A Work Project, presented as part of the requirements for the Award of a Master's degree in Business Analytics / Impact Entrepreneurship and Innovation from the Nova School of Business and Economics.

Building Portugal's Official Offsetting Platform - How are corporate buyers engaging in the voluntary carbon credit market and what are resulting pain points in the process of buying carbon credits?

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16/01/2024

Acknowledgments

We would like to express our sincere gratitude to Nova SBE, Prof. Leid Zejnilovic, Prof. Lénia Mestrinho, and Ian Choo for providing us with the valuable opportunity to engage in this captivating field lab. A special thanks goes to our practical partner, Celfocus, who served as our invaluable sparring partner. In particular to André Ramos Correia and João Carlos Simões. The weekly workshops proved instrumental, immersing us in diverse practical scenarios and providing our thesis with a robust real-world perspective. This helped us create a well-rounded thesis that meets both academic standards and practical implementation needs. This work was financially supported by Project Blockchain.PT – Decentralize Portugal with Blockchain Agenda, (Project no 51), WP 3: Sustainable Development and Smart Territories, Call no 02/C05-i01.01/2022, funded by the Portuguese Recovery and Resilience Program (PPR), The Portuguese Republic and The European Union (EU) under the framework of Next Generation EU Program

Abstract

This thesis explores the development of a marketplace for voluntary carbon credits, addressing market challenges and complexities. It underscores the importance of fostering sustainable corporate practices and advancing the voluntary carbon market. The study employs a mixed-methods approach, combining market analysis, interviews, and financial modeling. Findings reveal market dynamics, corporate pain points in credit procurement, and market inefficiencies. The proposed business model, developed in collaboration with Celfocus, offers a unique solution with blockchain technology, enhancing trust and efficiency. Findings are valuable for the development of a marketplace in the offsetting sphere, aiding stakeholders in navigating the evolving landscape.

Keywords: Carbon Credits; Voluntary Carbon Markets; Field lab; Celfocus

This work used infrastructure and resources funded by Fundação para a Ciência e a Tecnologia (UID/ECO/00124/2013, UID/ECO/00124/2019 and Social Sciences DataLab, Project 22209), POR Lisboa (LISBOA-01-0145-FEDER-007722 and Social Sciences DataLab, Project 22209) and POR Norte (Social Sciences DataLab, Project 22209)

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1. Introduction

1.1. Background and Context

The biggest threat facing our and future generations is climate change. From the start of the Industrial Revolution, the amount of greenhouse gases (GHG) in the atmosphere has significantly increased and the evidence points to the fact that it is caused by human activity (European Parliament 2023). The United Nations Youth Forum has aptly captured the urgency of the situation by stating that we are currently consuming resources equivalent to 1.6 Earths to sustain our current lifestyle. This includes a 45% surge in the use of fossil fuels. Immediate action is needed to address this pressing issue (United Nations 2023). As a consequence of human-induced climate change, global average temperatures rose to about 1.1° C from 1912 to 2020 with drastic aftermath to the entire planet's ecosystem. The impacts of climate change are already observable worldwide. Extreme weather events, droughts, and floods have led to regional conflicts, poverty, and food insecurity (National Oceanic and Atmospheric Administration 2021). Confronted with these unparalleled challenges, negotiators crafted the Paris Agreement — an international treaty addressing climate change (United Nations Framework Convention on Climate Change 2023). Consequently, both private and public actors are setting clear targets for reducing emissions that are consistent with achieving net-zero emissions. To reach the Paris Agreement targets, the international consortium proposed market-based mechanisms as part of a holistic solution. Paris Agreement's Article 6.4 enables global collaboration to cut emissions and achieve climate targets (United Nations Framework Convention on Climate Change 2021). As part of a comprehensive strategy to achieve global net zero by the second half of the century, this market-based mechanism provides polluters incentives and tools that mitigate or even eradicate harmful environmental consequences. This mechanism lays the groundwork for the Voluntary Carbon Credit Market (VCM) (Archer and Pandaya 2023).

This field lab work project is a result of a close collaboration between Nova SBE data science knowledge center and the software company Celfocus. The two organizations are part of the broader consortium of various private as well as governmental players under the “Plano de Recuperação para a Europa” aiding Portugal in the green and digital transformation and increasing the country´s economic and social resilience. This initiative is part of the European Commission's plan to convert Europe into a more sustainable economy. Under the European Green Deal the commission sets the goal to *“transform the EU into a fair and prosperous society, with a modern resource-efficient and competitive economy and no net emissions of greenhouse gases in 2050”* (European Commission 2019). To achieve this goal, significant amount of funding is allocated to projects in various European countries. One project is the creation of the official VCM in Portugal - whereby this thesis aims to support with research and the creation of a business model.

1.2. Research Problem

The VCM is seen as a fundamental tool to combat the climate crisis, pooling investments into regions that need it the most and improving the capabilities of carbon offset projects (Trouwloon and Gilde 2021). Unfortunately, it is highly inefficient. While experts are expecting the market to grow up to 100x until 2050, it has yet to deliver the growth and results that many businesses were hoping for (Blaufelder et al. 2021). Though it denotes an extraordinary opportunity for market participants to achieve environmental impact and financial growth, both external and internal factors have limited this potential.

External factors are highly affected by transparency scandals, particularly with REDD+ projects, which has led to the discreditation of the VCM in the eye of many buyers, and to an overall plateauing of carbon credit demand in 2023 (Climate Focus 2023). The unfavorable market environment since 2020 contributes to the problem: As cash is getting more expensive,

less firms are willing to pay for “intangible” carbon credits that, in the worst case, might not even have the impact that they state to have (Twidale and Mcfarlane 2023). This is partially due to the market’s overall complexity and low transparency: Traditional offsets are not regulated and automated, leading to fundamental problems, including impact overstatement or double counting (Fio 2022). Several businesses have been proven to engage in dubious carbon credit practices, which led to some climate activists disregarding carbon offsetting as a modern form of greenwashing (Raji 2023). On the supply side, while the market is overflooded with “low-quality” carbon credits stemming from avoided deforestation projects, there is a growing demand surplus for local carbon removal projects (Blaufelder et al. 2021).

Innovative start-ups have observed these market problems as an opportunity to create businesses that tackle these issues. This led to the emergence of many young and innovative companies, focusing on improving a specific step in the value chain. A large fraction of climate tech VC funding was allocated to these start-ups, with some of them managing to secure a relatively favorable positioning due to their differentiation strategy. This also exemplifies the competitive rivalry in the market as new players emerge in different parts of the value chain over time, which have the potential to gain large market shares and become established powerhouses of the industry.

Most experts agree that a highly functioning VCM will be integral to achieving net zero goals (Kreibich 2021). Skeptics claim that it will never reach maturity and is simply a method for large businesses to engage in greenwashing, investing in alibi impactful projects for improved ESG scores (Montgomery et al. 2023). This report, however, begs to differ. It follows the diagnostics and reports of highly accredited institutions to emphasize recent market developments and aims for a neutral and unbiased approach. It believes that while the problems

mentioned above are significant hurdles, there are ways to overcome them and finally build a profitable and viable venture in this market. The following section describes the overall structure of the thesis, providing the background to how this report aims to provide an answer to the problems.

1.3. Structure of the Thesis

This thesis will provide insights into the VCM by introducing extant literature to provide a theoretical background and establish a thorough understanding of the market. This includes the investigation of its historical development, regulatory drivers, challenges and criticism, the impact of quality and, lastly, emerging trends and innovation in the industry. This provides a sound foundation of secondary data and introduces the thesis research. Next, the methodological approach is to be examined which focuses on the research objectives, the formation of the research questions, the identified research design as well as data collection and analysis. Followed by the literature review, the analytical section of this thesis is divided into four parts according to the respective individual research questions. These parts all build upon each other and are providing the foundation of analysis. Ultimately, the conclusion summarizes these chapters and presents the essence of this thesis and synthesized findings. Moreover, avenues for further research as well as limitations are to be identified to to provide a constructive, holistic overview and outlook.

1.4. Research Scope

The scope of this thesis is based on findings specifically attributed to Celfocus. This implies that the findings are directly applicable to the company and are intended to provide insight for strategic decision-making. To provide tangible and valuable results throughout the analyses, the focus of examination and discussion will be on market entry via a platform-centric

marketplace. This is done to align interests with the external thesis partner and to gain in-depth insights while navigating through this highly complex market. Nonetheless, the creation of in-house credits will be kept in mind as a complement to the initial marketplace throughout the various analytical sections. This is done to ensure a basic understanding in case the business model suggests the creation of own credits to be published on the marketplace. For clarification, these credits refer to the credits created in collaboration with external project developers which are to be registered via a registry operated by Celfocus. In addition, the scope of the primary data collection is to cover key stakeholders across the value chain to gain valuable insights and ensure validity and reliability.

2. Literature Review

2.1. Introduction to Carbon Markets

The carbon market, established as a mechanism to quantify and trade carbon emissions, aims to mitigate greenhouse gas emissions by offering economic incentives for emissions reductions (Spilker and Nugent 2022). This concept was significantly advanced by the 1997 Kyoto Protocol, which introduced the Clean Development Mechanism (CDM), a cornerstone in the development of international compliance markets and a frontrunner to emissions trading schemes (Williams et al. 2009).

The carbon market's importance lies in its encouragement of both businesses and individuals to reduce their carbon footprint. By assigning a monetary value to carbon emissions, it incentivizes the reduction of emissions and the investment in cleaner technologies, also supporting projects aimed at reducing or removing carbon emissions, such as renewable energy or afforestation (Porsborg-Smith et al. 2022).

Carbon markets are divided into two main types: compliance markets and voluntary markets. Compliance Carbon Markets (CCM) are regulatory mechanisms established by national, regional, or global laws or regulations. These markets control the supply of allowances, distributed under caps set on greenhouse gas emissions for specific industries or sectors. Entities must surrender enough allowances to cover their annual emissions, facing penalties for non-compliance. The European Union Emissions Trading System (EU ETS) is a notable example, launched in 2005 as the first major carbon market, covering around 11,000 installations (European Emission 2023).

In contrast, the VCM operates on a non-mandatory basis, where companies and individuals voluntarily buy and sell carbon credits. Credits in the VCM are generated from projects that prevent, reduce, or sequester CO2 emissions, often involving technology or nature-based solutions (Ahonen et al. 2022). These credits are independently verified, each representing one metric ton of CO2 removed or avoided (Favasuli and Sebastian 2021). While CCMs are mandatory, regulated by various geopolitical jurisdictions, VCMs are voluntary, without oversight by a single regulator or government. The generation of credits also differs; CCMs use a cap-and-trade principle, while VCMs generate credits from CO2 emission reduction or sequestration projects (Rowan 2022). CCMs primarily target large greenhouse gas emitters, whereas VCMs are accessible to anyone looking to offset their carbon footprint (Burzec 2021). Voluntary carbon credits are instrumental in financing carbon reduction projects, such as renewable energy, through the proceeds from their sale (McKinsey 2020). The global carbon market has seen significant growth, driven by the increasing urgency to address climate change and meet emissions targets under the Paris Agreement (McKinsey 2021). However, challenges such as the integrity of carbon offsetting projects and the double counting of emissions reductions must be addressed to enhance the market's effectiveness. Despite these challenges, carbon markets are vital in the global fight against climate change (United Nations 2022).

2.2. Historical Development of Carbon Trading

The utilization of a market-driven approach in reducing greenhouse gas emissions has become a central strategy in the worldwide effort to combat climate change, known as carbon trading. The origins of carbon trading can be identified in the later part of the 20th century, marked by significant milestones that influenced its course. In 1997, the Kyoto Protocol marked a significant leap in international climate change endeavors by introducing emissions trading as a flexible mechanism to achieve emission reduction targets. 41 countries plus the European

Union, were tasked with meeting binding emission reduction commitments through a combination of domestic efforts and international cooperation, including emissions trading (The Editors of Encyclopedia Britannica 2007). Established in 2005, the European Union Emissions Trading Scheme (EU ETS) is recognized as the inaugural global carbon trading system, marking a significant milestone. Designed to cover diverse industries, its primary objective is to regulate carbon dioxide emissions from power plants and industrial facilities. Under this system, participants bought allowances representing the right to emit a defined amount of CO2, incentivizing emission reductions (European Commission 2021). The implementation of the Clean Development Mechanism (CDM) and Joint Implementation (JI) took place in 2008, under the Kyoto Protocol. These mechanisms allowed developed countries to invest in emission reduction projects in developing nations, earning carbon credits known as Certified Emission Reductions (United Nations Framework Convention on Climate Change 2023). The Doha Amendment in 2012 prolonged the commitment period of the Kyoto Protocol, introducing new emission reduction targets. Despite its adoption, widespread ratification has been limited. The Paris Agreement of 2015 aimed to limit global temperature rise to below 2°C above pre-industrial levels, marking a pivotal shift in climate policy. While the agreement did not establish a global carbon market, it encouraged market-based approaches and voluntary cooperation between nations (United Nations Framework Convention on Climate Change 2023). In the 2020s, various countries and regions, including Japan and Australia, have introduced carbon taxes and cap-and-trade systems as part of their carbon pricing mechanisms. (Dawes et al. 2023). Some jurisdictions have linked their carbon markets, fostering global collaboration. The private sector has also embraced voluntary carbon offsetting, with companies purchasing offsets to compensate for their emissions. Despite progress, concerns remain over offset project environmental integrity and market fluctuations (UBS Investment Bank 2023). The future of carbon trading hinges on ongoing international negotiations, the

emergence of new markets, and the need for robust mechanisms to ensure transparency and effectiveness in achieving emission reduction goals.

2.3. Regulatory Drivers

The pressing need to address climate change has led to the emergence of carbon credits, making the VCM an essential tool for companies to counterbalance their carbon emissions through carbon credits acquisition. Establishing regulations and mechanisms to guarantee the credibility of carbon credits is crucial for ensuring the integrity and efficacy of the VCM. This section delves into the regulations and mechanisms governing the issuance of carbon credits in the VCM. The VCM operates separately from the carbon markets mandated by the government. In the absence of a centralized regulatory authority, specific regulatory entities and standards wield substantial influence over both the broader sector and the criteria for carbon credits issued (Riverse 2023). In the following the most important ones are described in detail. Science based target initiative (SBTi), is a coalition of environmental groups, which guides companies to sustainability targets according to a 1.5°C future. With over 1,000 participating organizations, it allows carbon credits for neutralizing residual emissions or funding reductions beyond the company's value chain. The Net-Zero Standard emphasizes in-house emissions cuts while recognizing the importance of external actions for comprehensive net-zero goals (DFGE 2023). The Voluntary Carbon Market Integrity Initiative (VCMI) collaborates with various stakeholders. Its aim is to enhance the contribution of high-integrity carbon markets towards climate action and the SDGs. To maintain authenticity, VCMI addresses the requirements of both the demand and supply facets within this realm. On the demand side, it introduces the Claims Code of Practice, serving as a rulebook for companies to use carbon credits voluntarily. VCMI offers an Access Strategy Toolkit to guide countries in high-integrity VCM engagement on the supply side. This toolkit supports national climate objectives and economic prosperity

by facilitating the involvement of countries in VCMs while maintaining integrity and credibility (VCMI 2023).

2.4. Challenges and Criticism

While the VCM aims to tackle climate-related issues, some challenges and scandals have arisen over the last years that fostered a discussion regarding the credibility of carbon credits, and in particular, their standards, measurements, and implications. Investigating these issues through a close lens will hence not only aid to provide literature regarding the overall topic of interest, but also enables a critical view on the VCM and the challenges that are to be addressed when looking at the creation of a robust business model. In the following part of the literature review, both general challenges as well as recent scandals will be identified.

There are general challenges that contribute to the complexity of the VCM. The market is characterized by uncertainties in regulation, general market structures, and prices, which require management flexibility (Sumirat and Yulianda 2013). Furthermore, the issue of complexity is highlighted by the high costs associated with operating in the market, as well as the poor integration of biodiversity and climate change considerations (Oosterzee 2012). In addition, ensuring the quality of carbon credits is challenging. This also goes hand in hand with the obstacles of additionality, leakage, durability, baselines, monitoring and verification (Cao et al. 2012). Furthermore, different motivations and interests behind offset projects can create tensions between supporting local communities and production in developing countries (Karhunmaa 2016). This is also partly in line with broader challenges based on the unregulated nature of the market, which leads to verification and credibility issues, as well as a tendency towards corporate greenwashing. These issues therefore contribute to a lack of confidence in the effectiveness of the market (Spash and Theine 2016; Davidson 2008). Finally, there are

challenges related to compliance with global agreements and different regulations. Adjusting VCMs to fit within the legal framework of the Paris Agreement presents a significant challenge, necessitating innovative solutions and political support (Kreibich and Hermwille 2021). In conclusion, the VCM faces a myriad of challenges ranging from its fragmented and complex nature to regulatory uncertainties, issues of quality, standardization, and legal complexities.

Generally, there are controversies regarding transparency, encompassing issues such as human rights abuses, forced evictions, exploitations, corruption and land seizures as well as fraud and misconduct due to the lack of proper regulations (Oakland Institute 2016; Silverstein 2023). This is criticized as it ultimately leads to a negative impact on communities while diminishing the credibility and trustworthiness of the VCM. Going into depth with the headlines circulating in multiple news outlets, REDD+ credits have caused criticism. According to the UN, REDD+ stands for *"reducing emissions from deforestation and forest degradation"* (UNFCCC 2023) and is a multilateral framework designed in conjunction with the Paris Agreement. Being classified as an avoidance credit, REDD+ is measured via a baseline approach, taking predicted emissions into account. Calculating such a baseline is a complicated endeavor as it is highly based on assumptions and cannot be established with a high degree of certainty (Favasuli 2021). Especially Verra, the largest carbon credit registry by market size, has been under scrutiny within the last year based on the accusation of phantom credit creation in the rainforest offset sphere, mainly based on faulty baseline estimations. According to an analysis of scientific studies and an investigation by The Guardian, Die Zeit, and Source Material, 90% of such Verra credits have been deemed worthless as they do not represent genuine carbon reductions. This was mostly based on faulty baseline calculations, as forest loss appeared to be overstated by up to 400% of the actual indications (Greenfield 2023). In fact, only six percent of the credits were found to represent real reductions in emissions (Padín-Dujon 2023). In combination with these

claims, a study by the University of Cambridge has further found that four projects alone accounted for about 75% of the total forest that was protected while other projects merely had any impact at all regarding the emission efforts (Greenfield 2023). Ultimately, the need to standardize the methodological approach to baselines was amplified based on these findings to mitigate overestimation and create credibility and quality assurance. Overall, these scandals and the respective criticism hint towards the faulty system behind the creation of such carbon credits and the necessity to evaluate the influence of quality in the VCM.

2.5. Definition of "Quality" in Carbon Credits

Defining and measuring quality in carbon credits requires a rigorous approach, and is an ever-changing process, determined on technological and informational advancements. Depending on who one asks, different quality definitions will be provided and there is no such thing as a unified standard for assessing carbon credit quality. Nevertheless, there are certain criteria that almost all entities are willing to compromise on, which will be outlined in the following paragraphs. The US Environmental Defense Fund (EDF) examines the factors contributing to high-quality carbon credits in their paper, "What makes a high-quality carbon credit?" (EDF 2020). These criteria are organized into six key areas, which can be broken down into even more sub-topics. Firstly, the concept of *additionality* emerges as a critical criterion. Additionality ensures that emissions reductions, avoidance, or sequestration result directly from the support provided by the carbon credit project and would have not occurred without the intervention. For instance, a renewable energy project dependent on carbon credits for implementation satisfies the additionality criteria, while funding an already planned project does not demonstrate additionality (Jonson 2023).

Another pivotal aspect is the establishment of a realistic and credible *baseline*, essential for accurately gauging the impact of a carbon credit project. This baseline should accurately measure a business-as-usual scenario, meaning the emission projections without the intervention. Utilizing historical data or industry benchmarks is standard to prevent overestimation of emissions reductions (Sullivan 2023).

Robust *quantification, monitoring, reporting,* and *verification* practices constitute the third category, emphasizing the necessity of rigorous data collection and third-party verification to maintain transparency and accuracy. Insufficient practices, such as self-reporting and incomplete data, may compromise the credibility of a carbon credit project. Leakage is a result of this, which occurs when a project's emissions reductions lead to an increase in emissions elsewhere (Sullivan 2023).

The concept of *permanence* plays a crucial role in carbon removal projects, ensuring that the carbon dioxide captured stays securely stored and doesn't get released back into the atmosphere. With an afforestation project, for instance; it's vital that the planted forest isn't cut down or burned for a specified period such as 100 years. If the project is reversed during this time frame, such that the forest is logged or burnt down, the once-sequestered carbon dioxide is released back into the atmosphere (Jonson 2023).

Avoiding double counting emerges as the fifth vital factor, aiming to maintain the integrity of carbon credits. Double-counting occurs when a carbon credit is attributed towards multiple carbon credit programs or buyers, which in turn overstates the real impact of a project (Sullivan, 2023). Next to standardized accounting standards, especially the integration of blockchain technology can play a pivotal role, as will be later discussed in this report (Khodai 2022).

Finally, the consideration of *co-benefits* in the sixth category plays a role in determining the quality of a carbon credit. Projects offering additional environmental, social, or economic benefits beyond CO2 reduction or sequestration are often considered of higher quality compared to those solely focused on emissions reductions (Khodai 2022).

Next to the six quality criteria that evaluate the quality of carbon credits, the demand side also asks for more specified criteria, including geographic proximity. Most carbon credit buyers choose to invest in projects that are a), close to their value chain, or b), close in terms of geographic location. Although the geographical location of a carbon offset project does not have a direct impact on reducing global carbon emissions, the consideration of geography becomes significant when determining which projects to invest in. Therefore, the adherence to the criteria is integral for evaluating and ensuring the effectiveness of carbon credit projects in the broader context of mitigating climate change (Sullivan 2022).

2.6. Innovation and Trends

The VCM is undergoing a notable transformation, spurred by technological advancements and a growing emphasis on the quality and diversity of carbon credits. Innovations such as blockchain technology, AI, and IoT are impacting the market, addressing challenges like fraud, double counting, auditing, and project evaluation. Concurrently, there's a distinct shift towards higher integrity and quality in carbon credits, reshaping market dynamics. These developments are indicative of the market's evolution towards greater sophistication, diversity, and a focus on genuine impact and quality (Sylvera 2023).

Blockchain, at the forefront, has become a transformative force in the market. Known for its transparency and security, it addresses key challenges such as double-counting and fraud, fostering greater confidence among stakeholders. Platforms like Ripple are utilizing blockchain to broaden participation and streamline carbon credit trading (World Economic Forum 2022).

This technological progress in the VCM is matched by a significant shift towards credits of higher integrity and quality. Ecosystem Marketplace's "State of the Voluntary Carbon Markets 2023" report provides key insights into this trend. The report indicates a noticeable increase in average carbon credit prices showing a clear reflection of the market's gravitation towards higher-value credits. This trend is not just about price, it's also about a change in buyer preferences, where there's a notable preference towards premium offerings that assure higher quality and integrity (Donofrio and Calderon 2023). This shift suggests a consolidation of the market around a more discerning group of buyers, who are willing to invest more in credits that meet stringent quality and sustainability criteria. The rising demand for these high-quality credits highlights the evolving nature of the market, where emphasis is being placed not just on the quantity but also on the quality and impact of carbon offset projects (Deloitte 2023). Nature-based solutions, including forestry and agricultural projects, are increasingly significant, occupying a substantial market share. Credits with broader environmental and social benefits are in demand, attracting higher prices, especially those aligned with the UN Sustainable Development Goals (Donofrio and Calderon 2023). Artificial Intelligence (AI) is another key trend, revolutionizing carbon auditing and project evaluation. AI tools, capable of analyzing extensive datasets, provide more precise assessments of carbon reduction projects' impacts. AI applications in carbon credits auditing are also particularly noteworthy (Viact 2022). They demonstrate how AI is becoming crucial for accurate carbon accounting in the VCM, where it aids in verifying the authenticity of projects and enhances the efficiency of the auditing process in a complex and demanding market. The use of AI is instrumental in ensuring the integrity and

transparency of the carbon credits, making it a vital component in the evolving landscape of the VCM (Singh 2022). The Internet of Things (IoT) technology also plays a vital role, especially in real-time project monitoring. IoT devices and sensor technology offer continuous data transmission on environmental parameters, crucial for project integrity and effectiveness.

Lastly, the VCM is diversifying, with an increasing focus on both the variety and quality of projects. There is a growing interest in a range of project types, from traditional nature-based solutions to innovative technological approaches in carbon sequestration. This trend reflects the market's evolving sophistication, with participants seeking projects that promise long-term impact and meet stringent quality standards (Sylvera 2023).

3. Methodology

3.1. Research Objectives

Given the limitations of the existing literature and the complexity of the VCM, this thesis aims to shed light on the ever-changing offsetting sphere. In doing so, it can provide valuable learning perspectives. Furthermore, this research will add to the existing literature and provide an in-depth understanding of market and competitive dynamics, while also investigating customer needs and opening potential avenues for the creation of a platform-centric business model. Additionally, an objective is to advise the external thesis partner, Celfocus, in this endeavor. This practical example and research will support them in making valuable decisions to be implemented to create such a business model in accordance with the emergence of the Portuguese VCM and in relation to the received APA grant. Nevertheless, the findings of this thesis are not only applicable to Celfocus itself, but also provide insights to other key stakeholders, institutions, and academics in general. This is to be underlined by finding solutions based on the respective research problem and the challenges faced by entering the market. Ultimately, the intention of this thesis is to identify the strategic implications of market dynamics as well as customer needs and desires to establish a successful business model that is financially viable. Consequently, the underlying core objective of this thesis is to answer the following overarching research question, and sub research questions:

"In the context of the Voluntary Carbon credit market's unique challenges and dynamics, how can a carbon credit marketplace be developed to ensure a viable business opportunity for Celfocus?"

RQ1: *"To what extent do market and competitive dynamics shape the voluntary carbon credit market and what are resulting strategic implications?"*

RQ2: *"How are corporate buyers engaging in the voluntary carbon credit market and what are resulting pain points in the process of buying carbon credits?"*

RQ3: *"What are the critical components and steps involved in developing a successful carbon credit marketplace?"*

RQ4: *"How large is the business opportunity and what are key financial indicators for building a voluntary carbon credit marketplace?"*

3.2. Research Design

This thesis employs a mixed-methods research design to achieve a comprehensive and nuanced understanding of the VCM. By combining qualitative and quantitative methods, the aim is to explore in-depth insights while formulating a sound business model and investigating its financial viability. The study incorporates a triangulation approach to validate and cross-verify findings from both qualitative and quantitative analyses. This enhances the robustness of the research outcomes by ensuring consistency and reliability across different data sources. The nature of this paper can be classified as exploratory and inductive.

In order to allow for comprehensive and valuable findings, the process of gathering secondary data was fundamental. By conducting desk research and establishing an extensive literature review, an understanding of the VCM could be gathered. Based on this secondary data, a value chain could be established and key players as well as stakeholders were identified. This, in turn, aided the process of collecting primary data as it helped to pinpoint the people of interest to conduct expert interviews with. In addition to these interviews, conversations with the external thesis partner Celfocus were utilized to consolidate a market understanding. Selecting the

interviewees along the identified value chain allowed for comprehensive and valuable data which was then analyzed based on existing frameworks. The combination of primary and secondary data was hence solidified via the application of these frameworks and led towards a high quality of findings. Based on this research approach the structure of the following analytical sections has been determined to build upon each other. While the first three parts utilized the above mentioned primary and secondary data as well as the use of frameworks, the last part quantifies these findings by utilizing financial modelling and a scenario analysis. In this way, the reader is guided throughout the sections intuitively and is introduced to the market, the customers pain points and finally the business model as these analyses incorporate each other's findings. Lastly, the quantification rounds up the analytical part by taking these findings into consideration. Figure 1 visualizes the approach previously described, detailing the primary and secondary data sources used for each research question and illustrating the analytical methods applied.

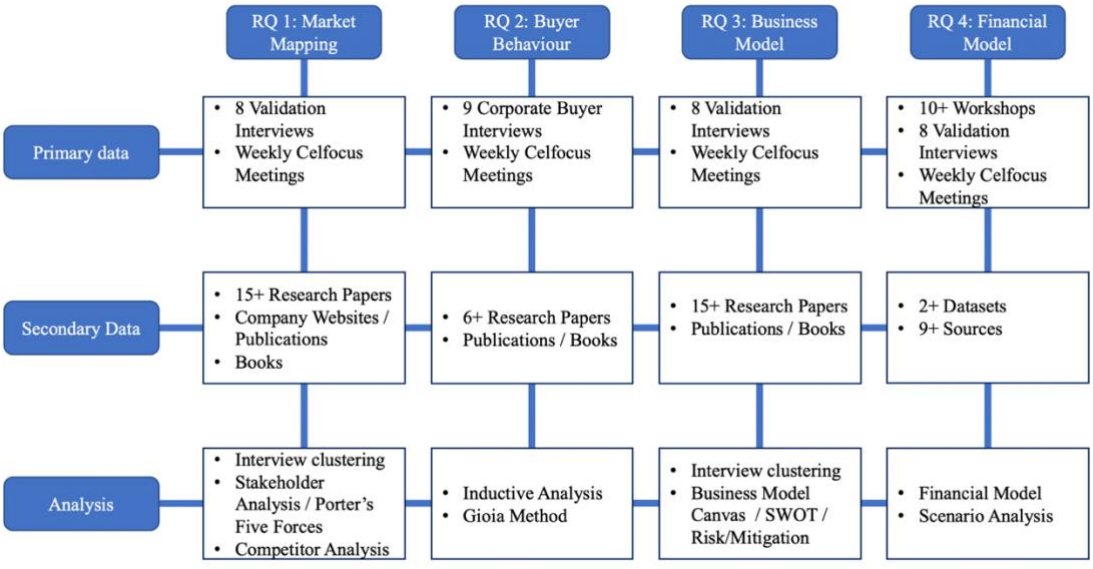

Figure 1 Research Design

3.3. Qualitative Approach

While this thesis employs a mixed-method approach, the qualitative data has been derived via conducting in-depth semi-structured interviews. In the following sections, the data collection as well as the data analysis will be further explained.

3.3.1. Data Collection

To guarantee the efficiency of the data collection, interviews have been divided into two groups. While the first group (Corporate buyer) focuses on demand-side insights, the second group (Industry experts) was utilized to provide market and business insights. Respectively, these interviews were grouped as buyer interviews and validation interviews (Appendix 2). All interviews were conducted between October 2023 and November 2023, totalling 18 sessions each spanning 40 to 60 minutes. Due to the geographic differences of research participants all interviews were hold online using Teams. The demand-side interviews followed a clear structure as per the interview guideline (Appendix 6) while the validation interviews were semi-structured, adapting to the direction of each conversation. In selecting interviewees, key figures involved in the VCM were targeted and research participants were contacted via LinkedIn while sufficient industry knowledge and experience was ensured prior to the interview. This allowed to gather valuable insights from diverse roles including sustainability managers, project developers, consultants, founders, and independent experts closely involved with the VCM in their respective organizations, many with years of experience in the industry. Individuals involved in the development of VCM marketplaces or possessing insightful perspectives on this topic were also interviewed. The interview guide outlined the topics to be addressed and was given to the interviewees prior to the meeting to elicit more reflected responses. This ultimately fostered a higher quality of the empirical data. Beyond the interview guide presented to the interviewees, an internal question overview was created to ensure that the interviewers touched

upon all the most important subjects. During the interview, it was made sure that sufficient information was received on each topic. Furthermore, interviews were also recorded as well as transcribed whereby prior consent was gathered. Recording the interviews was essential to ensure that all information was captured and that responses could be further analyzed afterwards.

3.3.2. Validity and Reliability of Data

Saunders, Lewis and Thornhill (2007) have set out the principles of research design and consider data validity and reliability to be important for research. To ensure data validity, the interview guidelines were designed to meet all important criteria and were drafted after extensive research on the topic. Accordingly, the selected interviewees were carefully selected and screened to ensure that they met all the necessary criteria established in advance. The reliability of the data in question was also ensured by using different methods to collect the data and by using several frameworks to further solidify findings.

However, it is also important to be critical of certain aspects that could potentially undermine the validity and reliability of the data. All the interviews were conducted with people employed by active players along the VCM value chain, based on their expertise in market dynamics. This could potentially lead to restricted insight into their firm's practices. To circumvent this challenge, anonymity was offered to interviewees. Additionally, the authors may have demonstrated a form of observer bias, as the questions selected for the interview guide were informed by previous research. However, this was eliminated, at least to some extent, by the semi-structured interview approach, which allowed for new ideas to generate throughout the discussion. In addition, a lack of inter-firm validity must be taken into account as only one interview was conducted per company. Given a longer period to research this topic, this

problem could have been overcome by interviewing up to three employees of different ranks per company. This would have ensured insight into different perspectives and further demonstrated the validity of the data by reducing participant bias and improving external validity. Nevertheless, several stakeholders within the value chain classifications were interviewed, which also increases the validity of the data by identifying recurring themes and issues. In terms of the generalizability of the data, this paper is somewhat limited to explicit findings based on the external thesis partner Celfocus and its unique attributes, business operations and ideas. Nevertheless, it can be argued that the first two sections of the analysis do indeed present generalizable data based on market research and carbon credit purchasing behavior.

3.3.3. Data Analysis

The data analysis approach in this thesis is tailored to address each specific part of the research, employing a combination of techniques to ensure a comprehensive understanding of the VCM. In the first part of the analysis, primary and secondary data from validation interviews, conversations with the external thesis partner and desk research were utilized to gain a deep understanding of the market and its competitive landscape. The analytical section was introduced via a value chain analysis and a classification of key players on which categorization all following sections were based. Regarding interview data analysis, the perspectives and insights of various stakeholders along the value chain were identified to exhibit key market dynamics, trends, and competitive factors. The interviews thereby helped to validate findings and aided to employ strategic implications for the development of the business model. Moreover, interviews were filtered and organized according to their belonging within the value chain and data was analyzed by grouping findings to support strategic implications. Further, interview transcripts were all thoroughly analyzed, and findings were filtered according to

different categories of interest. Thereby, responses were grouped according to key themes and recurring topics (Appendix 3). Finally, the most essential and insightful quotes from these key themes were gathered and used in combination with the analysis of frameworks to contrive palpable results. Having a strong understanding of existing theories and literature guided the data analysis as it allowed for a better understanding of the topics raised and how to categorize and interpret them. Within this context, frameworks such as Porter's Five Forces were utilized to extract valuable findings that were able to support the qualitative empirical data. An in-depth depiction of this methodological approach is to be found in Appendix 1.

The second analysis part focused on gaining a better understanding on how companies are currently engaging in the VCM. Corporate buyer interview findings were analyzed thoroughly in order to identify trends and commonalities resulting from the conversations. Delving into companies' typical sustainability strategies helped exploring their respective carbon credit approach and scrutinized the criteria for purchasing carbon credits. The findings are presented effectively with the support of own illustrations. The focus of this analysis hereby lies in exploring current pain points organizations are facing when buying carbon credits. Here, the Gioia method, a qualitative data analysis technique, was employed to systematically organize and interpret the data. This method allowed for categorizing the data into first-order concepts (direct quotes or observations) and second-order themes (broader categories or patterns), leading to the development of aggregate dimensions that highlight the primary concerns and challenges faced by buyers in the VCM. This rigorous approach provided a detailed understanding of the demand-side pain points, which are crucial for developing targeted solutions in the business model. Finally, the findings of the of the analysis are thoroughly examined, and existing biases were addressed.

In the third analysis part, validation interviews were analyzed to cluster and extract the most significant market inefficiencies. This involved categorizing and synthesizing the insights from various stakeholders to identify the key inefficiencies plaguing the market. The clustering process helped in pinpointing specific areas where the market is not functioning optimally. Based on this and the insights from the analyses conducted in part one and two, strategies and solutions were formulated for the proposed business model, aimed at effectively addressing market inefficiencies and enhancing the functioning of the VCM. Consequently, a Business Model Canvas was constructed. Afterwards, a comprehensive examination of the core advantages of the proposed solution was undertaken. Furthermore, tools such as the SWOT Analysis and a Risk Mitigation Strategy were employed to strategically position the solution in the market, identify potential risks, and develop strategies for their mitigation.

3.4. Quantitative approach

While discussing the approach for the qualitative methodology in the earlier part, this report will now further explain the methodological approach for the *quantitative* analysis. It combines secondary data with industry standard methodological approaches and primary assumptions to build a unique financial model. By conducting a scenario analysis, this model also takes future company uncertainties and the volatility of the carbon credit market into account.

3.4.1. Data Collection

Due to the sheer size of assumptions, this methodology section will not do a deep dive into each collection method. Overall, there were two main categories of how specific data points were collected: Primary data and secondary data.

Examples of primary data sources include weekly workshops with Celfocus, in which regular updates on the status of the project and relevant information that could help the work project

group and the client, was gathered. These workshops were also thoroughly used to better understand the size and scope of the project, framing the respective relevant cost- and revenue factors for a suitable business model. This report has also partly implemented primary data from interviews to benchmark certain business metrics, including average transaction size or pricing strategies and levels.

Examples of secondary data mainly encompass datasets or business benchmarks. For example, a report of McKinsey and the Taskforce for Scaling Voluntary Carbon Markets (TSVCM), which analyses carbon credit demand forecast until 2050, taking three different scenarios into account, was used to scale carbon credit demand until 2030 (Blaufelder et al. 2021). Additionally, this report also uses secondary data for internal assumptions, such as CAC benchmarks, or relative emissions, to optimize model precision.

3.4.2. Validity and Reliability of Data

The following section discusses the validity and reliability of the data, as outlined in the previous chapter. There were two main parties involved as the bodies of validation, especially for the primary assumptions. Firstly, Celfocus functioned as the arbiter, inducing that e.g. certain market share aspirations might be too high or the annual team composition too conservative. Subsequent iterations were done after discussing them in weekly workshops, until satisfaction of all parties was reached. Secondly, the Nova SBE Data Science Knowledge Centre was helpful in providing concrete recommendations on how to structure the financial model, which factors to include, and how to provide confidence levels using a scenario analysis. While secondary datasets were “confirmed” as trustworthy sources, the rigorous approach to audit assumptions were mainly done for primary data sources. This, in combination with the scenario analysis, enables confidence that the proposed venture will reach realistic values.

However, it should be mentioned that the consortium in which this marketplace operates is still at its beginnings, and strategic tweaks and additional services will have a significant effect on the validity of this solution.

3.4.3. Data Analysis

The logic behind the financial model follows a venture model approach, which operates primarily on market data (growth, market sizing), instead of using past data company on cash flows for revenue and costs predictions. This is due to the lack of this data, as it represents an entirely new business case that is generally not linked to the main business model of Celfocus. Additionally, the volatile and speculative nature of the VCM makes past data a less credible source than market demand predictions. The financial model consists of multiple sub-folders, including revenue projections, cost projections, a break-even analysis and cash flow statements. Moreover, this report offers a unique perspective on how different scenarios affect these variables, providing lower and upper bounds on each of these analytical components. The assumptions were collected and then put into one of four different buckets: Market assumptions, pricing assumptions, revenue assumptions, and cost assumptions. Depending on the nature of each assumption, different calculations were performed to attain the required values. The financial modelling analysis in section 4.4. will provide more comprehensive insights into the logic and results of the mode, and ultimately specific recommendations that can be extracted from this quantitative methodology. All assumptions were discussed and protocoled with the managing Celfocus team, ensuring consistency and a more realistic business case. The goal of this analysis is to draw conclusions on the predicted performance of the business model proposed. This quantitative analysis helps to contextualize the status quo and ultimately paves the way for a more inclusive, differentiated business model for a one-stop-shop marketplace in the VCM.

4. Analysis

4.1. Corporate Buyer Analysis

The following chapter spans the data collection and analysis of the conducted interviews with corporate buyers. Through these profound insights a comprehensive understanding of how buyers engage in the VCM via buying carbon credits is achieved. The focus hereby lies on identifying pain points from corporate buyers when buying carbon credits. The resulting pain points will then build the foundation for the creation of a sound business model in the following chapter, effectively addressing the research question: *"How are corporate buyers engaging in the voluntary carbon credit market and what are resulting pain points in the process of buying carbon credits?"*

4.1.1. Introduction

Speaking with companies planning to or already engaging in offsetting practices helped to understand their current offsetting approach in-depth. Furthermore, conversations with sustainability consultants provided a more high-level understanding about the overall market. In the following, key insights from interviews are summarized according to the interview guide structure (Appendix 4).

This chapter starts off with outlining organizations' overall sustainability strategies, highlighting the role of offsetting. Next, companies' carbon offset approaches are thoroughly examined, where the focus lies on three cases resulting from the conducted interviews. What follows is an analysis and description of the key decision criteria influencing the purchase of carbon credits. Finally, the challenges organizations face as a result of engaging in carbon credits are identified by applying the Gioia method, which offers a structured framework, enhancing the rigor and reproducibility of qualitative data analysis. It enables the identification

of patterns and themes, fostering a holistic understanding of challenges in buying carbon credits through expert interviews (Gioia et al. 2012). The resulting pain points lay the foundation for the creation of a sound Business model in the following chapter.

4.1.2. General Sustainability Strategy

In order to gain a comprehensive understanding of how companies approach sustainability and which role carbon credits play in it, it is beneficial to outline a general sustainability strategy. The following graphic (Figure 4) depicts a typical sustainability strategy shared by one of the interview partners, a large insurance company (Interview A).

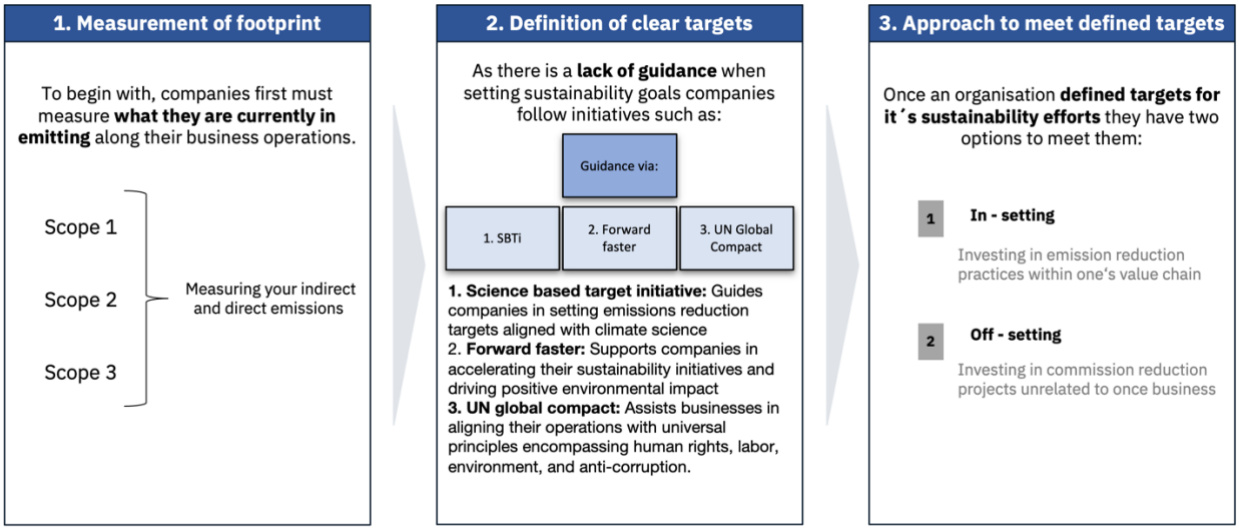

Figure 2 Competitive Landscape

Measurement of Footprint

In the first step, companies can start by conducting a comprehensive assessment of their environmental impact. This involves measuring their carbon footprint from Scope 1 to 3 (National Grid 2023):

- Scope 1 Emissions refer to direct emissions under a company's ownership or control.
- Scope 2 Emissions are characterized by indirect emissions linked to purchased energy.

- Scope 3 Emissions encompass indirect emissions within the company's value chain but beyond its ownership or control.

Our interview partner, a large Portuguese insurance company, reported that especially, scope 3 emissions introduce a spectrum of complexities for organizations, stemming from the diverse nature of indirect emissions across the entire value chain. Resulting from the conversation, one problem the insurer has been confronted within the process of measuring it´s footprint are missing methodologies for certain business areas. Here, the interview partner mentioned investment assets classes, as well as insurance products, which lack methodologies for footprint measurement. Among other reasons, this leads to an inaccurately calculated CO2 footprint, the company reported.

"The only thing I can be certain of is that the carbon footprint is wrong as the number of assumptions [the calculations are based on] is so high" (Interview A)

This problem has surfaced consistently in the discussions, such as in one instance with a Portuguese bank stressing the difficulty in obtaining precise data for measuring their carbon footprint. Still, they believe that this is a crucial step to start any offsetting activity.

"It's very difficult to understand what our footprint is as data is an issue […] we will only start offsetting once we acknowledged our footprint." (Interview L)

Despite the challenge in measuring scope 3 emissions, an interviewee from an educational institution emphasized the importance for organizations to consider these measurements when establishing sustainability goals.

"By the end of the year, we might have our scope 3 emissions and I guess only after that we will be able to start establishing targets." (Interview R)

Definition of Clear Targets

Once the environmental footprint is measured, the second step consists of companies setting clear and ambitious sustainability targets. From the interviews, it became evident that companies clearly differentiate between setting climate neutral targets or net-zero targets.

"Being climate neutral means, when I have too much money, I can completely offset my entire emissions, but if you plan to become net zero, you can merely offset around 5% of your emissions and the rest really must be reduced. "(Interview I)

However, defining precise sustainability goals proves challenging due to regulatory changes, the interviewee reported. As a guidance for defining these targets, companies can follow different initiatives which aim to provide a certain level of standardization and credibility to the companies' sustainability targets. One interview partner, for example, aims to be part of the science-based target initiative (SBTi) helping them to set their sustainability targets.

"Obviously, SBTi helps us a lot to understand [our offsetting efforts], we don't have yet the certification, but I think it is the best that exists at least today. […] it helps us to know if we reduce 'this' we will become net- zero." (Interview A)

Involvement in the initiative necessitates organizations to prioritize emission reduction activities within their company boundaries. Carbon offsetting through credits is only allowed when seeking additional reductions beyond their value chain (Interview I). This is a relevant detail as implementing emission reduction initiatives internally demands considerably more

resources, as argued by the interviewee. Next to clearly defined sustainability targets a respective time horizon needs to be set as well. On that note an interview partner emphasized the difficulty as well as the relevance in setting clear “Interim targets” compared to long term ones. Short to midterm targets create a greater imperative for action, facilitating companies to be on track with their defined targets whereas targets set over a long period of time loose significance.

“As my CEO used to say, I can say anything I want, as I won't be there in 2050 [where the company needs to be net-zero by European regulation].” (Interview A)

Definition of Clear Targets

In a last step, to achieve sustainability targets, companies need to decide between carbon in setting and offsetting measures, or a mix of both. Interview partner A, a large Portuguese insurance company, aims to meet the previously defined targets by carbon in setting. This sustainability action can be described as projects within a company's own supply chain, to reduce or remove emissions as described by the interview partner.

“My responsibility is to answer the question where do I put each euro […] and if I have the chance of buying a carbon credit or reducing, I’m sure where I will put my money [in insetting efforts].” (Interview A)

However, in the long term, the organization plans to invest in offsetting measures to avoid emissions that cannot be avoided internally. The approach of starting with insetting, to then transition to additional offsetting activities over time, is an overall tendency among the organizations that have been interviewed. This finding is supported by a conversation with a

sustainability consultancy, which works with a broad range of different organizations supporting them in their insetting as well as offsetting endeavors. From their experience, offsetting is typically the last step in a company's overall sustainability strategy.

"[Organizations ask themselves] How will they reduce, how will they avoid, and then as a last step, they could do the offsetting with us." (Interview G)

However, some companies, like a major German chemical company, aren't convinced that offsetting is a viable solution. Even with 18 million tons of yearly emissions prompting sustainability actions, they're questioning the efficacy of carbon credits. Instead, they rather focus on insetting measures that are aligned with their core company values.

"In our pursuit of achieving net zero by 2050, we view offsetting as not the primary tool for reaching our goals. Instead, we have a range of different levers [focused on in setting] at our disposal." (Interview I)

4.1.3. Carbon Offset Approach

After outlining the overall sustainability strategy and what role offsetting plays in it, this chapter describes in detail the different offsetting approaches companies can take. Figure 5 depicts the different approaches companies can take engaging in the voluntary carbon market. They can either invest in own carbon credit projects, partner up directly with project developers, or purchase spot carbon credits on marketplaces, leading to different levels of engagement in the carbon credit value chain. Based on the interviews, a trend was identified where companies tend to begin with a low-engagement approach, such as purchasing spot credits, in the short term. As their strategic horizon extends into the future, companies increasingly engage in carbon credit activities, by for example setting up their own carbon credit projects. The following graphic depicts three distinct approaches that companies can adopt for carbon credit

offsetting along their short-term, mid-term and long-term strategic horizon with respective level of engagement.

(1) Low Involvement

"We have our trading desk where we buy and sell credits from broker platforms. Right now, we will not retire on our own but will do so in the future." (Interview D)

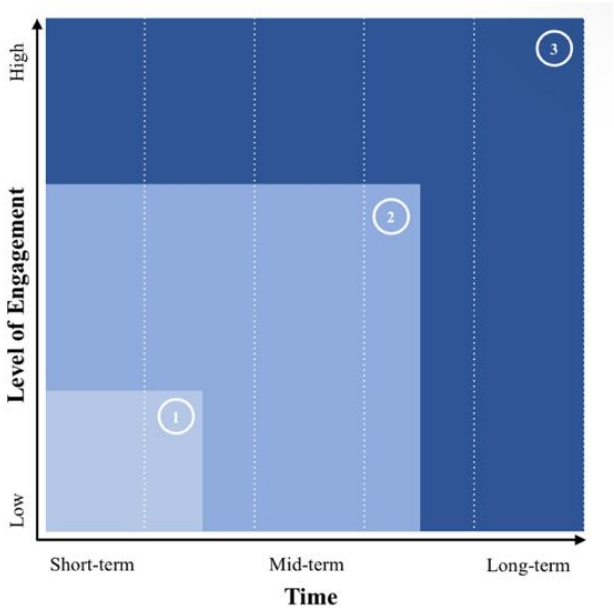

Figure 3 Overview of offsetting approaches

Some companies opt for a less involved approach in the credit creation process, choosing to purchase spot credits directly from broker platforms. An intriguing case surfaced during the interviews, particularly with an energy provider. This organization took a unique approach by establishing an in-house department functioning as a brokerage. This department is dedicated to buying and selling spot carbon credits, showcasing a distinctive strategy within their carbon credit engagement. The credit portfolio they cultivate serves a dual purpose. It can either be utilized to retire credits within their organization or, in favorable market conditions, be sold into the market. This flexibility allows them to strategically manage their carbon credits based on market dynamics.

(2) Moderate Involvement

In adopting this approach, corporate buyers have the opportunity to establish direct partnerships with one or more project developers, fostering a collaborative relationship that spans a considerable long-term timeframe. Throughout this strategic alliance, the corporate entity actively commits to sustaining a reliable and consistent supply of carbon credits, thereby contributing to the stability and continuity of their carbon offsetting initiatives.

(3) High Involvement

"We are building a forestry fund which is SFDR validated, basically meaning that it complies with the Portuguese regulation […]. This is the most important project we are doing, so we are building our own credits and maybe sell to the others". (Interview A)

This case study delves into an insurance company, showcasing a robust carbon offsetting commitment. This company demonstrates its dedication by substantial investments—amounting to 12 million euros—in a carbon credit project based in Portugal. This forestry project extends its impact beyond mere tree planting and emissions sequestration; it embraces a holistic approach, aiming to make a positive social contribution to the region. The project's objectives cover a broad spectrum. This includes establishing a source of high-quality carbon credits for their own use, as they maintain control over every step of the value creation process. Simultaneously, they aim for financial returns by planning to sell these carbon credits to their clients, hence, seeing this project not necessarily as a cost, but rather as an investment. Through discussions with 20 companies within their client base, it already became evident that there's a clear market demand for their credits. Companies are keenly interested in the project primarily due to its credibility. Being the largest insurance company in Portugal, they enjoy widespread

recognition, making them a household name. In the context of purchasing credits, credibility holds utmost importance for companies, and the project leverages this advantage effectively.

Comprehensive Approach

"It's more to have different places where we can get credits from not just relying on the market but having own internal projects and partnerships." (Interview M)

Besides the cases mentioned earlier about how companies approach carbon offsetting, some organizations adopt a more comprehensive strategy encompassing involvement levels. From the interview with an energy provider, it became evident that the company utilizes three distinct offsetting strategies. Firstly, they explore the VCM brokerage avenue. Here, the company buys and sells credits with a brokerage department. According to the interview partner, they are not able to avoid going into the VCM in a short-term timeframe.

"On short term, we wouldn't be able to escape going to the market because [own] projects take some time to develop." (Interview M)

Secondly, there's an emphasis on bilateral partnerships described in the "medium involvement" approach earlier.

4.1.4. Decision Criteria for Buying Carbon Credits

Nature-Based versus Technology-Based Credits

To begin with, the market can be delineated into two distinct types of credits: firstly, nature-based credits, and secondly, technology-based credits. In general, companies purchasing carbon credits at least in Europe, based on the interviews, lean towards nature-based solutions rather than technology-based ones.

Furthermore, buying technology-based credits is rather seen as an investment into the future of the respective technology itself than an offset investment. This perspective resulted from the interview with a sustainability manager from, a leading German machinery manufacturer.

"Because obviously with those [technology based] projects, there's a lot less experience around [hence it is] not necessarily something where you would claim credits for to account emission, [we see it rather as] our contribution towards the technology's future."

(Interview P)

Additionally, another interviewee highlighted a growing interest in nature-based solutions, emphasizing the increasing significance of biodiversity and social aspects which are more effectively met with nature-based projects.

"We are trying to move from a carbon discussion to a nature discussion, because that's the future, including biodiversity, including social, including everything […] people are only focused on carbon and forgetting everything else." (Interview A)

Another argument for the preference of nature-based projects compared to technology-based projects are the considerably higher costs associated with technology-based options.

"Technology based solutions are significantly more costly, so we focus more on nature based." (Interview D)

Decision Criteria when Buying Credits

Based on the interviews, various criteria are pinpointed for purchasing carbon credits, of which the most crucial ones are highlighted in what follows. One consistent theme in interviews with corporate buyers showed that they seek carbon projects closely aligned with their corporate identity. For example, the interview with a Portuguese bank showed that they have a focus on blue carbon credits as Portugal is a country with widespread coastlines.

"All our history is connected with the sea. We have the Azores, Madeira. I think it's a good way to help the country and to empower the ocean." (Interview L)

Furthermore, from the interviews, it becomes evident that companies can have geographical preferences for their carbon credits project they invested. This results from a conversation with a major logistics company in Portugal focusing on national projects.

"Yes, the calculated carbon footprint for our Express and Parcels offer is compensated through the support of a couple of offset programs, focusing mainly on Portugal." (Interview N)

Some interviewees discussed technical criteria for purchasing carbon credits. The Saudi Ministry of Energy, for instance, prioritizes permanence as their primary consideration when looking at carbon credits. It is interesting to note that they prefer technology-based credits as opposed to nature-based solutions contrasting the European preference on nature-based credits described earlier in this section.

"The more permanent the carbon credit is, the more valuable. So, in the case of, let's say, natural-based solutions like reforestation projects, they're not very valuable compared to, let's say, direct air capture or other technologies." (Interview K)

4.1.5. Pain Points Buying Carbon Credits

Following the general overview of how companies participate in the carbon credit market, this section delves into the challenges and pain points they encounter when buying credits — a central focus of this thesis.

To identify pain points, which are representative for the market, the *Gioia method* provides a useful structure bringing robustness to the findings presented in this part of the thesis. To establish the data structure, which represents a central element of the method, a coding process is applied. In this process the empirical observation, resulting from the interviews, are explained in increasingly abstract terms. The first step is an open coding of *first order concepts* describing the findings from the various conversations in a very descriptive manner. Here, the respective first order concepts are backed up by quotes from the conversations that can be found in the data table (Appendix 5) ensuring robustness of the findings. In the next step, *second order themes* are introduced. In a more abstract way of describing the findings, this step helps to categorize the first order concepts providing a detailed overview of existing pain points from corporate buyers when buying carbon credits. In the final step aggregated dimensions help to categorize the respective pain points into internal and external.

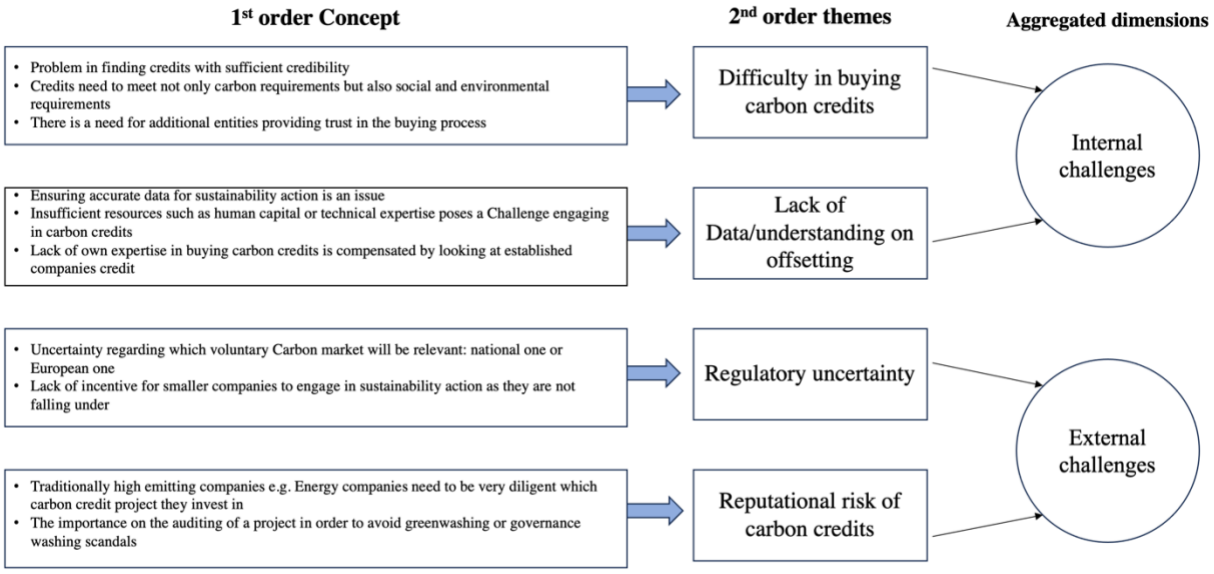

Figure 4 Data Structure

Figure 6, depicts these relevant pain points gathered from the interviews, describing challenges such as selecting the appropriate credits, navigating regulatory uncertainty, facing reputational risks linked to recent greenwashing scandals in carbon credit projects, and dealing with a shortage of relevant data and understanding regarding carbon credits. The respective pain points are then categorized in internal and external challenges corporate buyers are facing when engaging in carbon credits.

5. Conclusion

5.1. Summary of Findings

In addressing the central research question - *"In the context of the Voluntary Carbon credit market's unique challenges and dynamics, how can a carbon credit marketplace be developed to ensure a viable business opportunity for Celfocus?"* - a comprehensive analysis across four distinct parts provides a nuanced understanding of the complexities and opportunities within the VCM for Celfocus. Based on a combined assessment of quantitative and qualitative analyses, it is recommended that Celfocus should launch a one-stop shop marketplace, to capture more of the credit value chain.

The journey began with a detailed analysis of the VCM landscape, identifying key players, stakeholders, and the interplay of market dynamics. This initial phase shed light on the competitive environment and highlighted the necessity of strategic alliances and innovative approaches to navigate the complex market terrain effectively. Key findings underscore the intricacies of the VCM, revealing a web of interdependencies and a dynamic interplay of market forces. Robust strategic partnerships are emphasized as key to navigating this competitive landscape successfully. Further, it underscores the importance of a differentiation strategy, the need for innovative solutions and the quality assurance of carbon credits. The highly competitive rivalry and landscape suggest the adoption of successful business practices while also identifying the need to further expand business offerings along the value chain. Ultimately, the potential for integrating value-added services, embracing technological advancements, and establishing a strong competitive advantage as well as value creation strategy are identified as crucial components for achieving market relevance.

Subsequently, the research delved into understanding the perspectives and challenges faced by corporate buyers in the VCM. Insights regarding their preferences for carbon credit purchasing, along with their concerns about credibility and the complexity of the buying process, underscored the need for a marketplace that offers transparency and diversity in credit options. A notable observation is the long-term goal of major organizations to actively participate in the VCM by initiating their own carbon credit projects. Interviews revealed that the primary motivation is to guarantee high-quality carbon credits. Another important discovery from the interviews highlights a significant lack of knowledge among corporate buyers in navigating this dynamic field. Consequently, pain points emerged, including a lack of understanding about offsetting and challenges related to regulatory uncertainty.

Building upon these insights, a comprehensive business model canvas that highlights the critical role of utilizing technologies such as blockchain for enhanced transparency and security was developed. This business model goes beyond mere transaction management, establishing a hub for the carbon credit market. It integrates services like offset consultancy, footprint measurements, and a carbon intelligence blog, offering a holistic solution. The model also emphasizes the importance of forging key partnerships, maintaining rigorous quality assurance, and crafting a unified platform tailored to meet the diverse requirements of its customer base. The conducted SWOT analysis highlighted the model's strengths in technology and partnerships, acknowledged challenges in quality control and liquidity, and identified growth opportunities due to environmental trends. The strategic risk mitigation plan, detailed with a likelihood/severity matrix, prepared the marketplace to navigate risks and sustain its competitive edge, ensuring responsiveness to market uncertainties.

The final phase involved quantifying the business opportunity, taking various scenarios to predict revenue, sales, costs, and overall profitability into account. This rigorous financial analysis provided tangible insights into the economic viability and sustainability of the proposed marketplace. Built on the differentiation strategy, the market size was quantified, utilizing a top-down analysis for finding the TAM, SAM, and SOM. In a next step, different revenue streams were prized. The utilization of these revenue streams was later assumed, building the foundation for the revenue side of the business model. The cost side was also discussed, splitting costs up into different buckets and analyzing how they will develop over time. Ultimately, a scenario analysis was proposed, which assumes a 15% variance into both directions to account for external and internal uncertainties. The most impactful assumption affecting profitability was the market size, as it significantly changes the volume of carbon credits sold and the number of customers engaging in additional offsetting services. These results were compared, and finally, concrete, and actionable recommendations for the clients were provided.

The findings of this thesis offer substantial contributions to both academic and practical realms. Academically, it enriches the understanding of VCM dynamics, buyer behavior, and the intricacies of developing a business model in a complex market. Practically, it serves as a guiding framework for companies like Celfocus, aiding them in navigating the VCM with strategic acumen and foresight. It also informs policymakers about the critical role of regulatory clarity and market standardization.

In sum, this master thesis offers a comprehensive and insightful exploration of the VCM, delineating the complexities and opportunities inherent within. It provides a strategic roadmap for establishing a successful carbon credit marketplace, balancing the demands of market

efficiency, technological advancement, and environmental integrity. The research underscores the imperative of adaptability, innovation, and collaboration in navigating the VCM, ultimately contributing to a more sustainable and responsible approach to carbon trading. As such, this thesis stands as a significant academic contribution and a practical guide, poised to influence the future trajectory of the VCM.

5.2. Limitations

The findings of this thesis are supported by primary and secondary data, using a sound methodological approach. Nevertheless, there may be some limitations due to potential biases, the construction of assumptions, the inherent complexity of the market and the generalizability of the data due to the research partnership with Celfocus.

The validity and reliability of the data collected for this study present a notable limitation. Given the reliance on expert interviews, participant and observer bias may have influenced the findings. The subjective nature of interpreting qualitative data can lead to bias, potentially skewing the derived insights. Additionally, the lack of inter-firm validity of the data, where findings from one interviewee may not be applicable or representative of the entirety of the company, further represents a limitation. Furthermore, the number of interviewees represents a finite subset of the broader landscape of practices. The sampling method employed, while rigorous, introduces an element of selectivity that warrants consideration. The depth and breadth of these insights are thus influenced by the specific parameters guiding participant selection.

Moreover, the financial model developed in this thesis is assumption-based, which inherently limits its accuracy. In a field as complex and unpredictable as the VCM, crafting assumptions

that accurately reflect future market conditions is challenging. This limitation is significant as it affects the precision and applicability of the model's predictions.

More generally, the VCM is characterized by its complexity and constant evolution. This dynamic nature makes it difficult to accurately capture all nuances, market forces and prospects. This challenge is compounded by the rapid emergence of new players, evolving regulations and technological advances. As a result, findings and analyses can quickly become outdated or less relevant, affecting the long-term applicability of the research.

Ultimately, the scope of this thesis is specifically tailored to the strategic needs and context of Celfocus. While this provides in-depth insights for Celfocus, it limits the generalizability of the findings to other entities or stakeholders interested in entering the carbon market. The focus on Celfocus' network, capabilities and objectives means that the strategic implications and recommendations may not be directly applicable or relevant to other organizations with different profiles and operational contexts.

5.3. Avenues for Further Research

As the VCM continues to evolve, it provides a rich ground for numerous research opportunities that can significantly contribute to the advancement and refinement of such marketplaces. While this thesis has laid the groundwork for understanding and developing a platform-centric marketplace in partnership with Celfocus, the dynamic and complex nature of the market prompts a deeper exploration of several critical areas that would be interesting to explore on a larger scale.

One promising area for future research is the exploration of bilateral project development, which has emerged as the preferred method of purchasing carbon credits. This trend underlines the growing desire of companies to be actively involved in the credit creation process, as it allows them to ensure the quality of credits and tailor projects to their specific sustainability strategies. This also goes hand in hand with mitigating challenges regarding purchasing carbon credits, whereby recent criticism was voiced. Exploring the feasibility and implications of establishing an internal registry within this framework could provide invaluable insights. Such an approach could revolutionize the way carbon credits are sold, offering more tailored and transparent solutions to businesses. While this has been highlighted in the report, further investigation and research into its feasibility in the context of this marketplace would be valuable. Further research is also needed to ensure the successful integration of an in-house registry on which credits on the marketplace depend.

Another aspect that requires further investigation is the regulatory landscape surrounding the VCM respective to the emergence of the marketplace. Understanding how evolving regulations could affect the launch and operation of the respective marketplace would be insightful. This research should not only focus on the current regulatory framework, but also anticipate future legislative trends and their potential impact. Such further analysis would assist in ensuring compliance and provide insights into how to strategically navigate the complex regulatory environment of the carbon credit market.

The evolving landscape of the VCM is increasingly influenced by technological innovations, particularly in the realms of AI and blockchain. This underscores a growing need for comprehensive research into how these technologies can redefine market operations. AI's role

in the verification and monitoring of carbon offset projects is a significant area for exploration, ensuring the integrity and effectiveness of these projects.

Parallel to AI, the integration of blockchain technology, specifically through tokenization and smart contracts, presents a transformative opportunity for the carbon credit trading process. Even though this was included in this report, a deeper exploration could enhance the business model's future viability. Blockchain can significantly enhance transactional efficiency and security, addressing key challenges such as fraud and lack of transparency. Additionally, the introduction of Automated Market Makers (AMMs) within this blockchain framework could resolve liquidity challenges, further stabilizing the market and is therefore highly recommended to further explore. The importance of further research in these technologies is pivotal for establishing a more efficient, transparent, and credible carbon trading ecosystem. This is also supported by their potential to address current market challenges while paving the way for future growth.

Ultimately, these avenues for further research open opportunities to expand and support the understanding of market needs, regulatory requirements and future prospects. Consequently, further research should build on these areas to broaden the applicability and feasibility of the proposed business model.

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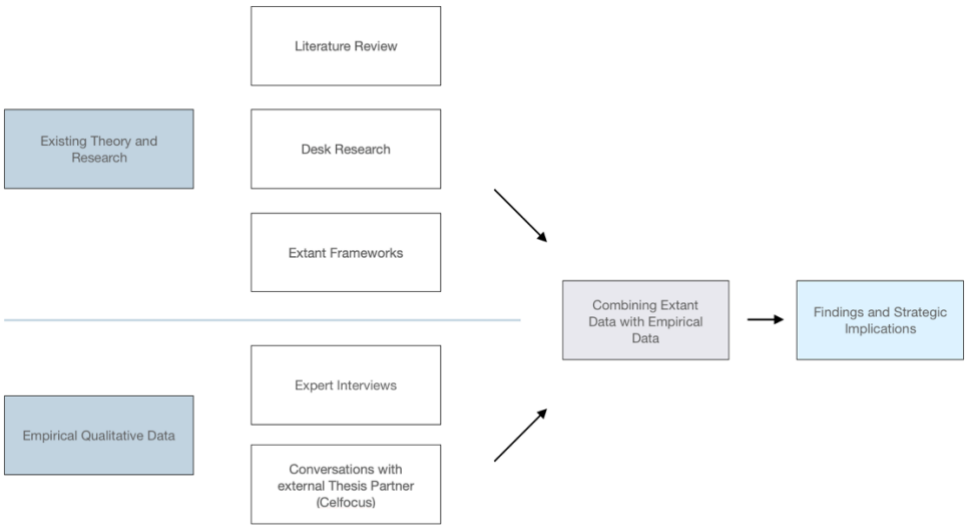
7. Appendix

Appendix 1: Methodological Approach - Analysis Part One Market Mapping



Appendix 2: List of Interviews

#	Role	Company	Date	Duration	Category of interviews: Validation interviews	Category of interviews: Buyer interviews
A	Head of sustainability	Insurance company	16.10.23	45 min	X	X
B	Business development and sales	Consultancy	16.10.23	45 min	X	
C	Cofounder and CPO	Energy Company	19.10.23	30 min		X
D	Carbon offset trading manager	Energy company	19.10.23	45 min	X	

E	Founder and CEO	Project developer	20.10.23	45 min	X		
F	Ex-founder associate	Carbon credit registry	23.10.23	45 min	X		
G	Sales manager	Consultancy	24.10.23	1 hour			X
H	CFO and head of investment	Consultancy	25.10.23	30 min	X		
I	Sustainability manager	Chemical company	27.10.23	45 min			X
J	Head of carbon markets	Marketplace	28.10.23	1 hour		X	
K	Sustainability manager	Governmental institution	30.10.23	1 hour			X
L	Head of sustainability	Portuguese bank	31.10.23	45 min			X
M	Sustainability manager	Energy company	03.11.23	45 min			X
N	Head of sustainability	Logistics company	08.11.23 (by mail)	NA			X
O	Consultant for sustainable farming investments	Consultancy	13.11.23	30 min	X		
P	Sustainability Manager	German Machinery manufacturer	15.11.23	45 min			X
Q	Sustainability manager	Sports good company	06.11.23	45 min			X
R	Director of Sustainability	Academic institution	10.12.23	1 hour			X

S	Partner	Sustainability consultancy	10.12.23	1 hour	X	

Appendix 3: Interview Classifications and Data Analysis – Part One and Three

Supply Chain Involvement	Interviewee	Market Mapping; Analysis Part 1				Business Model: Analysis Part 3	
		Market Understanding	Stakeholder Engagement	Porter's Five Forces	Competitive Analysis	Market Inefficiencies	Business Model Implications
Credit Creation	Interview F	✓	✓	✓		✓	✓
	Interview B	✓		✓		✓	✓
	Interview E			✓		✓	✓
	Interview S		✓	✓	✓	✓	
	Interview O					✓	✓
Credit Trading	Interview J	✓	✓		✓	✓	✓
	Interview H				✓	✓	
	Interview E			✓		✓	
Demand	Interview A	✓		✓	✓		
	Interview S		✓	✓	✓	✓	

Appendix 4: Interview Transcript of Corporate Buyer Interviews

Introduction
• Thank the interview participant for their time. • Personal introduction of the interviewer and interviewee. • General introduction regarding research objectives and interview procedure. • Request for permission to record the conversation. • Personal introduction of interviewee (general understanding what the interviewee is doing).
Section A: Company profile – What is the current situation?
• Does your company engage in offsetting? • What are your touch points in this process?

• What are your organizations main motivations to engage in offsetting (e.g. sustainability, regulations, financial)? • Who in your organization is responsible for carbon offsetting?
Section B : Buying process - How do you currently buy Carbon credits?
• Could you give us a brief overview of your credit buying process? • Are you following an avoidance or a removal strategy? • What tools/platforms do you use such as rating agencies marketplaces brokers. Please name them. • Who in your organization is buying the carbon credits? • When do you buy/invest in the carbon crediting process (early-stage projects or already issued credits on marketplace) and why? • How do you define quality in carbon credits? Please name and rank the quality criteria (e.g., additionality, project type, permanence). • What are the decisive factors for buying or not buying a carbon credit (e.g., certifier, price, type, location)? Please rank them.
Section C: Pain points - How can your Carbon credits buying experience be improved?
• From your perspective, what factors contribute to the complexity or problems in the voluntary carbon credit market (e.g., quality, transparency, financial problems)? • How big is the problem? • Can you identify any notable challenges experienced by stakeholders in the market (e.g., marketplaces)?
Section D: Future outlook
• What will be your next steps for your carbon offsetting strategy? • How do you envision the ideal carbon marketplace? • From your perspective, what are potential strategic approaches that entities can adopt to position themselves effectively in the market?
Closing questions
• Is there anything we have overlooked? • Is there anyone else you would recommend I should talk to in your network?

- Could I reach out to you again to seek your expert opinion on our advanced research process?

Appendix 5: Data Table for the Gioia Method

Second order concepts	First order Concept and representative quotes
Difficulty In buying credits	*"But again, the problem is credibility. Okay, not only price but mainly credibility." (Interview A)* *"We would like to offset in projects that connect both the environment and the community, not just the environment." (Interview L)* *"An additional layer of trust such as rating agencies would help us by credit form for example marketplaces." (Interview D)*
Regulatory Uncertainty	*"I don't know if I will be validated by the European or the Portuguese Regulation. I don't know which will be first." (Interview A)* *"There are new regulation, Net zero strategy, CSRD for the reporting coming up and Switzerland is still waiting to understand the landscape and where to go." (Interview I)* *"There's no real incentive to buying carbon credits, unless you are a really big company." (Interview R)*
Reputation risk of carbon credits	*"as an Energy company we are very much under scrutiny by the public, we need to be very cautious which projects to support." (Interview D)* *"Also, how we can follow the project and how it's audited so that we'll never have any kind of social or greenwashing or governance washing." (Interview L)*
Lack of Data/understanding on offsetting	*"Data is an issue that we need to manage as well because, as you know, it's sometimes not so accurate as we would like." (Interview M)* *"Many companies perhaps don't have a specific sustainability department or team (…) you have to have a certain amount of technical expertise related to." (Interview K)* *"I trust when big players such as Microsoft, Swiss Re, BCG, and some of the companies that are investing, JP Morgan, these types of companies that are much, much bigger than ours, that can do very deep due diligence. "(Interview A)*