to include carbon emissions from all sources. Finally, increased financial aid to invest in CCS technology would benefit both innovators and compensators. However, since CCS is not optimal for everyone, policy mechanisms should be designed in a way that creates the most impact for society at large and not only for one municipality or a single actor.

8.2 Limitations

One limitation in this thesis is that there might be other barriers that are likely to influence companies' strategic decisions for CCS. For example, factors such as company size or ownership structure, which have not been examined in our study. A second limitation is that this study is applicable for Sweden and cannot explain the future for CCS in a global context as other countries might have other institutional frameworks and access to external and internal resources that would influence how they perceive the current barriers and drivers for CCS. A third limitation is that the perspectives and themes raised in this thesis are not mutually exclusive for determining the future of CCS. There might be interrelations between different factors which makes it hard to determine what is driving what.

8.3 Future research

In relation to this thesis, there are several perspectives to explore further. First, to nuance the discussion about high emitting industries' choice of climate action even further by applying other theoretical lenses. For example, instead of focusing on how actors are implementing mitigation measures to respond to climate change, rather look at the reverse relationship, i.e how the actors are being influenced by climate change. Theories about innovation and disruption could possibly explain this. Second, future research could adopt a customer perspective, and examine whether there is an interest from potential customers of negative emissions. This would reduce uncertainties that exist regarding the business model for CCS on biogenic emissions.

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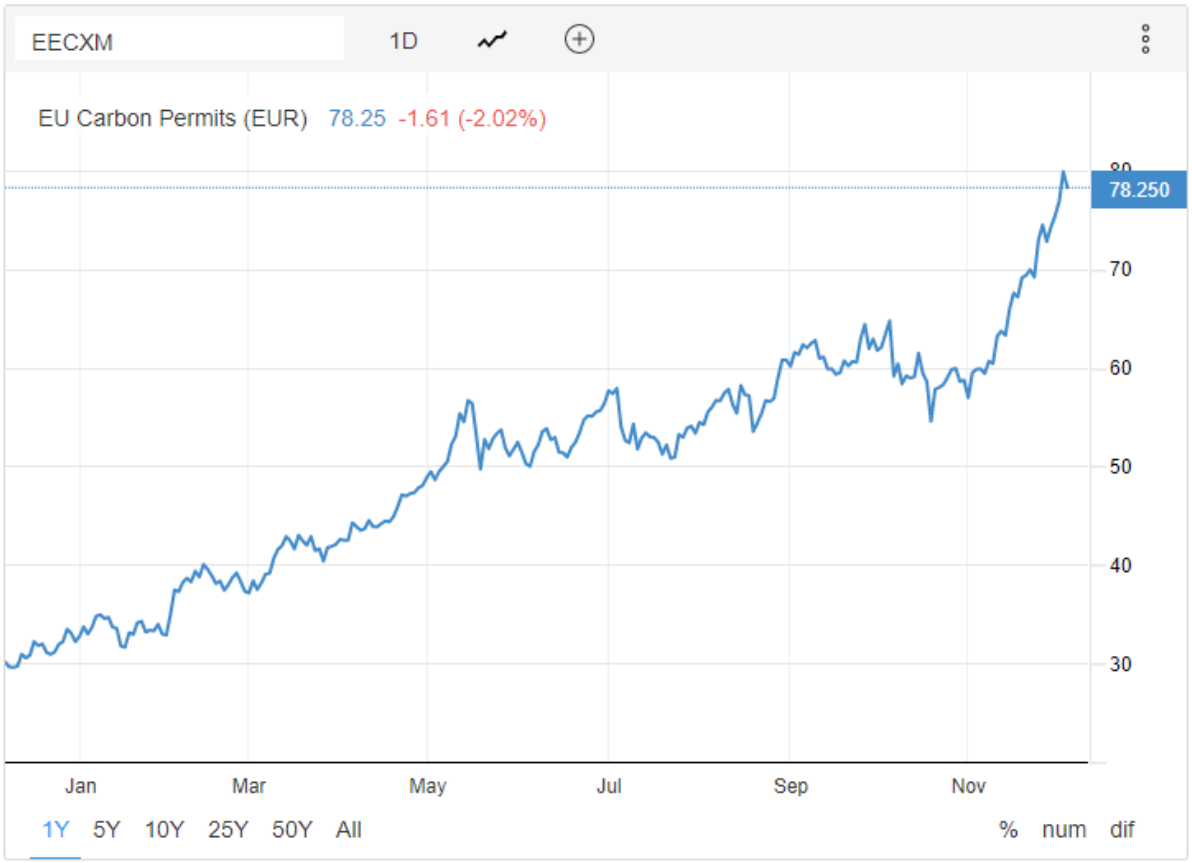
Appendix A: Price of EU Carbon Permits



Source: Trading Economics, (2021)

Appendix B: Interview guide

Intro

1. How long have you been working at X and what is your role?

Overall climate strategy

2. How would you describe your climate work?
    a. Have you set any climate-related sustainability goals?
        i. Why / why not?
    b. Do you have a stated climate strategy / priorities that you work according to?
        i. Why / why not?
    c. Has your focus on these issues changed over time?
        i. How / why?
    d. What measures have you taken so far to achieve your climate-related goals? (example)
    e. How many employees are responsible for your climate initiatives? Which?
    f. What are the biggest drivers behind your current strategy?
    g. How well would you describe this strategy (or climate issues if there is no sustainability strategy) is integrated into your overall business strategy?

Sweden's climate goals

3. What do you feel about your responsibility as an actor for contributing to Sweden's climate goals being met?
4. How would you describe your company's work in relation to current climate issues / Sweden's climate goals?
5. Do you experience any type of external climate pressure, from authorities, customers, the public in general?
    a. How?
    b. How has it affected your work?

Technologies/CCS

6. Do you know what emission reduction technologies that are available for your industry and the advantages and disadvantages associated with these technologies?
    a. Elaborate.
7. How do you see the future for large-scale use of CCS in your industry: no potential / possible potential / great potential?
    a. Why?
    b. If great / possible potential: Within what time period?
    c. What benefits do you see with CCS?
    d. What obstacles or areas for improvement do you see with CCS?
8. How do you think implementing CCS would affect your customers' image of you?
    a. Why?
9. What kind of cooperation or external help would you need to achieve your goals?

Concluding question

10. Is there anything you would like to add?

Appendix C: Overview of coding

Company	B12	B11	F5	B7	F&B5	B6	B5	B4	B3	B2	F&B4	B1	B10	F4	F3	F2	F&B3	F1	F&B2	B9	F&B1	B8	Total
	CLIMATE STRATEGY																						
Compensation strategy																							
Internal activities:																							
Changing fuels	x	x	x	x	x	x		x	x		x	x	x	x	x	x			x	x	x	x	18
Improving efficiency	x		x	x			x				x		x										6
Transportation									x	x		x											3
Short-term focus:																							
Absence of formal goals, Weak goals		x		x		x			x	x		x	x		x			x					9
Innovation strategy																							
Transforming business practices:																							
Circular business models					x						x			x		x	x				x		6
New product offering			x											x		x		x	x			x	6
First mover strategy								x	x			x	x	x		x	x	x	x				9
Long-term focus:																							
Net zero ambitions	x		x		x			x			x			x		x	x		x	x	x	x	12
External activities:																							
Value chain emissions	x							x			x	x	x			x	x	x	x		x	x	11
Pilot projects			x		x		x	x			x			x		x	x	x	x		x	x	12
Collaborations	x	x	x		x		x	x	x		x	x	x			x		x	x	x	x	x	16
	DRIVERS AND BARRIERS																						
Drivers																							
Competitive advantage																							
Cost savings		x		x			x				x		x		x					x			7
Customer demand		x	x		x		x	x	x		x	x		x	x				x		x	x	13
Customer willingness to pay			x				x	x						x	x				x				6
Long-term business potential	x		x		x		x				x	x	x	x		x	x	x	x		x	x	14
External resources																							
Access to biomass																			x				1
Affordable energy								x															1
Favourable location							x	x			x								x			x	5
Internal resources																							
Favourable facility			x	x															x			x	4
Strong financial situation											x					x		x	x			x	5
Regulative pressure																							
Financial support					x			x								x					x	x	5
EU ETS			x					x	x					x	x					x	x		7
Quota obligation																x		x					2
Normative pressure																							
Norms (positive attitude or expectations)	x	x	x	x	x		x	x	x		x	x		x	x	x	x	x		x	x	x	18
Cogntive pressure																							
Inner driving force		x												x		x			x		x		5
Risk taking											x								x		x	x	4
Significant/supportive	x		x		x				x		x	x		x	x	x		x	x		x	x	13
Barriers																							
External resources																							
Uncertain energy supply			x	x			x								x	x				x			6
Limited acces to biomass	x					x									x					x			4
Unfavourable location								x	x				x								x		4
Underdeveloped infrastructure	x		x		x						x			x	x	x	x			x	x	x	11
Internal resources																							
Unfavorable facility		x	x								x	x	x		x					x			7
Weak financial situation		x		x		x		x	x	x			x				x						8
Lack of knowledge																							0
Rergulative pressure																							
Weak financing meachanisms	x		x	x	x		x				x							x	x	x	x	x	11
Weak carbon price			x				x	x		x	x						x						6
Unregulated market	x	x	x	x	x		x		x		x	x		x	x			x		x	x	x	15
Slow permitt processes					x								x	x		x				x		x	6
Cogntive pressure																							
Relucant to risk		x	x	x	x	x																	5
Limited own cost responsibility									x	x													2
Limited climate responsibility		x		x		x				x		x					x			x			7