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Adapting to an evolving market:

A framework for business model innovation in the
carbon dioxide removal market

Master thesis in Management and Economics of Innovation

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Summary

The Carbon Dioxide Removal (CDR) market is rapidly evolving and is increasingly recognized as an important complement to emission reductions in addressing climate change. However, the market remains uncertain and fragmented, creating challenges for both buyers and providers of carbon dioxide removal credits. This thesis explores industrial buyers' preferences, needs and barriers related to the purchase of carbon dioxide removal credits. It also explores how CDR providers can adapt their business models and operations accordingly. The study aims to contribute insights that support the continued development and adoption of CDR solutions. A qualitative research approach was applied, centered around a main case, a marine CDR provider, and additional interviews with buyers, intermediaries and certifiers, complemented with secondary data. Two research questions guided the study: *How do industrial buyers select CDR providers and what hinders buyer adoption of CDR?* and *How can CDR providers innovate their business model to adapt to industrial buyer preferences and needs?* The findings show that buyers evaluate providers based on several choice factors such as trustworthiness and transparency, proximity, storytelling, price-fit and growth potential, as well as characteristics of CDR method. The findings also revealed several barriers limiting the adoption of CDR such as price uncertainty, regulatory uncertainty and evolving standards, high market complexity and shifting perceptions of CDR. A framework integrating business model innovation and dynamic capabilities with the synthesized findings was developed. The framework illustrates how providers can use sensing, seizing and transforming capabilities to identify market signals, adapt their business models and continuously reconfigure their operations in response to changing customer needs and market conditions. Based on the findings several practical recommendations for providers are identified.

Keywords: Carbon dioxide removal, business model innovation, dynamic capabilities, carbon credits, complex market, evolving market

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Sincerely,
Louise Allgöwer & Lovisa Karlsson June 2026

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1. Introduction

As the world is trying to limit the temperature rise to 1.5 degrees, researchers search for new ways to limit the increasing amount of carbon in the atmosphere (Smith et al., 2024). In recent years, there has been significant development in carbon dioxide removal (CDR) technologies. Different methods are used to extract carbon directly from the atmosphere and durably store it, resulting in what some call “negative emissions” (Akeret et al., 2023). According to the Intergovernmental Panel on Climate Change (IPCC), CDR will play a vital role in reaching the world’s climate targets, both as a balance tool for emissions that are hard to reduce and the vast number of legacy emissions from previous centuries (Intergovernmental Panel on Climate Change [IPCC], 2023). Because of this, public funding and private investments have led to an increase in CDR-research, -intermediaries, -verifiers and -start-ups (Smith et al., 2024).

There are many ways to group different CDR methods, but in general, CDR technologies can be divided into two categories: Conventional CDR and novel CDR. Conventional CDR accounts for 99% of the total carbon removed yearly, approximately 2 GtCO₂ per year (Lamb et al., 2024). It involves forest and soil management such as restoration of wetlands and mangroves, afforestation and reforestation, and will in this thesis be denoted as land-nature-based CDR. Novel CDR technologies are often more engineered methods, such as Direct Air Carbon Capture and Storage, Biochar, Bioenergy with Carbon Capture and Storage and Enhanced Weathering. It also includes some marine CDR methods such as macro- and micro algae cultivation. The technology that currently dominates the novel CDR market is Biochar, where wood and agricultural residues are burned in a low-oxygen environment and transformed into a brick-like material called Biochar. The Biochar can then be used in agriculture to improve soil health or as a component in durable building materials. In contrast to some other methods, the durability of Biochar has been proven in laboratories and field studies, and Biochar accounted for 86% of tons delivered from novel CDR in 2024 (Chen et al., 2025). The American-owned Exomad Green accounts for 25% of the world’s novel CDR deliveries with large customers such as Microsoft, Mitsubishi and Blackrock (Exomad, 2026).

For the CDR provider to profit, the removal method must be verified and the removed carbon certified and registered as carbon credits (Smith et al., 2024). Carbon credits are certificates representing tons of reduced, removed or avoided carbon and ensure that the mitigation activity has taken place. Carbon credits are not only issued for CDR, but also for emission reductions and avoidance projects. Trade in carbon credits can be a way for companies to reach their sustainability goals and for funneling money into CDR projects. However, some argue that they may serve as an excuse not to limit own emissions and often do not result in as many emission reductions as assumed (Probst et.al, 2023). This can be due to unrealistic assumptions of the reduction capability of the mitigation activity or picking of favorable data, which makes the carbon credit misalign with actual emission reductions.

Carbon credits are traded both in compliance and voluntary carbon markets (Smith et al., 2024). *Figure 1* presents a simplified version of the voluntary CDR market with its different actors. Compliance markets are official and regulated markets and dominated by credits from reduction or avoidance projects. They only allow for limited accounting of carbon credits generated from CDR methods. In the voluntary carbon market, which is a global, self-policing, voluntary marketplace, people trade in carbon credits generated from CDR methods, emission reductions and avoidance projects. It is controlled by market demand which makes it a niche where CDR start-ups can experiment and develop. However, carbon credits from CDR are only a small part of the voluntary carbon market (approximately 10% of credits sold in 2023), and they are expensive in comparison to other credits. Furthermore, credits from novel CDR are significantly more expensive than credits from land- nature- based CDR (Smith et al., 2024). In 2023, credits from novel CDR ranged from \$111 to \$1,608, while credits from land- nature- based methods ranged from \$12 to \$16. Despite this, most of the financing goes to novel CDR, as this market is considered young and growing, while the land-nature-based CDR market is more mature and limited by land availability. Even though the novel CDR market is considered promising, there is a gap between actual sales and market potential (Akeret et. Al., 2023). Private investors, start-up growth, subsidies, and environmental reports point to the growth of novel CDR, but start-ups struggle with insufficient customer transformation, profitability and long delivery times (Akeret et al., 2023).

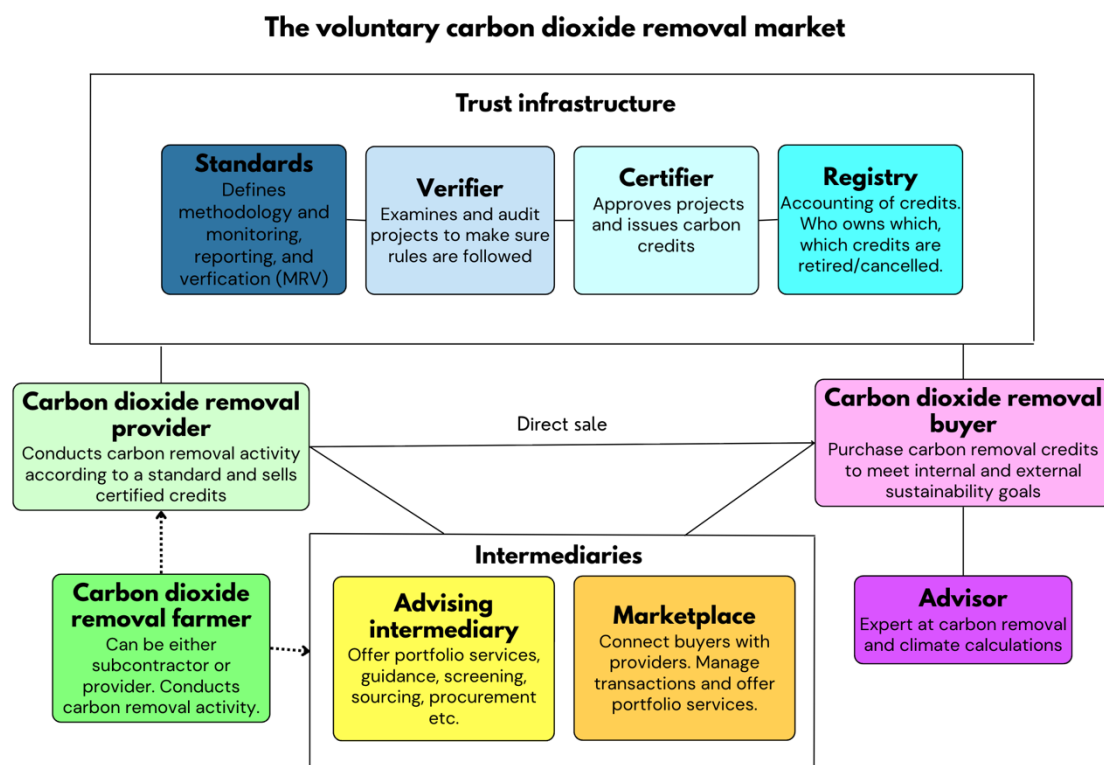


Figure 1: A visualization of the voluntary carbon dioxide removal (CDR) market. Note that an actor can sometimes be several entities such as interviewee nr. 7, who is both a standard, registry and certifier. Sometimes the carbon removal farmer acts as a subcontractor to the CDR provider, and sometimes they are in direct contact with an intermediary.

Furthermore, according to IPCC, CDR will play a vital role in limiting the amount of carbon in the atmosphere, which in turn is needed for counteracting the increasingly severe effects of climate change (IPCC, 2023). The effects are often most visible in developing countries, with extreme weather, rising sea levels, loss in biological diversity and diseases, but its consequences will in time affect every country on earth. Growth in the CDR market will remove carbon from the atmosphere, which can aid in counteracting this climate change. Halting the temperature rise will benefit communities suffering from effects of climate change and give societies time to adopt more sustainable practices. On a more local level, some CDR projects also create job opportunities in indigenous communities by locating their operations there.

While there has been lots of research on the topic of CDR; what role CDR will play in different emission scenarios (IPCC, 2023; Smith et al., 2024; Lamb et al., 2024), the science of CDR methods (Wu et al., 2023; Smith et al., 2024; Sanei et al., 2024; Fuss et al., 2018), and the economics and policy design of CDR (Edenhofer et al., 2025; Honegger et al., 2021), research needs a deeper understanding of customer needs, preferences and barriers, and how providers can adapt to them. Changing customer needs, technology advancement, and policy changes make the CDR market a highly complex market to navigate for both buyers and providers. By taking a closer look at the buyer and provider sides, this thesis aims to shed some light into how CDR start-ups can detect, interpret and adjust to customer needs, and thus be more successful in this rapidly evolving market.

1.1 Purpose

The aim of this thesis is to provide insights that contribute to CDR providers' understanding of buyer needs, preferences and barriers related to the purchase of carbon removal credits, and how they can adjust their operations and offerings accordingly. The result of these insights is synthesized into an actionable framework as well as practical suggestions on how providers can adapt to challenges related to customer needs. By doing so, this thesis aims to facilitate provider sales and increase adoption of CDR. Hopefully, it contributes to the development and growth of the CDR market, which according to IPCC, is needed for reaching the world's sustainability goals.

Two research questions guide the thesis:

- **How do industrial buyers select CDR providers and what hinders buyer adoption of CDR?**
- **How can CDR providers innovate their business model to adapt to industrial buyer preferences and needs?**

1.2 Delimitations

The main scope of this thesis is how CDR providers can adjust to challenges related to customer needs, preferences and barriers. Regulations, standards and policy development are discussed to the extent that they are relevant to the study's purpose but

the thesis does not aim to provide an in-depth analysis of policy and regulatory systems. Furthermore, this thesis focuses on a provider's understanding of industrial buyer preferences and needs and excludes sales to private individuals, which sometimes occurs in the CDR market.

As the market is new and nascent, there is little consistency regarding naming. In this thesis, land-nature-based CDR is used to denote reforestation, afforestation, soil management and wetland restorations projects. Some definitions of nature-based CDR include certain marine CDR methods, but that is not the case in this thesis. Novel CDR is used to denote engineered methods such as Biochar, Direct Air Capture with Carbon Storage, Bioenergy Capture and Storage, and marine CDR methods etc. This thesis primarily focuses on providers offering novel CDR but may be of use for nature-based CDR providers.

2. Theoretical Background

This thesis utilizes two theoretical concepts – business model innovation and dynamic capabilities. The frameworks act as a theoretical lens in analyzing data and answering the research questions.

2.1 Business model innovation

A business model describes how a company operates, creates value and how it transforms its offerings into profit (Teece, 2018). It explains what a firm offers, whom its customers are and how it organizes its resources and activities to generate revenue. The concept of business model has many definitions, but it generally includes components such as core activities, core offerings, partnerships, revenue model and channels etc. Business model innovation (BMI) refers to the process of adjusting these components to meet changing circumstances, and thus reconfiguring how a company creates, delivers and captures value (Teece, 2018). According to Teece, BMI is especially important for firms operating in uncertain and rapidly changing markets where companies continuously must adjust their business models to new circumstances.

Teece emphasizes that successful BMI starts with a deep understanding of customer needs and market problems. Companies must identify what customers value and develop solutions that customers are willing to pay for. In addition, firms need to continuously refine and adapt their business models as the market evolves. Business models are therefore not static, but dynamic structures that can be modified over time in response to external signals.

Overall, BMI is structured around three interconnected areas of innovation - *value proposition*, *cost model* and *revenue model* (Teece, 2018). These dimensions together explain how a company creates value for customers, generates revenue and manages the resources and activities needed to operate effectively.

The *value proposition* focuses on elements that addresses the fundamental “why” questions (Ramdani et al. 2019). It describes the value a company offers to its customers and why customers choose a specific product or service over alternatives (Teece, 2018).

According to Teece a successful value proposition requires a strong understanding of customer needs and preferences. These elements relate to reconsidering what the firm offers, identifying unmet or emerging customer needs, selecting and acquiring target customer segments and assessing whether the proposed benefits are recognized and valued by customers. It also relates to how the company differentiates itself in the market.

The *cost model* focuses on elements that are associated with the “what” questions (Ramdani et al. 2019). It concerns the resources, activities and partnerships required to deliver the value proposition (Teece, 2018). According to Teece, firms must decide which activities should be managed internally and which can be outsourced to external actors. These elements concern the configuration of organizational resources, operational capabilities, development of strategic partnerships and investments needed to support the business model.

The *revenue model* is associated with the “how” questions (Ramdani et al. 2019). It explains how a company captures value and generates income from its offering (Teece, 2018). Teece highlights that firms need pricing mechanisms and payment structures that customers perceive as reasonable while also supporting profitability and future growth. A successful revenue model therefore needs to balance customer expectations with the company’s financial sustainability. Revenue models can include different pricing logics, long-term agreements, subscriptions, direct sales or platform-based transactions.

Teece (2018) further argues that the different parts of a business model are interconnected, meaning that changes to one component often influence others. BMI therefore requires firms to continuously align their value proposition, cost model and revenue model with changing market conditions and customer demands. BMI is thus an iterative process.

2.2 Dynamic capabilities

The successful creation and implementation of a business model depends on the organization’s dynamic capabilities (Cruz-Sánchez et al., 2026; Teece, 2018). While operational and ordinary capabilities are needed for managing the daily routines and

operations of a company, dynamic capabilities enable firms to successfully renew and reconfigure their business models over time. Dynamic capabilities thus drive the process of business model innovation. In addition, the relationship between the two is iterative – dynamic capabilities enable business model innovation and business model innovation may in turn strengthen or reshape capabilities over time (Cruz-Sánchez et al., 2026).

Teece (2018) conceptualizes dynamic capabilities as three core clusters of activities: *sensing*, *seizing* and *transforming*. These represent the key processes through which firms identify opportunities and threats, mobilize resources to capture value from those opportunities and continuously renew and reconfigure their business model. Rather than viewing dynamic capabilities as abstract organizational traits, this breaks them down into concrete activities that enable companies to adapt and remain competitive in changing environments.

Sense refers to the firm's ability to identify and interpret opportunities and threats in its external environment (Teece, 2018). This involves scanning markets, monitoring technological developments, understanding evolving customer needs and recognizing regulatory or institutional shifts. *Seize* concerns the company's ability to mobilize resources and make strategic decisions to capture identified opportunities. This includes designing business models, making investment decisions, forming partnerships and developing offerings that align with market needs. *Transform* relates to the firm's ability to continuously renew and reconfigure its asset base and organizational structures to support changes to the business model and remain competitive over time. For instance, by enabling internal processes, developing new routines, acquiring resources or competences, scaling operations or shifting strategic focus as the market evolves.

2.3 Motivation of theoretical concepts

The complementing concepts of business model innovation (BMI) and dynamic capabilities provide a solid theoretical foundation for analyzing how CDR providers can adapt to market demands and changing customer needs. The process of BMI is driven by the dynamic capabilities of sensing, seizing and transforming (Teece, 2018),

and thus it makes sense to use them together. This combination is particularly relevant for the CDR market, because according to Cruz-Sánchez et al., BMI is especially fitting when the company operates in a market characterized by environmental dynamism (uncertain market demands created by heterogeneous and unpredictable customer preferences), technological advances, market changes and regulatory changes, all of which are present in the CDR market.

Together the concepts provide a suitable theoretical foundation for answering both research questions. The identified buyer preferences, barriers and market signals from the empirical findings can be connected to business model components such as value proposition, revenue model and cost model, which by using the dynamic capabilities can be reconfigured to better meet changing market conditions in a process of BMI. The concepts therefore support both the analytical and practical purpose of the study by linking market needs with strategic adaption and business model reconfiguration.

3. Methodology

3.1 Research approach

This thesis adopts a qualitative approach because of the study's exploratory nature and its aim to develop an in-depth understanding of how companies select CDR providers, as well as the challenges CDR providers face in acquiring and retaining customers. Unlike quantitative research, which focuses on measurement and statistical generalization, qualitative research enables the exploration of perceptions, decision-making processes, experiences and contextual factors (Bell et al., 2022). This approach allows a researcher to capture rich, detailed insights that would be difficult to obtain through standardized surveys or numerical data alone.

However, qualitative research also entails certain limitations. Findings are typically context-specific and based on smaller samples which limit the ability to generalize results to a broader population (Bell et al., 2022). In addition, qualitative analysis involves interpretative elements. The researchers' prior assumptions or pre-understanding may lead to certain interpretations of the data which may influence the findings. Despite these limitations, the depth and contextual understanding provided by qualitative research are highly valuable for emerging fields such as the CDR market where the existing knowledge is limited.

The data collection is based on a main case as well as several interviews outside of the case scope. The case consists of a marine CDR start-up which is described in 3.2 *Case study overview*. A main case study method enables an in-depth exploration of the selected company and its organizational context, business model and market environment (Bell et al., 2022). Nevertheless, a main case studies also present weaknesses. The primary limitation concerns external validity, as findings derived from one case cannot be generalized to the entire industry. There is also a risk that the selected case may not be fully representative.

The main case study is complemented with several additional qualitative insights, including interviews with a CDR certifier, marketplace, buyers, a marine scientist and a CDR webinar. By mixing a main case with additional interviews from several actors

outside of the main study scope, the study broadens its analytical perspective, allowing for comparison and a more comprehensive understanding of the CDR market. Further description of the interviews and interviewees can be found in *3.3 Data collection*.

3.2 Main case study overview

The main case consists of a marine CDR start-up with four employees founded in 2022. For this thesis, the start-up is called Blue, but it is actually named something else. As an early-stage CDR start-up with limited customer base, the company is currently navigating challenges that this study seeks to explore, for instance what factors influence potential customers to purchase carbon removal credits and how to adjust the business model accordingly. Overall, the case provides an opportunity to generate in-depth insights that directly align with the thesis aim of supporting CDR providers in understanding customer preferences, needs and barriers and how they can adapt the business model based on the insights.

The company currently employs two methods, both of which leverage photosynthesis to remove CO₂ from the atmosphere. In the first method, bamboo pods bound together with seaweed are deployed offshore. As the algae grow, they absorb CO₂ from the atmosphere. Once fully grown, the biomass is lowered to the deep seabed - where the carbon is isolated from the atmosphere for centuries to millennia. The second method involves round ocean baskets made of bamboo that contain fully grown seaweed and are lowered directly in certain locations.

Blue methods are a man-made version of a naturally occurring process. It is low-tech, low-cost and requires low manual labor. However, the methods used require access to deep ocean waters. Sufficient depth is essential to ensure that bamboo pods filled with seaweed sink to a level where they remain undisturbed, allowing for reliable verification of long-term carbon dioxide removal. To meet these conditions while avoiding long offshore transport, the company has so far established sites in Kenya and has an ongoing setup in Indonesia and Tanzania, where deep waters are located relatively close to mainland. The company collaborates closely with local communities in the development and operation of these projects.

Blue is certified by a third-party organization, who also verifies the CO₂ that is removed. The company generates revenue through the sale of verified negative CO₂ credits to companies seeking to take responsibility for their climate impact and strengthen their sustainability profile. Currently, Blue is in its early stage of development, with small service-oriented companies as its initial customers. These early adopters primarily seek to compensate for emissions related to staff activities and business travel, driven by emerging regulations, internal sustainability goals and broader societal trends. However, as an early-stage company operating in the emerging marine CDR market, Blue faces significant uncertainty.

Blue operates in a highly uncertain and rapidly evolving market environment characterized by changing and uncertain customer preferences, technological development and emerging regulations surrounding CDR. This creates uncertainty for Blue regarding future standards, competition and market demand. Buyer expectations are diverse and many companies remain hesitant to purchase CDR, creating challenges for CDR providers. These conditions make the case particularly suitable for this study as Blue faces the same challenges that the thesis aims to explore, namely how CDR providers can understand industrial buyer preferences and barriers to adoption and in turn adapt their business model and strategies in response to changing market signals and conditions.

3.3 Data collection

The data collection is mainly based on semi-structured interviews as a source of primary data. This approach provides a chance to collect significant and unexpected data (Bell et al., 2022). This type of interview is typically structured around a predetermined set of open-ended questions, with additional questions arising organically from the ongoing dialogue between the interviewer and the interviewees. Five interview guides, one for each role of the interviewee, was used consisting of approximately 10 questions each with questions allowing for openness and reflection. All the five interview guides can be found in *Appendix 1-5*. Interviews were recorded and later transcribed, after first asking for consent. Interviewees were asked if they want to be anonymous, adhering to ethical aspects. Informed consent can be given verbally or textual and is an essential aspect in business research to confirm that participants

voluntarily confirm their willingness to participate after being fully informed of how their data will be used. When possible, interviews were held in Swedish to get a better flow in the conversation and possibly extract more insights. When quoting from a Swedish interview in the findings it is translated into English.

Several semi-structured interviews are conducted with the employees at Blue to get a deep understanding of their overall business, current challenges, and strategies for acquiring and retaining customers. Interviews are conducted with three actively working co-founders who all play an important role in the company. One of them is technology focused (CTO) and works as a Technical Manager and Production Manager, another one is sale focused (CSO) and work with partnerships, collaborations and suppliers as well as growth and strategy. The third founder is CEO and works with shareholders, financing matters and to some extent sales and marketing partnerships. However, since the company is small, their responsibilities vary and they help each other out with different tasks, so everyone has a good knowledge of all areas.

Semi-structured interviews was also held with one of Blues' customers to get their perspective of why they choose Blue as provider and how they initially found the company. Blues' certifier and a marketplace in which Blue partner with was also interviewed in order get a fuller picture of the case and get their insights on Blue as a company and the overall market concerning buyer needs and challenges.

In addition, interviews were held with many actors and individuals outside of the main case study. The reasoning behind interviewing many different actors in the CDR market is to get a complete understanding of the market and its challenges. Interviewing different actors gives insights into the ecosystem and provides experiences from different angles, leading to a comprehensive understanding to all factors influencing buyers to purchase and what barriers they and providers face. One certifier, five buyers and one marketplaces was interviewed outside the main case. In addition, one marine scientist was interviewed who had been in the advisory board for a marine CDR that ultimately went out of business. The interview with the scientist contributed to valuable insights from the experience advising a marine CDR start-up as well as lessons learned along the way.

Table 1: Visualizing all interviewees of the study. Interviewees pertaining to the main case study of Blue are the six interviewees placed highest in the table and are marked with a star in the “Actor Type” column. As mentioned in the text of figure 1, interviewee 7 is denoted as a certifier for simplicity, but in reality takes three main actor types; standard, certifier and registry.

Interviews

Interviewee no.	Actor Type	Role	Duration (min)
1	Provider*	CTO	57
2	Provider*	CSO	35
3	Provider*	CEO	45
4	Advising intermediary*	CEO and co-founder	49
5	Buyer*	Managing partner	44
6	Certifier*	Business development	45
7	Certifier	Head of Supply	43
8	Buyer	Environmental manager	41
9	Buyer	Chief sustainability officer	48
10	Marine scientist	Senior scientist	59
11	Advising intermediary	CEO	50
12	Buyer	Head of property development	43
13	Buyer	Environmental manager	46

In addition, a webinar with discussions around buyer preferences and market insights is used as secondary data. It was organized by an international climate focused non-profit organization working to accelerate the development and adoption of CDR solutions. The webinar included a discussion panel consisting of one CDR buyer and three intermediaries, who shared what they are looking for in CDR projects, which solutions they consider most promising, future market developments and the challenges they see for CDR providers and buyers. The event was open to anyone interested in attending, allowing participants to both listen to the panel discussion and ask questions. Additional secondary data, including scientific articles, industry reports and academic

literature, was used throughout the thesis to provide contextual understanding and support the findings.

Table 2: Visualizing informants of the CDR webinar, used as secondary data.

Webinar

Informants no.	Actor Type	Role	Duration (min)
1	Advising intermediariy	Leads offtake team	57
2	Advising intermediariy	Carbon dioxide removal and Science policy expert	57
3	Advising intermediariy	Head of Growth	57
4	Buyer	Leads a Sustainability Fund of a company	57

3.4 Data analysis

The data are analyzed using thematic analysis, a widely applied method in qualitative research for identifying, analyzing and interpreting patterns within textual data (Bell et al., 2022). An advantage of the thematic analysis is its flexibility for organizing and interpreting qualitative data. However, the method involves interpretation of data which means that theme development is influenced by the researcher's judgment. To strengthen the credibility of the analysis, the coding and development of themes were therefore continuously discussed and compared to the raw data throughout the research process.

The thematic analysis in this study was largely inspired by the Gioia methodology which provides a structured and systematic approach for moving from raw empirical data to more abstract theoretical themes and dimensions (Gioia et al., 2013). The analysis began with a close reading of all interview transcripts to gain familiarity with the data. An excel file was created to organize the data analysis, where relevant categories connected to the purpose of the study were placed along the y-axis and the interviewees, grouped according to their roles, were placed along the x-axis. The

transcripts were reviewed one at a time and relevant parts of the text were extracted and inserted into the appropriate categories in the excel file. New categories were also added when relevant data emerged that did not fit within the existing structure. In the first stage the coding stayed close to the interviewees' own words and expressions to capture their perspectives as accurately as possible. Relevant statements, recurring ideas and meaningful quotes connected to the study's purpose and research questions were collected into the excel table. This resulted in 20 categories. After reviewing the categories and the data within them, only 10 categories were considered relevant to the scope of the study, while the remaining categories were excluded. The collected data within each remaining category across all interviewees were used to develop *first order concepts* (figure 2a and 2b).

In the second stage, the *first order concepts* were compared and grouped based on similarities and recurring patterns. Color codes were used to group and sort *first order concepts* to larger themes. This process made it possible to identify higher-level themes that reflect common perceptions, experiences and challenges across the interviews. Through this iterative process broader *second order themes* were developed (figure 2a and 2b).

During the third stage the second order themes were further synthesized into two *aggregated dimensions*, "Factors influencing choice of CDR provider" and "Barriers to purchasing CDR", (figure 2a and 2b).

Note that the Gioia data structure is presented across figures 2a and 2b for readability purposes only. Together, the two figures represent one complete data structure.

First-order concepts

Second-order themes

Aggregate dimensions

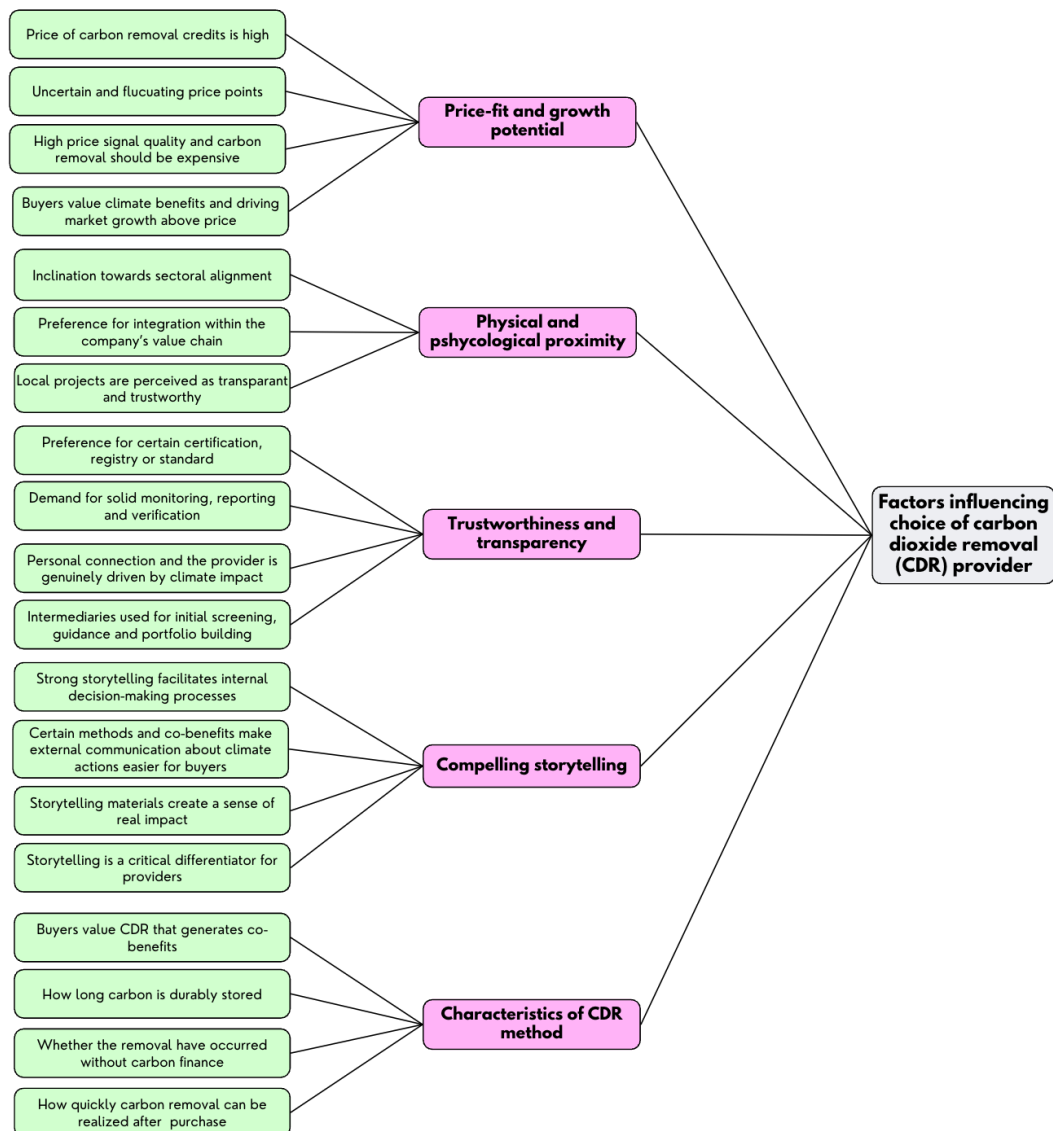


Figure 2a: Illustration of the data structure with aggregated dimensions of factors influencing choice of CDR provider and barriers to purchasing CDR

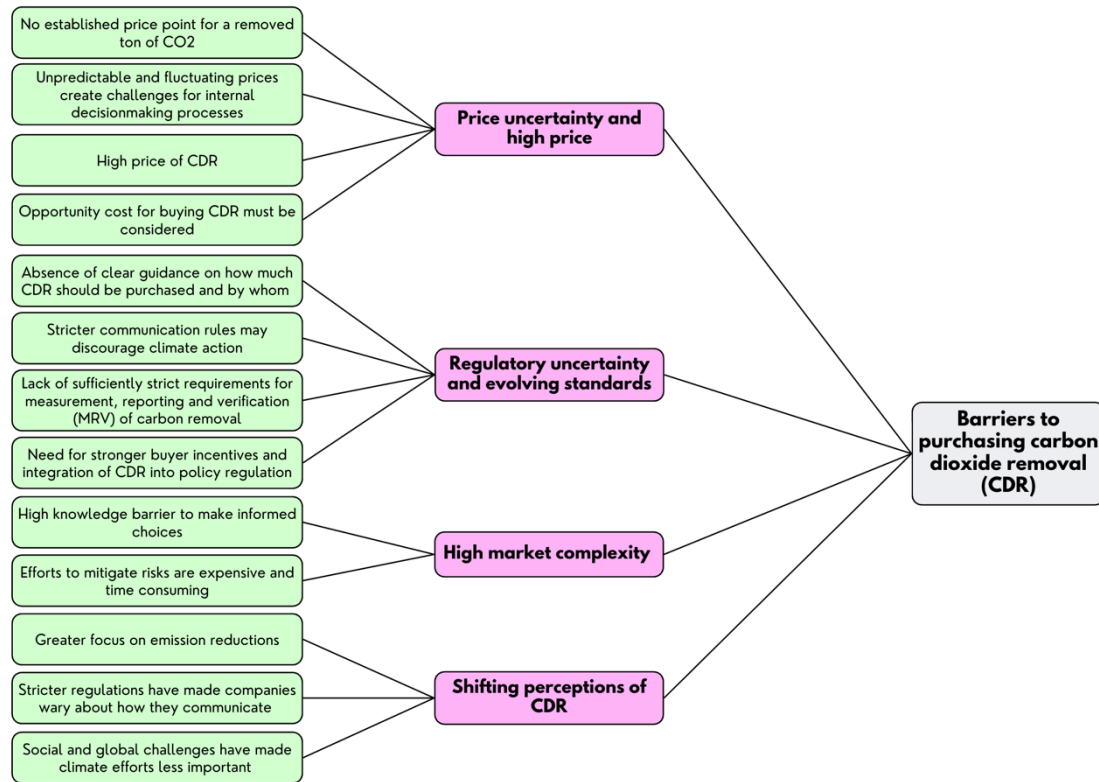


Figure 2b: Continuation of illustration of the data structure with aggregated dimensions of factors influencing choice of CDR provider and barriers to purchasing CDR

3.5 Synthesis of findings and development of framework

In this section, it will be explained how insights from the findings were combined with the theoretical concepts of business model innovation (BMI) and dynamic capabilities to develop a framework for business model innovation in the CDR market. The framework is presented more in depth in *5.1 A framework for business model innovation in the CDR market* and in figure 3.

Following the synthetization of empirical data, different theoretical concepts were considered which could be combined with the findings to answer the research questions. According to Cruz-Sanches et al. (2026), BMI is especially useful when the environment is characterized by uncertainty, technology advancements and changing customer preferences, all of which aspects were present throughout the findings. This made BMI and dynamic capabilities, which drive the process of BMI, fitting theoretical concepts to apply in conjunction with this thesis' findings.

Moving on, it was more closely explored how the theory could be connected to the empirical findings. The dynamic capability of sensing is carried out through market orientation, and going further, customer orientation, which is defined as systematically identifying customer's needs, both implicit and explicit (Cruz-Sanches et al., 2026). The findings revealed several factors influencing the choice of CDR provider and barriers with purchasing CDR, which were synthesized into customer needs and preferences. The findings can thus be seen as market signals, revealing customers' needs and preferences, which the provider can detect through the dynamic capability of sensing.

An additional connection was made: Teece (2018) and Ramdani et al. (2019) present different components of a business model such as revenue model, cost model and value proposition. Several insights from the findings could be connected to a provider's value proposition, cost model and revenue model. Therefore, the theoretical concepts and findings could be combined into a business model designed to include important aspects unique to the CDR market.

After making these connections, the basis of a framework started to appear. To answer the second research question, the framework must illustrate how providers can innovate their business model in the changing CDR market. Different ways to combine the findings with the theoretical concepts were explored, but in the end, a vertical framework moving from the market signals through a process of sensing, seizing and transforming into a reconfigured CDR business model was deemed to be the best way to illustrate how providers can carry out BMI in the CDR market. An arrow from BMI back to the sensing capability illustrates the iterative aspect of the framework. The sensing, seizing and transforming capabilities were presented as sequential steps, as a company must have detected the market signals before they can develop ways to adjust their business model accordingly. Likewise, they must know which adaptations to the business model must be made before they can transform their organization to sustain them. However, they are sequential in each cycle, but the BMI process is iterative, which will allow for a somewhat more cyclic approach when the framework is implemented practically. Questions, based on theory and insights from the findings, were included in each sensing, seizing and transforming box to help guide the process of each step.

4. Findings

Based on the interviews, several themes and categories could be synthesized and are presented in this chapter. The findings chapter presents the synthesized analysis of the interviews using the structure illustrated in figures 2a and 2b. The two aggregate dimensions of *factors influencing choice of carbon dioxide removal (CDR) provider* and *barriers for buyers purchasing CDR* make out the overarching themes of the analysis and the main sections of the findings chapter. Each of these have second-order themes, which make out the sub-sections. The first-order concepts are found throughout the text.

4.1 Factors influencing choice of CDR provider

This section outlines the aggregate dimension of *factors influencing choice of CDR provider*. It presents a synthesized summary of the interview findings and the second-order themes identified in the data analysis regarding how buyers select CDR providers: *price-fit and growth-potential; physical and psychological proximity; trustworthiness and transparency; compelling storytelling; characteristics of CDR method*.

4.1.1 Price-fit and growth-potential

The price of carbon removal credits is a key criterion for many buyers when selecting a CDR-provider. Many interviewees agree that the *price of carbon removal credits is high*, especially for engineered methods such as Biochar, Bioenergy with Carbon Capture and Storage and Direct Air Carbon Capture and Storage. However, many buyers and intermediaries do select these methods because they have other valuable characteristics, such as high permanence and approval by international standards. The less expensive and more mature alternative of land-nature-based CDR still attracts most buyers (it accounts for 99% of the carbon removed yearly (Lamb et al., 2024)). While land-nature-based projects have received criticism regarding permanence and additionality, the relatively lower cost per credit attracts buyers because they can get more removed carbon dioxide out of their purchase in comparison to more expensive alternatives. A buyer explained their strategy regarding choice of method:

“We want to buy credits of high quality, but there's a remarkable difference in price amongst alternatives. Biochar, which we are interested in, is often quite expensive, but

reforestation is usually much less costly. Not that it's inexpensive, but it's a huge difference."

The *uncertain and fluctuating price points* of some methods also trigger a preference for providers who can offer more predictable pricing. Currently, there is a lack of standardized benchmarks of what a negative ton of carbon is worth. The price per ton for some methods may shift from one week to another, which makes it difficult for buyers to budget for CDR efforts and make cashflow analysis for investment decisions. However, some methods offer more price stability than others, for example land-nature-based solutions, which makes it the preferred choice for some buyers and intermediaries. An buyer explained their reasoning on CDR pricing as:

"We'd like to do our budget one year in advance, so it's a huge advantage if the CDR price is stable, which reforestation projects often are. Some CDR projects have spot-prices, which makes it harder. To get a fixed cost, we'd have to make an agreement, but I'm not sure we purchase the volume that motivates such an agreement."

However, some interviewees expressed that *high prices signal quality and carbon removal should be expensive*. Given that carbon credits were created as a tool to limit emissions, several interviewees emphasized that purchasing CDR credits should be costly, so that the incentive to keep reducing emissions within a company remains. Many interviewees noted that CDR credits should not be used to easily pay for your way out of massive carbon emissions. According to an intermediary expensive carbon credits can act as a driver for real emission reductions as they create financial pressure on companies to reduce emissions rather than relying solely on offsetting. Furthermore, according to some interviewees, high prices signals a perception that the provider is serious and conduct carbon removal in the correct way, thus increasing the perceived quality of the CDR credit. An intermediary described how they reasoned about pricing:

"We focus on a niche with nature-based carbon removal credits where the price is good for the carbon farmer and high enough for a company to hurt a little bit, and therefore also drives reduction efforts within the company. Then you don't end up with a company that just buys carbon credits to offset and then continues polluting."

While price seems to be important, the interviews revealed that some *buyers value climate benefit and market growth above low prices*. This is connected to the fact that there is often an inherent will among CDR buyers to contribute to a more sustainable planet. Some buyers and intermediaries state that they often select high-cost and long-term solutions to facilitate market growth. Many buyers want to drive change toward a functioning CDR market and supporting growing CDR projects is a way to do this. In these cases, the upscaling potential of the company were taken into consideration by buyers. Buyers looked for clear roadmaps from providers outlining how costs are expected to decrease over time, which can support long-term investment decisions. The team and mindset of the CDR provider was also considered of great importance when evaluating their potential to scale. Further, an intermediary from the webinar explained that a CDR buyer often start with the lower cost, near term removals, and then gradually transition toward more expensive and durable CDR as their budget and knowledge increase. One intermediary from the webinar explained their selection strategy as:

“We are explicitly leaning toward high-leverage purchases, because we think the ecosystem needs more bets being made, and more altruistic, catalytic buyers focused on innovation.”

Further, Blue explained their perception of how actors view provider’s upscaling potential:

“Platforms and major clients want CDR producers to have a clear plan for a downward price trend. They ask, ‘What is your price right now? What do you want to achieve in a year, and what are your future goals?’ And then they want to see a downward trend.”

4.1.2 Physical and psychological proximity

A recurring theme across interviews is that buyers of CDR solutions tend to prefer projects that are physically and psychologically close to their own operations. This closeness can take several forms, including alignment with the company’s industry, integration within its value chain and geographical proximity to its markets or operations.

Several interviewees highlighted the *importance of sectoral alignment*. Companies are often more inclined to invest in CDR solutions that are related to their own industry. For instance, firms with a connection to marine environments show stronger interest in marine CDR. An intermediary actor described how projects are actively matched with buyers based on industry relevance, for example textile companies are connected with regenerative cotton initiatives, food companies with land-nature-based projects and shipping companies with ocean-based solutions. This matching process is seen as important for creating both strategic relevance and internal engagement within the buying organization, and exemplified...

"As an intermediary we look at the customers interest, what is their value chain and supply chain? And choose a carbon farmer close to their business, physically close or physiologically close to their industry. It makes more sense to the buyer."

In addition to industry alignment, *integration within the company's value chain*, often referred to as "insetting", emerges as a key preference. One company emphasized that investments are increasingly directed toward projects that addresses emissions within their own operations, such as transitioning factories to renewable energy sources. This approach is perceived as more impactful, as it targets emission sources the company directly influences. The company also stated that if they were to resume purchasing CDR in the future, it would need to address their most significant environmental impact, which is largely linked to cotton production. Therefore, regenerative agriculture would be of interest, as it not only enables carbon removal but also can contribute to improved biodiversity. Another buyer described a shift from investing in land-nature-based projects only toward including Biochar production, motivated by high permanence, the opportunity to integrate CDR into its own value chain and making a sustainability impact in the country in which they operate. In this case, Biochar was seen as directly linked to agricultural inputs used to make their products, while also supporting regenerative farming practices by increasing soil moisture retention, improving soil structure and reducing the need for synthetic fertilizers. As the buyer explained:

"I think it adds a lot of value that the Biochar is produced here, unlike the forestry projects we invest in, this is a local climate action. It's really great to be able to bring

something back home to Sweden where we operate. The other thing is that it fits right into our value chain.”

Geographical proximity also plays a significant role. Several informants expressed a preference for local CDR projects in the country where they operate. For instance, a buyer emphasized the importance of local proximity and control, highlighting investments in nearby Bioenergy with Carbon Capture and Storage facilities and local district heating solutions. *Local projects were perceived as more transparent, trustworthy* and easier to monitor. Another company similarly expressed interest in investing in CDR closer to the business, valuing the ability to contribute to domestic climate solutions while strengthening local value chains. Blue also mentioned that their customers had asked if marine CDR could be done in Sweden and at the same time solve local problems such as eutrophication. However, local and value-chain connected projects are also seen as more commercially viable in certain contexts. According to one certifier, projects with strong local networks and direct connections to businesses within the same value chain are more successful in direct sales. This suggests that proximity not only influences buyer preferences but may also impact scalability and market success of CDR projects. One intermediary noted:

“We’ve seen a growing demand for local projects. I think that’s also a consequence of the trust issue, people are looking more toward local projects, the kind of things they feel they have a bit more control over.”

However, this preference for local solutions also creates challenges. One intermediary noted a mismatch between demand and supply, as many buyers seek local projects, particularly in Sweden, where the availability of high quality, verifiable projects remain limited according to interviews. In some cases, available projects are restricted to certain certification standards that are perceived less robust, which further complicates procurement decisions.

4.1.3 Trustworthiness and transparency

The CDR market is fraught with uncertainty and lacks standardization. There exist several methods, CDR providers, registries, shifting regulations and guidelines,

conflicting scientific reports and news articles regarding different CDR methods' effectiveness, making buyers unsure of how to act and who to listen to. Accusations of fraud and shifting perceptions towards the effectiveness of CDR credits have made the subject complex and volatile. Considering this environment, there is no wonder all interviewees state that trust and transparency are the most vital criterion when choosing a CDR provider.

As CDR methods need to be verified, and credits need to be certified and registered by a third-party to exist for trading, buyers' purchasing decisions can be based on which certifier and standard the CDR provider adheres to. It was revealed in the interviews that buyers often show a *preference for a specific certification, standard or registry*. Some interviewees only considered CDR credits registered on a specific platform. Some demanded that the CDR method must be included in EU's carbon removal certification framework, where they are developing certification methodologies for technologies such as Bioenergy with Carbon Capture and Storage, Direct Air Carbon Capture and Storage and Biochar (European commission, 2026). One buyer explained their reasoning behind preferring a certain registry:

"We make sure that the CDR provider we choose exists in our preferred registry, and that there is solid portal verification and post verification. Other registries have gotten some negative publicity, so we are more at ease with the one we know."

That a CDR provider signal trustworthiness is crucial. This is foremost achieved by having solid scientific evidence for their method and transparent calculations of its effectiveness, as well as *solid measuring, reporting and verification (MRV)*. Deliberately obscuring some parts of its processes or having unaddressed risks or weaknesses, immediately make all the interviewees lose trust in the provider. If the method is well-tested, the provider has operated for a while and is financially stable, many interviewees feel more confident in choosing the provider. As many buyers fear being the first customer and seek social proof, providers that showcase current customers were brought up as more attractive and trustworthy. Physical proximity is for some interviewees connected with quality and trust, as this enables easier audits and controls. According to an intermediary, some countries are entirely avoided because of

frequent accusations of fraud in the past and connections to lower-quality certification bodies. One buyer described their demand for solid MRV as:

“You need to be able to show how much carbon you are removing and have clear calculations. To my understanding, a lot of criticism against CDR credits is that there is layer upon layer of providers, making it hard to know things like: Where is the money going? Which projects are we supporting? What is the impact and tractability?”

Further, the buyer perceives the CDR provider as more trustworthy if the buyer feels a *personal connection and the provider is genuinely driven by climate impact*. According to some buyers, they feel a personal connection with the CDR team, when the buyer and provider share the same values and mindsets regarding sustainability. As the market is voluntary, a provider who is predominantly focused on profit maximization may fail to meet buyers on a personal level, since buyers are often intrinsically motivated by a will to contribute. It also makes buyers question if the provider has the motivation to really ensure that the removal is done correctly. Thus, for most buyers, a profit-maximization focus reflects negatively on the perceived quality of the CDR credit. Likewise, if the CDR provider is pedagogical and has the right values, interviewees are positive. One buyer explained their view on the mindset of the providers:

“A warning signal is when the providers are a bit cynical and you get the feeling that they are only in it for the money. We lose the personal connection because we don’t strive for the same thing, and I also start to doubt the quality of their removal, as they might not be mindful in getting it right.”

One reoccurring theme was that buyers use *intermediaries for initial screening, guidance and portfolio building*. Intermediaries, act as a shortcut to guarantee sufficient measurement, reporting and verification (MRV), while also ensuring that established standards and requirements are followed. If a CDR provider is present at an intermediaries website, it has already passed their initial screening, reducing the risk of fraud. If the buyer is nonetheless accused of supporting a project of poor quality, the buyer can redirect some of the attention towards the intermediary, providing an extra layer of safety. Further, as it is very time-consuming and difficult to understand the CDR market to make informed decisions, buyers use a third-party, such as advising

intermediaries, marketplaces, industry advisors or sustainability consultants to get advice and support. Depending on the intermediary, they take care of audits, calculations and offer guidance. Some interviewees are tuned toward a specific niche that the buyer is interested in. One interviewee explained that if the intermediary has a clear view of the future they want to achieve and know their role in it, they feel safe to trust their guidance, instead of bearing that burden themselves. Several interviewees agree that it is very positive that intermediaries offer tailored portfolios of CDR projects, effectively dividing risks and adjusting to the buyers' wishes, budget and value chain. One buyer explained how they used a consultancy to aid them in their CDR purchases:

“When we selected CDR-providers we used a consultancy who was expert at different kinds of carbon credit projects. They had knowledge about the CDR market. Then we also looked at which standards and certification the provider had.”

4.1.4 Compelling storytelling

Storytelling emerges as an important factor influencing how buyers evaluate and select between different CDR methods and providers. Through interviews with several actors, storytelling is described not only as a sales tool for providers, but also as a means for buyers to justify, communicate and derive broader value from their CDR investments.

From the buyer perspective, strong storytelling by the provider can *facilitate internal decision-making processes*. Two informants noted that a great story makes it easier to gain approval from management. However, this effect is moderated by price, costly methods may still be difficult to justify since they result in fewer carbon credits. As one buyer motivated...

“The co-benefits and the storytelling make it much easier to justify the choice of supplier. It also makes it easier to convince my fellow partners that, even though we're paying a larger sum of money, it's going toward something that benefits many people.”

Further, *some methods and co-benefits make external communication about climate actions easier*. Certain CDR methods, such as land-nature-based methods are perceived

as easier to understand and communicate to end consumers, particularly in business-to-consumer contexts. Similarly, when CDR projects are aligned with the company's value chain or industry, it becomes easier for the company to build a coherent sustainability story toward customers and stakeholders. Co-benefits such as biodiversity improvements and job creation further strengthen storytelling. One buyer emphasized that co-benefits made it significantly easier to justify investments internally, as stakeholders could see that the investment contributed to multiple positive impacts. Several buyers also noted that CDR investments can strengthen their brand by enabling them to communicate climate action to customers and attract employees. In this sense storytelling is not only a factor in selecting a provider but also a mechanism through which companies create internal value. One buyer highlights the importance of co-benefits and storytelling:

“We felt that reforestation projects were more effective from an educational perspective. People understand the value of planting trees, but we also appreciate the local benefits. The certifier of these projects was created to combat poverty from the start and encourage local entrepreneurship. It was a collaboration with many small farmers. They might own a hectare or up to ten hectares or something like that, so it allows small landowners to do this and move toward a better life.”

Intermediaries confirm the importance of storytelling in influencing purchasing decisions. One intermediary highlighted that especially for smaller buyers a compelling story combined with local relevance is sufficient to drive purchasing decision. Some intermediaries develop storytelling materials, for example, annual impact reports that include project descriptions, images and information about how funds are used at project level. These *storytelling materials are described as creating a sense of real impact* and strengthen customer retention. Another intermediary emphasized that long-term commitments to CDR projects by the buyer enable stronger storytelling compared to single purchases, because they allow companies to demonstrate commitment to sustained climate impact over time and integrate it into their broader sustainability strategies.

“The storytelling is not even that much focused on carbon. Carbon is just something used in the formula to decide for example how many trees you will plant. The

storytelling is about, we want a good-looking world, we want a safe environment, we want biodiversity, we want local social impacts in the place where we build it. It gets communities together.”

From the perspective of certifiers, *storytelling is currently a critical differentiator* in a market where supply exceeds demand. Projects that communicate their activities in an engaging and transparent way are more successful in attracting buyers. At the same time, the importance of storytelling may decrease as demand for CDR increases and the market matures. A lack of storytelling from providers or an unwillingness to communicate the purpose and motivation behind a project is perceived as a red flag, because it raises concerns about credibility and the underlying intentions of the provider. Many buyers expect providers to clearly communicate their climate driven motivations and want to see a genuine commitment from founders.

“The way you are able to communicate your projects or let brokers communicate your projects, that is crucial. It will differ in the future when the demand for credits will be higher than the supply. Then it will change a bit because then, probably, organizations will focus more on price. They will just want to get the cheapest credits, probably. But right now, to be able to sell your carbon credits, you just have to be a good salesman.”

CDR providers themselves also recognize the role of storytelling in positioning their offerings. For instance, Blue highlighted how they work with brand identity and their communication around their natural ocean-based method, the fact that the sea is underutilized and that their high permeance method can help ocean restoration, which many of their customers value.

4.1.5 Characteristics of CDR method

The characteristics of different CDR methods play a central role in shaping buyer preferences and supplier selection. CDR is not perceived as a standardized commodity market where all credits are viewed as interchangeable. Instead, buyers often have different preferences and proprieties regarding the characteristics of the CDR method. Across interviews, four key dimensions emerge as particularly important: co-benefits, permanence, additionality and deliverability. As a result, project developers need to

identify which buyers are most suitable for their specific method and must position and communicate their projects toward the right audience. One certifier emphasized that matching the right CDR method with the right buyer is an important aspect of provider selection and market growth:

"What we observe today is that CDR is not a commodity. There are hundreds of buyers and there's probably hundreds of sellers and they each have different characteristics and so they each must discover who's their audience. If you're a project developer, you need to make sure that you're running a project and generating carbon dioxide removal credits where the characteristics are attractive to a buyer."

Co-benefits are frequently highlighted as a significant factor in decision-making and interviewees generally *value CDR that generates co-benefits*. Buyers value projects that generate positive social and environmental impacts beyond carbon removal, such as contributions to biodiversity, local communities and broader sustainability goals. Several interviewees emphasized the importance of aligning CDR investments with the United Nations Sustainable Development Goals (SDGs), including poverty reduction, human rights and access to clean water. Nature-based methods are perceived as particularly strong in this regard as they tend to generate multiple benefits at the same time. For instance, land-nature-based methods can provide shade for agriculture, support local livelihoods and contribute to ecosystem restoration. These co-benefits make some buyers, intermediaries and certifiers show a clear preference for natural solutions. One buyer emphasized the importance of receiving direct value from the co-benefits of their chosen CDR method, such as energy or heat from Bioenergy with Carbon Capture and Storage or Biochar:

"Emissions-free district heating is the reason we are investing in Bioenergy with Carbon Capture and Storage, we want to support and ensure that we achieve net-zero district heating in order to meet our climate goals."

Permanence refers to *how long carbon is durably stored*, and all actors generally agree that more permanent solutions are preferable. For example, some buyers expressed a clear preference for Bioenergy with Carbon Capture and Storage, Direct Air Carbon Capture and Storage or Biochar due to higher durability compared to land-nature-based,

where carbon storage may be reversed due to risks such as fires or land-use changes. However, despite these concerns less permanent methods like land-nature-based methods are still widely used, primarily due to their significantly lower cost. This shows a trade-off between quality and affordability in current purchasing decisions. One intermediary described a shift from their customers towards novel, high permanence methods. This shift was partly explained by strong lobbying from actors promoting methods such as Bioenergy with Carbon Capture and Storage, often emphasizing the risks associated with land-nature-based solutions, for example that forests can be destroyed by events such as wildfires, making carbon storage less durable. One buyer that has invested in land-nature-based CDR for many years and now has begun to invest in high permanence Biochar said:

"The biggest drawback of the trees has always been its permanence. How can we guarantee that? Our contracts and certifications are for 20 years; extending them beyond that would be unethical. Should you have a contract that lasts longer than a generation? What does the children want to do with the trees? I mean, that wouldn't be fair either."

Additionality is defined as *whether a project would have occurred without carbon finance* and is another factor concerning buyers' decision. Several interviewees raised concerns about additionality of certain land-nature-based projects, where activities as planting or conservation might have taken place regardless of carbon credit revenues. Intermediaries, providers and buyers all emphasized the importance of ensuring true additionality, although acknowledging that it can be difficult to verify in practice. One intermediary highlighted:

"We always look at how projects address additionality."

And Blue argued:

"Many argue that in forestry, harvesting and replanting are a natural part of the process. Forest owners normally harvest trees and then replant afterwards. However, some actors now claim that they would not replant unless they receive climate-related financial compensation, even though replanting has traditionally been a natural part

of forestry practices. In our industry, discussions around additionality and permanence are therefore extremely important.”

Deliverability, referring to *how quickly carbon removal can be realized after purchase* is also an important consideration. Many buyers are driven by short-term climate targets and reporting requirements which creates demand for solutions that can deliver short term measurable impact. For example, some buyers expressed interest in spot purchases to ensure that their emissions are offset within the current reporting period. Spot purchase mean that you buy CDR credits that has already been removed and verified. One intermediary noted that they want to help customers with offsets today and to do so, low-cost, near-term removal and avoidance projects is necessary in the portfolio to offer customers a reasonable price. At the same time, they also work with pre-purchase claims, which are investments in future CDR projects. Another intermediary state that many customers want to reach their climate goals during the occurring year which make customers choose cheap land-nature-based projects with lower permanence compared to other more durable methods. One buyer stated that:

”We do still buy some lower-cost, near-term solutions because we have an annual carbon-neutral commitment, but we’re slowly trying to work towards fully compensating that with durable CDR, there’s just not a ton of deliveries happening, so that makes it a little bit challenging.”

An intermediary further explained that buyers often begin with lower-cost, near-term removals to meet annual climate targets and budget constraints and gradually increase the durability of their purchases as budgets and market maturity develop over time:

”Most buyers start with near-term, lower-cost removals. They’re often working with a target budget and trying to maximize both impact and catalytic purchasing within that per-ton budget. So you’ll see companies start with near-term, low-cost removals and then work over time to increase their annual budget, and with it, the durability and technology profile of the purchases they’re making.”

4.2 Barriers to purchasing CDR

This section reports findings related to the main barriers making a buyer hesitant to purchase CDR. In this thesis, a barrier refers to factors that either complicate the purchasing decision or are perceived as significant enough to prevent a purchase entirely. Four main barriers were derived from the interviews: *Price uncertainty and high prices*, *Regulatory uncertainty and evolving standards*, *High market complexity* and *Shifting perceptions of CDR*. Several concerns regarding pricing were brought up, such as the lack of an established price point for a ton of CO₂, as well as fluctuating prices making investment decisions harder. The uncertain regulatory landscape also poses a barrier, as well as a shifting view of the effectiveness of CDR. The large number of methods, conflicting views and changing recommendations make the process of making an informed choice difficult and time consuming.

4.2.1 Price uncertainty and high price

A key barrier to CDR adoption identified across interviews concerns its price, such as too high prices, price variability and a lack of standardized benchmarks of what a negative ton carbon dioxide is worth. The pricing not only limits the number of companies willing to purchase carbon removal credits but also influences which methods are selected, often favoring lower-cost options over potentially higher quality but more expensive alternatives. Unlike more mature markets there is currently *no general established price point for a removed ton of CO₂*. Instead, prices are largely determined by individual suppliers, often based on their production cost and chosen method. This results in a significant variation across methods and providers, contributing to a fragmented market which is difficult to navigate. One certifier explained how providers come up with the price of a ton removed carbon dioxide:

"For actors to come to a certain price point is kind of like just looking at how the wind blows, and then you have a price. There's not really a very specific price. It's the production costs, generally."

Further, *unpredictable and fluctuating prices create challenges for internal decision-making processes*. For buyers, there is considerable price uncertainty related to both short-term pricing, such as expected prices in the coming year, and how prices from

specific methods and providers may develop over time, creating substantial challenges for decision-making. One buyer highlighted that the lack of reliable pricing is a major barrier to investment decisions. Without a clear understanding of what a ton of CO₂ removal, particularly from technologies such as Bioenergy with Carbon Capture and Storage, costs it becomes difficult to assess financial viability or incorporate such investments into cash flow calculations. Similarly, another buyer emphasized that fluctuating prices, particularly for Biochar, make it difficult to budget for CDR within internal carbon pricing frameworks and therefore stick to more mature forestry projects where prices are more or less the same. The inability to present stable and predictable costs to management limits the willingness to invest, even in methods that are otherwise considered attractive. As is explained in this quote by one interviewee:

“There’s the issue of transparency in the market. Because right now, we actually don’t know how much a ton of Bioenergy with Carbon Capture and Storage costs. People are doing some sort of reverse engineering on this, but it’s very unreliable. It’s pretty much impossible to put a price on it, and being able to put a price on something is, after all, what we need to do to assess how large the cash flow might be in the future, and whether we can finance it or not. This lack of transparency, especially when it comes to pricing, is a major obstacle for us.”

Another point raised was the generally *high price of CDR*. Several interviewees noted that the price for CDR can be very high, depending on what method or supplier you choose and how large volume you want to purchase. Blue described how their current price levels make it difficult for larger organizations to adopt their solution broadly, for example when aiming to offset emissions on a per-employee basis. While such costs may be manageable for smaller companies, they become significantly more challenging as the scale increases. As a result, price differences between CDR methods can be decisive in determining which solutions buyers ultimately select. One certifier stated that high prices is a major barrier, and lower price would increase adoption:

“The lower the unit price, then the easier it would be for more industries to use it as part of their toolkit for decarbonization.”

A few interviewees brought up that the *opportunity cost for buying CDR must be considered*. One interviewee had ceased buying CDR credits as they deemed that they could make a bigger impact on their emissions by investing in reduction projects in their value chain. Another interviewee pointed out that investments in, for example, Direct Air Carbon Capture and Storage could be used for other climate efforts in your organization, pressing on the fact that:

“A company must have come a long way on their sustainability journey to consider something like Direct Air Carbon Capture and Storage.”

4.2.2 Regulatory Uncertainty and Evolving Standards

A major barrier to the development and adoption of CDR is the lack of clear standards, regulatory frameworks and consistent guidelines. The current market is largely voluntary and fragmented, creating uncertainty for both buyers and providers and limiting the scale and speed of adoption.

From a buyer perspective, the *absence of clear guidance on how much CDR should be purchased and by whom*, creates hesitation. One informant from the financial sector emphasized the need for clearer frameworks, to provide directions for buyers. Without such guidance it becomes difficult to justify investments internally or determine what constitutes a “sufficient” level of action. At the same time, one buyer pointed out that being highly engaged in the CDR space and conducting thorough sustainability calculation may unintentionally create negative consequences. The interviewee explained that their company had carried out significantly more detailed emissions assessments than many industry peers, which made their reported emissions appear substitutionally larger in comparison. This creates a paradox where companies that actively seek to take greater responsibility for their climate impact risk appear less sustainable than competitors that apply narrower reporting boundaries or conduct less detailed emissions assessments across their value chains. This highlights the broader uncertainty experienced by buyers regarding both expectations and responsibilities within the CDR market, as one buyer expressed:

“We want clear requirements. What types of companies should purchase CDRs, and in what quantities?”

Intermediaries also highlight challenges related to how companies are allowed to communicate their climate actions. One platform noted that recent regulations around green claims, which intended to reduce greenwashing, may have had unintended consequences. Companies have become more cautious in communicating about carbon removal and instead focus on emission reductions, which some interviewees state may lead to shifting attention away from purchasing CDR. This creates a paradox where *stricter communication rules may discourage transparency and broader climate action*. A previous CDR buyer discussed this shift in sustainability communication:

“The trend has shifted against communicating about sustainability, and one factor is an EU regulation called the Green Claims Directive. Then there’s another one, Empowering Consumers for the Green Transition Directive. These are two regulations that deal with sustainability communication. Under them, you simply have to verify all sustainability claims you make. Within these regulations, it has been prohibited to make net-zero claims. That eliminates all forms of carbon offsetting and communication about it.”

Another barrier highlighted by the interviewees is the lack of clear and supportive policy which creates uncertainty for buyers in the CDR market. From a policy perspective, several interviewees pointed to the *need for stronger buyer incentives and clearer integration of CDR into existing regulatory systems*. Suggestions include tax incentives and formal recognition mechanisms, which would incentivize and acknowledge buyers, as well as integration of CDR into frameworks like EU Emissions Trading System (EU ETS). Blue also emphasized that a broader recognition of different CDR methods at the EU level, including marine based solutions, would provide legitimacy and simplify purchasing decisions. Blue argued that mandatory requirements for CDR purchasing would be transformative as the current market relies on voluntary action. The need for stronger incentives and political support was highlighted by this buyer:

“Purchasing carbon credits while reducing emissions is currently the best way for companies to manage their emissions or take responsibility for them. And here I would love to see political support to open things up, to make it easier for companies that actually take responsibility. Perhaps give them tax breaks or some form of recognition, like a registry or something that shows they’ve taken responsibility for their emissions, or at least VAT breaks when they buy carbon credits.”

One intermediary expressed that a barrier for some buyers is the difficulty of trusting that the carbon removal credits they purchase will deliver the promised climate impact. In particular, some buyers perceive a *lack of sufficiently strict requirements for the measurement, reporting and verification (MRV) of carbon removal*. As a result, some buyers request increased requirements and stricter standards for CDR providers regarding MRV processes in order to ensure high quality and credibility. Buyers want reassurance that the carbon removal credits they purchase can be trusted and deliver the climate impact they are promised. However, although these demands are driven by a legitimate need to transparency and quality assurance, stricter standards and requirements may also introduce new challenges, particularly for smaller CDR project developers. One intermediary highlighted that as regulatory requirements become more complex and costly to comply with some smaller or early-stage climate projects risk being excluded from the market. This creates a trade-off between improving quality and maintaining diversity and innovation within the CDR ecosystem. According to one intermediary many valuable CDR projects may struggle to survive under increasingly demanding regulatory conditions, despite their potential contribution to climate action:

“Quality improvements and increased requirements are good and necessary and make it safer for customers to buy because it ensures that they get the climate benefits they’re paying for. At the same time, I know that for many smaller climate projects, it will become very expensive for project developers, and it will essentially be impossible for them to comply with all these upcoming regulations. So then, a fairly large portion of the climate projects that are also needed will be disqualified.”

4.2.3 High market complexity

With the CDR market being uncertain and undeveloped, a substantial effort for purchasing CDR credits is required by the buyer. A lot of different methods to understand and choose between, conflicting reports criticizing CDR and its methods and cases of fraud have made many interviewees wary and unsure. Buyers fear that the CDR method will lead to negative side effects at the production site, such as loss in biodiversity or loss in income of the local population. In addition, buyers are afraid of getting bad media exposure from their investments in CDR. To avoid these dangers, buyers must educate themselves on the CDR landscape, which is no easy feat as it is constantly shifting and growing. Thus, there is a *high knowledge barrier to making an informed choice* of a CDR-provider. Buyers must conduct research, data control, audits and demand transparency from providers. An interviewee expressed their view on the complexity of the CDR market:

“It’s generally hard to know if a project is good or bad. At first, I was positive and liked the idea of a new CDR project, but then an article was published that had another view, which made us hesitant.”

However, understanding this complex market and making efforts to reduce risks makes the *process of purchasing CDR expensive and time consuming*. One common solution is to outsource some of these efforts to an intermediary, who has knowledge of methods, market trends, ethical principles and ultimately functions as a second layer of certification. Many intermediaries also offer portfolio services, where buyers can invest in many projects at the same time, which limits the perceived risk. Many buyers do not want to be a provider’s first customer and stated that seeing existing customers strengthens a provider’s trust. However, all intermediaries and certifications are not of the same quality so buyers feel like they must be careful in their selection of these as well. One buyer described their partnership with an intermediary as:

“We are experts at what we do, but not at carbon removal. It would be very time consuming to understand what is ethical and unethical, and what you need to think about. It’s nice to have an expert who you can discuss with and who recommends credits from projects they believe in that fit our wishes.”

Regardless of whether you do the knowledge-seeking yourself or outsource it to an intermediary, it requires a substantial effort, and as it is currently not required by companies to remove carbon, this may discourage potential buyers. Buyers must spend their money on understanding the CDR landscape rather than purchasing credits.

4.2.4 Shifting perceptions of CDR

The findings revealed that in recent years, the perception of carbon removal as a vital part in companies' climate strategy has shifted amongst standard-setters and governing actors, industrial buyers and the public. In the late 2010s, a perception that companies in parallel to their emission reduction also should remove carbon was fueled by a great public interest in climate change. Today, interviewees report that this perception, due to criticism against CDR, has shifted to a *greater focus on emission reductions*. According to a buyer, standard-setting and governing actors such as EU and Science Based Targets, emphasize that CDR efforts should not be implemented unless the company already implements ambitious emission reduction. When recommendations change, many companies have transitioned their focus from CDR towards emission reductions. One interviewee had ceased buying CDR altogether believing they could achieve more by investing in emission efforts along their value chain:

"I am skeptical because CDR can take away focus from the actual work of reducing emissions. EU and Science Based Targets have changed their language around climate targets and stress that CDR should never be used as a replacement for actual emission reductions. We need to put our resources toward other efforts in our value chain rather than CDR."

Along these lines, many buyers emphasized that emission reductions remained their primary climate action, while CDR was only a complement to an already ambitious climate strategy. However, many interviewees still see CDR as a vital part of their climate strategy. Some interviewees in service-based companies, who generally had quite low emissions, bought CDR credits to take care of their emissions. Other interviewees stressed that reduction and removal must be implemented simultaneously,

as there are some emissions that are impossible to reduce. One interviewee described how they incorporate CDR in their climate strategy:

“Our strategy is to measure, reduce and remove. We have worked hard on reducing emissions and have achieved great results. A few years ago, we wanted to do something extra, so we started removing carbon to account for the emissions that were left and more.”

Connected to this are the recently installed policies regulating communication about climate efforts. The *stricter regulations have made companies wary about how they communicate* their climate action. A few years ago, it was common practice in sustainability communication to use words such as ‘climate neutral’, ‘net zero’ and ‘climate compensated’. However, a common meaning for these words did not exist, leading to misunderstandings and customers feeling misinformed. This was acted upon by EUs Green Claims directive, and Science Based Targets, regulating the use of such words in the communication of sustainability efforts, effectively forbidding the use of ‘net zero’. Today, many interviewees state that they and their industry peers are much more aware of how they communicate about CDR purchases. They much rather undersell their engagement to avoid being targeted by media or EU regulations. Several interviewees also state that they know of companies buying CDR secretly. To combat ‘green washing’, actors in the CDR market now rather experience ‘green hushing’, which makes buyers even more hesitant towards CDR. Further, according to some interviewees, this new regulation has the opposite effect it’s meant to have, leading companies to communicate heavily about emission reductions while neglecting to address the remaining emissions that cannot be eliminated through reductions alone. One interviewee expressed their view on how climate communication has changed the CDR market:

“Today, people are more afraid to talk about their climate efforts. They do things but don’t say anything or tone it down significantly, which is sad because a lot of companies do a lot of good.”

The Green claims directive was further problematized by an intermediary:

“It’s a balancing act; you should not be able to say anything without proving it. Green claims was meant to counteract greenwashing, but in some ways, it has led to companies who are communicating aggressively about their emission reductions while not taking care of the emissions they do have. That, if anything, is a form of green washing.”

Further, *social and global challenges have made climate efforts less important* to both the public and for companies. Uncertain geopolitical tensions and a financial downturn have drawn attention away from climate issues, making companies shift focus to more present challenges. Buyers also noticed that their end customers were not as concerned about climate change as they were a few years ago due to factors such as the covid pandemic, oil crisis and the wars in Ukraine and the Middle East. This lack of interest coupled with a financial downturn and strictly regulated communication has made CDR drop on companies’ agenda. One buyer explained that they had noticed this trend among its customers:

“Our customers have had lots of things to consider these past years: a pandemic, wars, inflation and AI. If the climate was very important in 2020, it is not as important today. Customers don’t have the energy to consider everything, so we have noticed a decline in climate concern.”

CDR purchases has decreased from companies who previously bought CDR mainly as a tool to use in their sustainability communication. An intermediary noticed a downward trend amongst especially business-to-consumer companies, because of the strict communication regulation and the lessened public interest, which has redirected the reason for buying CDR to other factors:

“Two years ago, many buyers were companies who wanted to communicate that they were climate neutral or had targets of being net-zero through carbon removal. Today, we see more buyers who want to drive innovation or contribute to biological diversity. It’s more of a contributing mindset rather than communicating that you are net-zero.”

5. Theoretical discussion

This section brings forth aspects from the theoretical framework together with the findings to deepen the analysis from the previous chapter. In doing so, a framework is proposed that illustrates the transformative journey a provider may make to detect and adapt their business model to the evolving carbon dioxide removal (CDR) market. Lastly, the thesis's overall contribution to theory is discussed.

5.1 A framework for business model innovation in the CDR market

As the CDR market is characterized by uncertainty and is thus continuously evolving, so must the CDR provider's business model. Based on the analysis, a framework is proposed that describes how a carbon dioxide removal (CDR) provider may adapt and reinvent their business model to better meet customer needs in the uncertain and shifting CDR-market (*figure 3*). By comparing and reconfiguring the results from empirical analysis with theory of business model innovation (BMI) and dynamic capabilities (Teece, 2018; Ramdani, 2019; Cruz-Sanches et al., 2026), a framework depicting the three phases of BMI in the CDR market was deemed to be the best fit to illustrate how CDR providers can innovate their business models. This BMI is driven by the dynamic capabilities of sensing, seizing and transforming presented by Teece (2018).

The analysis presents two aggregate dimensions: *factors influencing choice of provider* and *barriers for purchasing CDR*. *Factors influencing choice of provider* describe what a buyer values when they venture to buy CDR, while *barriers for purchasing CDR* describe what hampers market growth and triggers the need for BMI. The content of these aggregate dimensions can thus be seen as market signals that inform a provider of possible opportunities and threats.

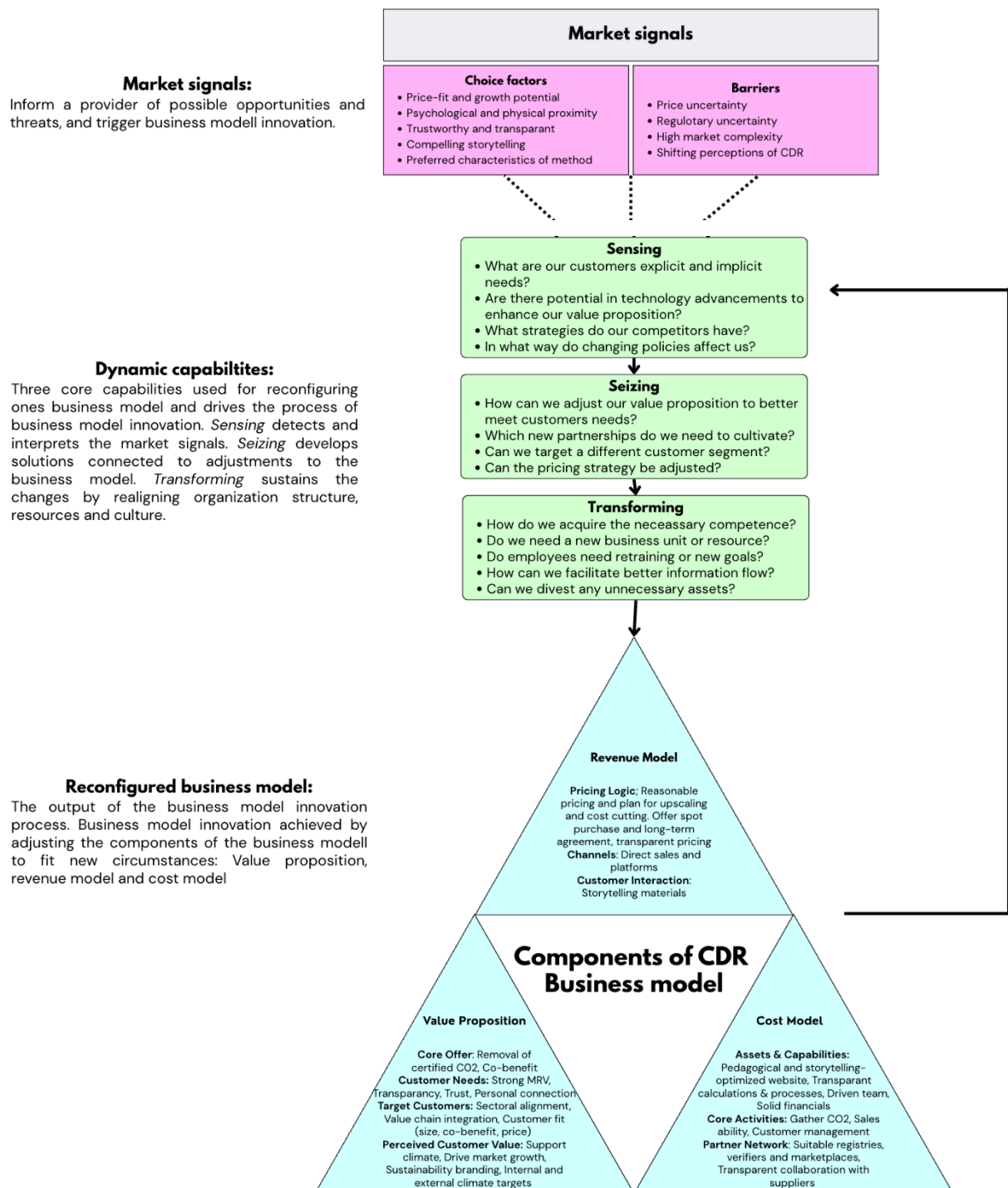


Figure 3: A framework for business model innovation for CDR providers

5.1.1 Dynamic capabilities driving business model innovation

The dynamic capabilities of sensing, seizing and transforming drives the process of BMI, leading to a transformed business model. From the sensed market signals that

were revealed in the analysis, alterations to the business model can be made to better meet customer needs and the organization primed to enable these alterations.

Sensing: Detect and interpret market signals

The ability to detect and interpret the opportunities and threats derived from the market signals is directly tied to the dynamic capability of sensing described by Teece (2018). A CDR provider needs to sense a shift in customer preference towards, for example, sectorial alignment, to make changes in their business model, for example, adapt their value proposition to target new customers. Another example is that by sensing that buyers value personal connection, the provider can tailor their value proposition to include meetings or a thorough ‘about us’-page. Sensing a barrier such as price uncertainty can inform a provider of a need to adapt their revenue model to lower this barrier and better adapt to customer needs.

A crucial part of strategic sensing is market orientation, entailing customer and competitor orientation (Cruz-Sanches et al., 2026). Customer orientation is to systematically identify and interpret explicit and implicit customer needs, while competitor orientation is analyzing and leveraging intelligence about competitors’ strategies. Another area to be vigilant about is technology advancements, and a company adept at the sensing capability will continuously monitor and analyze technological advancements for new ways to enhance their value proposition. This could be by using new digital assets, infrastructure, channels and services. Blue incorporates market orientation by using AI tools to scan market changes, as well as visiting CDR fairs to connect to partners and listen to buyers. By doing this, Blue better sense opportunities such as changing customer preferences and can adapt their business model accordingly. In the sensing box in figure 3, there are examples of guiding questions that can be used in the sensing process.

Seizing: Develop and implement solutions

When the provider has interpreted these market signals they can develop solutions for them, which is tied to the dynamic capability of seizing. Providers can seize value by evaluating the existing business model and adjusting its core components and committing resources to the new situation (Teece, 2018). Classic ways to do this are to reconfigure the value proposition by creating new products or changing the core

offering of existing ones (Cruz-Sanches et al., 2026). For example, companies may localize their products to cater to local preferences and develop the necessary channels to do so. The revenue model can be adjusted by introducing new ways to achieve financial stability considering the new value proposition, such as moving from a licensing-based model to a subscription-based. In the CDR context, a solution to the barrier of fluctuating price points could be to offer a fixed cost agreement spanning over a few years, thus making an alteration to the revenue model. The guiding questions in the seizing box are designed to highlight different components of the business model that can be considered for reconfiguration.

Transforming: Sustain changes to the business model

To sustain these changes to the business model, the organization must be able to realign its resources, structure and culture to fit the new situation. This pertains to the dynamic capability of transforming (Teece, 2018). It requires innovative and flexible organizations, primed for redesign, and is generally easier for startups, as they are smaller, have an entrepreneurial mindset and are less likely to experience organizational inertia. To implement the decided changes to the business model, resources must be reorchestrated (Cruz-Sanches et al., 2026). For example, enabling information and resources to flow fast and frictionless through the organization will make it easier to read market signals and formulate new value propositions. Effective implementation of changes to the business model also requires organizational structure adaptation (Cruz-Sanches et al., 2026). Value chains may have to be reconfigured to include new business units or new resources need to be acquired. Employees may have to be retrained or recruited, and goal setting and motivation reconfigured. Another important capability incorporated in transforming is to continuously renew resources and capabilities. This entails acquiring competence in a new field or divesting assets that are no longer necessary in the new business model. Connecting back to the CDR market, to include storytelling materials in the revenue model the provider may have to hire a graphic designer, videographer or a new digital asset and acquire the knowledge to use it. To become visible on a platform, new partnerships need to be cultivated and processes for this must be created. The different areas of transformation discussed in this paragraph are distilled into guiding questions in figure 3.

5.1.2 Output: The reconfigured business model

Business model innovation is achieved when the components of the business model are successfully reconfigured and the organization primed to sustain them, which as stated is a process driven by dynamic capabilities. This section takes a closer look at the three dimensions of a business model in the CDR market. The business model in figure 3 is based on Teece's (2018) three core building blocks: *Value proposition*, *revenue model* and *cost model*, and is complemented by Ramdani (2019) and Cruz-Sanches et al. (2026). The core building blocks contain this thesis's proposed components of a CDR business model, based on insights from the analysis. However, as CDR is not a commodity and providers have different assets and customers' different preferences, it is important to note that the proposed CDR business model is not a one-size fits-all. It aims to outline a baseline business model for the CDR provider, but it must be modified by the provider to fit their business and their target customers. The CDR business model can however be seen as a map helpful in determining where and how changes to the business model may be applied.

For example, the *cost model* includes assets and capabilities, where this thesis proposes that a pedagogical and storytelling optimized website is an important asset. This conclusion is based on that buyers who consistently value transparency are more likely to purchase CDR where the storytelling is compelling. This helps in their internal and external communication of their sustainability efforts and increases their trust in the provider and quality of the carbon removal. In the *revenue model*, storytelling materials are proposed as an important component of customer interaction. This alludes to things like customer journeys and impact reports, containing documentation and pictures of the production site, making the buyer feel the tangibility of the otherwise intangible CDR credit. According to several buyers, this generates employee motivation and strengthen internal brand identity, as well as facilitates internal decision-making processes towards management. In the *value proposition*, customer fit is brought up as an important aspect of target customers. Deeming the heterogeneous nature of both providers, methods and buyer preferences, when designing the value proposition, the provider must find the right buyer for them, regarding factors such as method, size, co-benefit and price. The analysis revealed that a certain co-benefit often drove a buyer's decision, such as heat from Biochar or biodiversity restoration from land-nature-based

methods. A buyer purchasing smaller volumes of CDR may direct them away from larger providers who demand large volumes to offer stable price agreements.

Business model innovation may help a provider better meet customer need and be successful in the uncertain and evolving CDR market. It is, however, important to note that this is an iterative process, and that providers continuously should implement sensing capabilities to detect changing circumstances and evolve together with the market. This is visualized in figure 3 by the arrow going from the reconfigured business model back to the sensing capability.

5.2 Theoretical contribution

Taking a step back, this thesis puts the concepts of dynamic capabilities and business model innovation (BMI) (Teece, 2018) in a fresh context, namely the carbon dioxide removal (CDR) market. Being characterized by uncertainty, technology advancements, changing policy regulations and changing customer preferences, the CDR market is, according to Cruz-Sanches (2026), a good fit for applying the BMI and dynamic capabilities concepts. Business model innovation has been investigated in several contexts and industries, such as digitalization (Daradkeh, 2023; Ancillai et al., 2023) and circular economy (Bigliardi & Filippelli, 2021). There have been many studies on CDR in recent years on topics such as the science of CDR methods (Wu et al., 2023; Smith et al., 2024; Sanei et al., 2024; Fuss et al., 2018), and the economics and policy design of CDR (Edenhofer et al., 2025; Honegger et al., 2021). Some research has focused on the business perspective of CDR; a quantitative choice experiment to determine environmental managers across Europe's preference for land- nature-based or technology-based CDR (Mili et al., 2026), the interplay between BMI and policy to promote carbon savings in the building sector (Nussholtz et al., 2019) and investigating BMI in the CDR related context of carbon capture and utilization (CCU) (Sairanenen et al., 2022).

This thesis extends previous research by investigating BMI in the CDR context and connects it to buyer preferences, needs and barriers. Applying these theoretical concepts in this fresh context makes for a thorough analysis of how CDR providers can use BMI and dynamic capabilities to better adjust to the evolving market. Further, this thesis

adds to the knowledge of CDR buyer needs and preferences, taking a step farther what has been presented in white papers (Akeret et al., 2023) and NGO reports (cdr.fyi, 2024) through academic research.

6. Practical recommendations for CDR providers

This chapter assumes the perspective of the provider and zeroes in on what implications the findings have for them. Strategic suggestions are then presented, based on an analysis of the insights derived from the findings and theoretical discussion. These are general suggestions that may be of use to a provider in the carbon dioxide removal (CDR) market.

6.1 Manage price uncertainty and justify high price

The findings indicate that buyers face challenges related to the price of carbon removal credits sold by CDR providers. These challenges include high price variability depending on which removal method that is used and by which provider, high uncertainty about future prices of CDR, fluctuating spot prices from some methods and high price for novel methods compared to mature land- nature-based methods.

One practical implication among providers is the need to reduce perceived price uncertainty and improve transparency around pricing structures. Providers need to improve the way price is communicated and justified. To address these challenges, providers should clearly communicate how pricing is calculated and what factors drive costs. Transparency regarding production costs, operational processes, scalability plans and expected future price development may help reduce uncertainty and strengthen buyer trust. Offering more stable pricing mechanisms, such as long-term contracts, fixed-price agreements or communicated price ranges that the price most likely will stay between, could further support internal budgeting and investment processes for buyers. Since many companies require predictable future prices to justify sustainability investments internally, increased pricing stability may become an important competitive advantage.

The findings also suggest that providers need to improve how they communicate the value of high-price novel methods. Buyers often compare solutions on price per ton of CO₂ removed, which risks favoring cheaper but potentially less durable methods. Providers of high-cost novel methods therefore need to actively explain why higher prices may be justified. Storytelling and educational communication become important

tools for highlighting factors such as permanence, co-benefits and being part of driving innovation and helping the market to develop. By helping buyers understand the broader value created beyond carbon removal credits, providers may strengthen willingness to invest at higher price levels.

Finally, the findings indicate that providers should demonstrate credible pathways toward future cost reductions and thereby lower price per ton of removed CO₂. Since buyers are sensitive not only to current prices but also to expectations of future affordability, providers may benefit from communicating how scaling, technological development and operational improvements could reduce the providers costs over time and what prices that could lead to.

6.2 Take on an advisory and educational role to decrease complexity

The findings reveal that purchasing CDR is associated with significant complexity and workload due to the uncertain and fragmented nature of the CDR market. Buyers must invest substantial time, knowledge and internal resources to understand different CDR methods, evaluate providers and determine which solutions best align with their needs and sustainability goals. This complexity is further intensified by regulatory uncertainty, undeveloped standards and a lack of clear guidance for buyers, making the market difficult to navigate. At the same time buyers are concerned about reputational and investment risks connected to purchasing CDR. Buyers fear investing in methods or providers that may later prove ineffective, misleading or environmentally problematic, which could negatively affect both financial outcomes and company reputation. As a result, many companies hesitate to make purchasing decisions while waiting for clearer regulations, more established market standards and norms and greater clarity regarding which methods and providers can be considered credible and trustworthy.

The amount of time, expertise and engagement required to purchase carbon removal credits creates a strong need for CDR providers to simplify the process. This indicates that CDR providers cannot rely solely on selling carbon removal credits. Instead, providers increasingly may need to take on a more educational and advisory role to reduce complexity, time and engagement needed.

Offering support related to climate calculations, target setting, how sustainability actions and investments by the buyer can be legally communicated and understanding evolving regulations may reduce uncertainty for buyers and simplify adoption. This may also involve educating buyers about how the CDR market is structured, explaining different CDR methods, clarifying the roles of various market actors and pedagogically guiding companies through the complexity of the market. Several intermediaries interviewed already provide such comprehensive solutions by helping companies calculate emissions, set climate targets, explain regulations and standards, build portfolios, and identify which CDR methods and providers best align with the buyer's needs, budget and sustainability ambitions. This type of educational and advisory approach from a CDR provider may decrease both uncertainty and workload for buyers and may be necessary for CDR providers to offer in order to succeed in direct sales. Although CDR providers may not be able to offer the same level of advisory support as specialized intermediaries, they can consider incorporating some elements such as educational materials, simplified market guidance, support with calculating emissions or giving assistance in understanding different methods and actors. Taking away some of the tasks and complexity from the buyer may help buyers feel at ease.

Another related implication derived from the findings is that buyers may need different levels of educational and advisory support from the provider depending on the buyer's company size. Larger companies often have a dedicated sustainability department and possess more internal expertise, knowledge and experience regarding CDR compared to smaller companies. Smaller companies seldom have a sustainability department with a dedicated team just focusing on CDR and the strategy around it, instead they are often very new to the subject. Blue stated that many of their current customers, which are primarily smaller companies, purchased carbon removal credits for the first time through Blue. As a result, these buyers often had limited knowledge about different CDR methods, the trade-offs between different solutions and how carbon removal credits may fit into their sustainability strategy. Consequently, Blue helped its customers better understand CDR and the role it can play in a company's sustainability efforts, as well as its importance for the climate. Blue also guided them through their CDR method step by step, introduced common concepts within the CDR market such as permanence, additionality, deliverability and co-benefits, and explained how their

method performs in comparison to other methods. Taken together, these findings indicate that providers may benefit from adjusting their language, communication style and level of technical detail depending on the buyer they are approaching, while also being prepared to provide more explanatory information to smaller or less experienced buyers.

6.3 Collaborate with intermediaries

The findings pointed to the fact that many buyers choose to purchase carbon removal credits from intermediaries as it help buyers de-risk and simplify the decision-making and purchasing process. To reach a large number of buyers and succeed in the CDR market it may therefore be crucial for providers to partner with intermediaries.

Collaborating with intermediaries may also increase providers overall visibility in the market as many buyers and other actors visit intermediaries' websites and may then discover new providers they did not know of. The findings also revealed that partnering with an intermediary strengthen the buyer's perceived credibility of the provider, as the intermediary has already evaluated and selected providers based on factors such as transparency, quality and long-term potential. A suggestion for providers is to backwards-engineer which intermediaries cater to their target customers and build relationships with these intermediaries.

In addition, intermediaries may also function as an important support actor for providers by providing market and buyer insights. Since intermediaries maintain close relationships with a wide range of buyers they may also provide valuable insights into customer needs, market gaps and opportunities and changing buyer preferences. Intermediaries themselves benefit from sharing such knowledge and their success depends on being able to offer solutions that align with customer demand. This creates a mutually beneficial exchange where providers gain market intelligence and legitimacy while intermediaries strengthen their ability to match buyers with suitable CDR solutions.

6.4 Find the right buyers for you

The CDR market is highly diverse and CDR is not perceived as a standardized commodity where all credits are interchangeable, instead, buyers have different choice factors, face different barriers, and place varying importance on different aspects. Because of this, providers need to identify the specific customer segments most likely to value their offering. In addition, investing in CDR is costly and voluntary, and only profitable companies can do so, therefore when targeting buyers providers should make sure they are financially stable.

The findings reveal that sectoral alignment and value chain integration may significantly influence provider selection. This suggests that providers should strategically target buyers where their method naturally aligns with the buyer's industry or value chain. This makes the likelihood higher that the buyer will value the providers co-benefits and resonate more strongly with the provider's method, storytelling and the sustainability problems the projects aims to address. It may also make it easier for buyers to communicate their sustainability efforts externally toward customers and stakeholder, while also facilitating internal justification of the investment, as the CDR project is connected to their own industry or value chain. For example, Blue and other marine CDR companies may target shipping companies, seafood or marine related industries. They are likely to value Blue's co-benefits regarding biodiversity restoration and ocean health. Another example is Biochar providers who may target companies within agriculture, food production, or energy-intensive industries. They are likely to value Biochar's agricultural and energy-related benefits. When targeting buyers within the same sector and value chain, providers could benefit from adapting their communication toward the terminology and the sustainability challenges of the industries they seek to approach, to make it more relatable. They can also consider explaining how the method's co-benefits are strategically relevant to the buyer and how they can contribute to the buyer's internal engagement and branding.

Many buyers and other interviewed actors mentioned that buyers prefer to purchase from CDR providers that operate physically close to them, for instance within the same country or region. This preference was motivated by higher perceived trust, an interest to support local companies and the opportunity to contribute to environmental

sustainability in the areas geographically close to the buyer's own operations. Blue mentioned that several interested buyers had asked whether their method could also help address environmental challenges relevant to the buyer's home country such as eutrophication in the Baltic Sea, while simultaneously removing CO₂. Many potential customers expressed interest in contributing to climate and environmental improvements that they could more directly relate to and observe locally, rather than creating impact in a distant part of the world. The practical implication for providers is therefore to strategically approach buyers located geographically close to their operations or projects. When doing so, providers may benefit from relating their communication to sustainability problems that are particularly relevant in the region or country and explain how their method and its co-benefits may contribute to addressing these issues.

Another important implication concerns the company size of the buyer when selecting target customers. The findings revealed that larger corporations usually have higher expectations and requirements when purchasing CDR. These may include demands for specific certifiers and standards, extensive measuring, reporting and verification procedures, evidence of scalability and clear pathways toward future cost reductions and lower prices. Large buyers may also expect providers to have already removed certain amounts of CO₂ and may seek to purchase large carbon credit volumes, which smaller early-stage providers may struggle to meet. At the same time, interviews revealed that some larger buyers have a strong motivation to support innovative early-stage CDR providers to help the CDR market to evolve and already purchase from smaller early-stage providers as a part of their broader CDR portfolio. However, small early-stage providers may still struggle to meet all the operational, reporting and delivery expectations associated with large buyers. Smaller buyers, on the other hand, may in many cases be more accessible and flexible. The findings indicate that it is sometimes easier to reach the individual responsible for purchasing decisions, decision-making processes are often shorter and smaller buyers may not have as extensive requirements to meet. This suggests that providers should strategically target customers whose purchasing demand and expectations align with the provider's current production capacity and stage of development. For early-stage providers, targeting smaller or more innovation-oriented buyers may therefore represent a suitable strategy for customer acquisition in early phases of growth. At the same time, small early-stage

providers should not ignore larger corporations, as understanding their preferences and requirements may help providers for future growth. By monitoring these buyers and gradually adapting toward their expectations, providers may position themselves to attract larger customers as they scale and grow.

6.5 Address buyer concerns and preconceptions

The continuously evolving and shifting perceptions of CDR create challenges for buyers. Criticism of the effectiveness of CDR, together with and changing policy recommendations, has led some companies to shift their focus away from CDR and prioritize emission reduction efforts instead. Cases of fraud among CDR providers, along with greenwashing accusations directed at buyers, have further damaged the reputation of CDR and made buyers more cautious and skeptical, increasing demands for high transparency and solid monitoring, reporting and verifying. In addition, stricter regulations about how companies are allowed to communicate their sustainability efforts have caused uncertainty and concern. Global issues and financial downturns have further reduced the priority placed on climate initiatives among companies and their end-customers. Overall, these factors have acted as barriers to the adoption of CDR and contributed to an overall skepticism toward the field.

The findings indicate that CDR providers may need to actively reshape how buyer's perceive the role of CDR within buyers' sustainability work. The interviews revealed that companies commonly perceive carbon removal credits as something that should only be considered after emissions have been reduced as much as possible, often by 2030 or 2035. However, reports from IPCC emphasize that both reduction and removal are needed to limit global warming to 1.5 degrees. A suggestion for providers is to acknowledge the buyer's primary focus on emission reductions, while also emphasizing the role of CDR in addressing unavoidable or remaining emissions. A suggestion for providers is therefore to emphasize that CDR should complement emission reductions, rather than replace, for example, by including links to reports from IPCC, and thereby establish an objective need for their services.

Providers may also emphasize that they are unlikely to fully eliminate all emissions through reduction efforts alone, meaning that some residual emissions will likely

remain. In this regard, buyers could gradually reduce their purchases of carbon removal credits in parallel with their emission reductions over time. One buyer, currently having this strategy, expressed that this approach creates additional incentives for the company to achieve their reduction targets, as remaining emissions will otherwise need to be addressed through carbon removal purchases. Providers may therefore benefit from helping buyer develop long-term reduction and removal roadmaps, including yearly targets and estimated carbon removal needs, while also demonstrating how successful reduction efforts may lower future carbon removal costs and accelerate climate action.

Since there is uncertainty and skepticisms of CDR among some buyers, providers need to actively build legitimacy and trust around both their methods and the broader role of CDR in a buyer's overall sustainability strategy. One suggestion is to present a timeline of the CDR market's evolution, including when different methods have been approved by the EU, growth in market adoption and sales and expected future developments. By doing so, providers can demonstrate that CDR is increasingly being recognized and adopted by international bodies such as the EU, thereby strengthening buyers' confidence in its long-term relevance and potential. Providers may also emphasize that although climate initiatives may currently receive less attention due to economic and global challenges, climate change will be an increasingly important issue and many scientific reports and organizations state that CDR will be a vital part in reaching the world's climate goals (IPCC, 2023; Smith et al., 2024; Lamb et al., 2024). In addition, emphasizing scientific grounding, transparent measurement, reporting and verification processes and alignment with emerging standards may further strengthen buyer confidence during periods of regulatory uncertainty.

Further, as companies become more cautious about making climate claims due to stricter greenwashing regulations, providers are suggested to help buyers understand what can responsibly be communicated. This can be done with a "communication guide" as part of the value proposition, clearly outlining what words are forbidden and what phrases are safe to use. The interviews revealed that many buyers buy CDR secretly or downplay their engagement, because of fear of greenwashing accusations or criticism. However, responsible CDR communication may still strengthen the buyer's brand amongst its customers and employees. In addition, CDR activities often result in unique co-benefits that can be useful in storytelling, such as biodiversity restoration,

heat generation, improving soil health or creation of jobs at the production site. Pressing on these benefits creates another incentive for buyers to purchase CDR, because responsible communication about them might strengthen brand identity.

Trust and transparency emerged as an important choice factor from the findings. Providers should therefore focus on ensuring transparency, for example by using storytelling materials, transparent carbon removal calculations and reporting as well as having a trusted third-party verification and certification actor. Providers may benefit from optimizing their websites for storytelling by including pictures and videos of the production site, presenting pedagogical and science-based explanations of their method and showing how much carbon dioxide they so far have removed. Another suggestion is to offer 30-min questions & answers calls to establish relationships, demonstrate commitment and address any worries buyers might have. In addition, a frequently asked questions text on their website addressing common concerns and misconceptions may further strengthen transparency and trust.

It was also revealed in the interviews that a climate-committed and purpose-driven team increased buyers' trust and strengthened the perceived quality and credibility of the carbon removal credits. Providers are therefore suggested to present their team members and communicate a genuine motivation for operating in the CDR market, demonstrating that their engagement is driven by climate impact and long-term commitment rather than purely commercial interests. Blue for example, presented an introduction of its team on their website, which reportedly helped buyers perceive the company as a group of real and dedicated people rather than a faceless provider. To further create trust and show that the removal is of high quality, providers can invite buyers to visit production sites or offer virtual tours. The interviews also revealed that buyers value social proof, suggesting that providers may benefit from developing case studies and showcasing successful collaborations with existing customers.

7. Conclusion

In this chapter limitations and suggestions for further research is discussed. In addition, a summary is presented, giving an overview of the thesis.

7.1 Limitations and future research

One limitation of this thesis is its qualitative research design. Since the findings are based on a limited number of interviews and one main case company, the results cannot be generalized to the broader CDR market. Instead, the study aims to provide in-depth insights into how industrial buyers perceive and select CDR providers, as well as how providers can adapt to these preferences in an emerging and uncertain market. Although the qualitative approach enabled a nuanced understanding of buyer motivations, barriers and market dynamics, future research could complement these findings through quantitative studies. For example, surveys distributed to a larger sample of industrial buyers could test the prevalence and relative importance of the choice factors and barriers identified in this thesis. Quantitative research could also examine whether buyer preferences differ across industries, company size or geographical markets. This could provide high value for CDR providers as they better know which buyers to target.

Another limitation concerns the proposed framework combining dynamic capabilities and business model innovation. While this thesis contributes with a conceptual framework illustrating how CDR providers may use sensing, seizing and transforming capabilities to adapt their business models to market signals, the framework remains exploratory. The study identifies guiding questions that providers may consider throughout the process, but it does not examine in detail how these dynamic capabilities should be operationalized in practice. In other words, the framework outlines “what” providers may need to reflect upon, but not exact processes, structures or managerial practices required to successfully conduct sensing, seizing and transforming activities.

This opens several opportunities for future research. One way would be to develop more operational frameworks or step-by-step models for how CDR providers can practically implement dynamic capabilities in rapidly evolving markets. Future studies could for example investigate how providers can systematically monitor customer preferences,

identify relevant market signals, reorganize internal resources or redesign their business models over time. Studies following CDR providers throughout different stages of growth could provide valuable insights into how business model innovation evolves in practice and thus improve this thesis framework. Furthermore, future research could apply and test the proposed framework in real-world settings by examining how CDR providers use it throughout different phases of growth. Such studies could generate insights into the practical value of the framework and contribute to further refinement and development of the model.

7.2 Summary

In this thesis, the evolving CDR market was studied, focusing specifically on Carbon Dioxide Removal (CDR) providers. The aim of this thesis was to provide insights that contribute to CDR providers' understanding of buyer needs, preferences and barriers related to the purchase of carbon removal credits, and how they can adjust their operations and offerings accordingly, and thereby contribute to the development and growth of the CDR market. The thesis took a qualitative study approach with a main case, a marine CDR start-up, in this thesis called Blue, and several additional interviews with a broad set of actors within the CDR ecosystem, including buyers, intermediaries, certifiers and providers. In addition, a CDR webinar was used as secondary data with several industry actors. Two research questions guided the thesis, *How do industrial buyers select CDR providers and what hinders buyer adoption of CDR?* and *How can CDR providers innovate their business model to adapt to industrial buyer preferences and needs?*

The findings show that buyers select CDR provider based on several choice factors: *Price-fit and growth-potential, Physical and psychological proximity, Trustworthiness and transparency, Compelling storytelling and Characteristics of CDR method*. At the same time, several barriers faced by buyers that limit the CDR adoption were identified, including *Price uncertainty and high price, Regulatory uncertainty and evolving standards, High market complexity and Shifting perceptions of CDR*. These findings illustrate that the CDR market remains highly uncertain and fragmented, making provider selection a complex process for buyers.

A framework integrating business model innovation and dynamic capabilities was developed. The framework illustrates how CDR providers can use sensing, seizing and transforming capabilities to identify market signals, adapt their business models and continuously reconfigure their organization in response to evolving customer needs and challenges. The study further translated the insights from the framework together with the findings into practical recommendations for providers. The suggestions were structured into five main areas for providers to consider, *Manage price uncertainty and justify high price, Take on an advisory and educational role to decrease complexity, Collaborate with intermediaries, Find the right buyers for you, Address buyer concerns and preconceptions.*

Overall, the thesis contributes with both theoretical and practical insights into the emerging CDR market. By linking buyer preferences and market barriers to business model innovation and dynamic capabilities, the study demonstrates how CDR providers may better adapt to changing market conditions and improve customer acquisition. In doing so, the thesis answers both research questions and fulfills its purpose of generating insights that may support the continued development and adoption of CDR solutions.

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Appendix 1: Interview guide - Employees at Blue

Introduction questions:

- Can you describe Blue as a company?
- Can you describe your role at Blue?

Main questions:

Customers:

- Describe how you acquired your current customers. (If they need prompting: Marketing? Personal contact? Did they contact you or did you contact them?)
 - What types of companies seem interested in buying? Why some and not others?
 - What is your perception of the demand for CDR?
- What characteristics do you believe customers value when purchasing CDR (current/potential customers)?
- How do you communicate your unique value to customers?
- What is your current strategy for generating repeat purchases from the same customer?

Market:

- How are you affected by different actors in the CDR market? (Platforms, marketplaces, certifiers, providers)
- How do you keep track of opportunities/shifts in the CDR market?
- How (if at all) do you adapt to these?

Challenges & goals:

- What types of problems/challenges are you facing right now?
 - Looking ahead?
- What are your current goals?

Specific for CTO: (Fewer of the customer questions)

- Why did Blue choose to enter the CDR market?
- What are the advantages (and disadvantages?) of your technology compared to other technologies on the market?
 - How do you communicate that to customers?
- How do you view the scalability potential of your CDR method?

Appendix 2: Interview Guide – Buyer

Introduction questions:

Could you tell us a little about your role as ...?

Please briefly describe your environmental sustainability strategy.

Main questions:

Can you tell us how you started buying carbon removal credits, what motivated you back then?

When discussing climate strategies, reducing, avoiding, and offsetting emissions are often mentioned. How do you currently approach the balance between these three?

- What role has CDR historically played in your strategy?

How did you identify potential suppliers or projects?

- Through an intermediary?

Which CDR methods did you choose, and why those in particular?

- How important are co-benefits?
- How did you evaluate factors such as cost, permanence, deliverability, and scalability?

Why did you choose method A specifically as a method for reducing carbon dioxide over other methods, such as method Y, method Z...?

Are there any factors that are must-haves for a CDR provider? And from the other side, what would be a red flag with a CDR provider?

What challenges do you as a buyer face within the CDR market?

- When comparing CDR methods and finding a provider to trust?

If you could change one thing about the CDR market to make it work better or grow, what would it be?

What is your industry's stance on climate issues and CDR?

When applicable: You mention that you work with advisors (or an intermediary) to evaluate and identify long-term climate projects, what role do they play in your decision-making process?

Appendix 3: Interview Guide – Certifier

Introduction questions:

Can you tell us about your role as...

What role would you see that you have in the CDR market today?

Main questions:

Describe the typical CDR provider that works with you. What does a CDR provider gain by working with you?

How would you describe your relationship with suppliers - more transactional, partnership-based, or something else?

What are the most common challenges providers face in the CDR market?

Have you seen mismatches between what CDR buyers want and what CDR providers can deliver?

What trade-offs do you face between enabling innovation (new start-ups, methodologies) and maintaining strict quality standards?

Looking at the future, how do you believe the CDR market will evolve? What needs to happen for the CDR market to grow?

How do you determine which methodologies to certify?

Can you describe a typical customer regarding size, start-ups, maturity, industry?

In perspective, have you noticed that buyers of CDR prefer some methodologies over others and why?

Appendix 4: Interview Guide – Intermediary

Introduction questions:

Can you tell us about your role as...

What role would you see that you have in the CDR market today?

Main questions:

How would you describe your marketplace's role as an intermediary between customer and carbon farmer?

Is there anything that's a must-have criterion when you're evaluating a new carbon farmer? On the flip side, is there anything that's a red flag for you when you're looking at individual companies?

What is the advantage for buyers to purchase credits through you instead of going directly to the carbon farmers?

Can you describe your typical customer? (Regarding industry, size, production/service)

- Is there any specific segment that has increased or decreased in recent years?

In your perspective, what do buyers of carbon credit value or demand when it comes to choosing a CDR project? (t.ex. price, permanence, risk, co-benefits, geography, in own value-chain)

- Do you have any examples on what makes some projects stand out and get more attention and demand than others?

In your perspective as an intermediary, is there a mismatch between what buyers want and what carbon farmers can offer?

How do you work with customer relationships and retain your customers over time?

- Do buyers prefer spot-purchases or long-term agreements?

- What makes a customer transition from a spot purchase to a more long-term commitment?

If you could change something in the CDR market to get it to develop faster, what would it be and why?

