

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

**Carbon Bridge: Making businesses greener by realizing the potential of biochar -
Impact: elevating customer success**



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Abstract

This work project discusses the development of the impact business Carbon Bridge. Carbon Bridge has the mission of increasing the sale of biochar by raising awareness for it. While doing so it is aiding businesses to reduce their emissions with biochar. The project, guided by the Plan-Do-Check-Act framework, evolved from an initial vision to a multifaceted product which was further developed using the Lean Business Model Canvas. The final product is a website that includes an educational blog, a Python-built impact assessment tool, and a marketplace for biochar. Upon the reflection of this progress, the work extends with a discussion of customer success. More importantly how Carbon Bridge's platform and marketplace can positively impact our customers success based on the three pilar approach. It distills the biochar producers needs and expectations based on direct conversations and how we aim to build trust-based relationships to lay the foundation of a strong, long-term bond.

Keywords

Entrepreneurship, sustainability, biochar, impact innovation, carbon sequestration, impact assessment, innovation, impact

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List of Abbreviations

B2B.....	Business-to-business
B2C.....	Business-to-consumer
CAC.....	Customer acquisition costs
CEO.....	Chief Executive Officer
CO ₂	Carbon Dioxide
EBC.....	European Biochar Certificate
MQL.....	Marketing qualified leads
MVP.....	Minimum-Viable-Product
PDCA.....	Plan-Do-Check-Act
S&P500.....	Standard & Poor's 500
SAM.....	Serviceable available market
SBE.....	School of Business and Economics
SEO.....	Search Engine Optimization
SERP.....	Search Engine Results Page
SOM.....	Serviceable obtainable market
TAM.....	Total addressable market

Part I: collective work

On reading this document

The following pages depict the story of an entrepreneurial journey. As it is the joint effort of three people, the work here presented is divided into a core part written collectively and individuals parts complementing the former. To have a guiding structure for the overall process, the Lean Business Model Canvas together with the Plan-Do-Check-Act (PDCA) framework was applied. Explored within the subsequent chapters, the foundational idea of the Lean Canvas is to break down a business idea into a one-page business model (Lean Foundry, n.d.). The PDCA framework aids in achieving this goal by establishing an iterative process that allows improvement through testing ideas in practice and evaluating the outcome.

The journey here begins with a resource that has been around for a long time, and while being almost forgotten, it is now more necessary than ever. By establishing the case for biochar in **1 Introduction: a case for Carbon Bridge** the rationale for this project is simultaneously being found. For grounding the process in existing data and industry expertise, **2 Methodology: frameworks and data collection** explains the paths here taken. The iteration, which is at the heart of the PDCA model, can be traced in chapter **3 Journey: establishing a feasible project**. In having this foundation, it is possible to dive into the process of asking and answering the relevant questions when it comes to starting a business. **Chapter 4 Structure: leveraging the Lean Business Model Canvas** provides information from initial problem definition to the businesses' revenue streams.

The individual parts extend on three main topics. Firstly, it is critical to understand how Carbon Bridge found its niche within the value chain and the reasoning behind it. Such can be identified in chapter **5 Value chain: finding the right spot (Sebastian Immervoll)**. Secondly, the development of the product is thoroughly explored in chapter **6 Product development (Katharina Brunner)**. The third part consists of a detailed discussion of how success can be

defined in this relation, and which value the project is able to create. Focusing on a customer centric approach, these considerations are to be found in chapter **7 Impact: elevating customer success (Sara Serra Siebels)**. The work comes to an end with a reflection on key learnings and experienced limitations in chapter **8 Reflections: learnings and limit**. Finally, it closes with a remark on what might lay ahead in chapter **9 Horizons: Carbon Bridge's future**.

1 Introduction: a case for Carbon Bridge

Addressing climate change is a challenge of increasing complexity and urgency (Zajmi, 2012). The global mean surface temperature is on track to reach a total increase of 1.5 °C, the agreed upon acceptable temperature increase of the Paris Climate Agreement (United Nations, 2015), in the next ten to thirty-two years (IPCC, 2018). Evidence points to the human economic activity as the main impact factor on the environment (Zajmi, 2012). Consequently, firms are confronted with an increasing amount of pressure to acknowledge and address global warming. From policy changes to stakeholder demands, climate change concerns became one of the most significant issues of modern businesses. Management of emissions is a new challenge for managers globally (Lee, 2015). To avoid a global crisis global warming must be limited. Mitigating climate change requires a reduction of atmospheric carbon dioxide (CO₂) by reducing emissions but also by taking up and storing CO₂ from the atmosphere, so called carbon dioxide sequestration (Hutchinson, et al., 2007).

Biochar emerged as a promising global solution that has the potential to sequester carbon (Matušík, et al., 2020). Biochar is produced by thermal decomposition of biomass in an environment with limited or no oxygen at high temperatures. This process is most commonly called pyrolysis. The biochar derived from pyrolysis is a carbon rich product, which resembles charcoal.

Figure 1: Biochar in bulk (left); Forms of biochar - from powder to coal (right); Pictures taken at Ibero Massa Florestal



Biochar is suitable for many different applications and industries. It can be used for wastewater treatment, energy production, absorbing pollutants, reducing carbon in the atmosphere and as a soil remediation (Yaashikaa, et al., 2020). The range of application is not only limited to using it in an environmental context but also extends to industrial and construction use cases (Bier, et al., 2020).

Biochar has a significant potential to aid humanity in achieving the Paris climate goals and limit the emissions of businesses and industries, yet currently does not have the scale necessary to facilitate that (Bier, et al., 2020). Biochar producers often mentioned during the team's primary research that a lack of awareness around biochar is a constricting factor in the growth of the industry. This lays the foundation for Carbon Bridge's mission to unfold biochar's full potential, thereby enabling businesses that utilize it to become more sustainable in the process. This is achieved by increasing the awareness and usage of it through making information accessible and finding the most suitable biochar product through Carbon Bridge.

2 Methodology: frameworks and data collection

It is an interesting situation for biochar: the product has an extensive legacy, while its current market is widely unstructured. Hence, there is only limited market research available. For building an understanding of both the overall topic and the product's market, the team applied a two-fold approach. Its starting point was secondary research. Reading through research

papers, published articles and interviews, a preliminary knowledge base was established. To see the full picture, these insights were complemented with interviews to gather first-hand experiences of people working in the field of biochar.

2.1 Articles and papers: secondary research

To get an understanding of the extent of biochar being covered in research publications and market reports, a quick benchmark test was performed. Using coal as a reference point, 3,570,000 results were found on Google Scholar compared to 433,000 for biochar (Google Scholar, 2023; Google Scholar, 2023). Looking for a coal market report and a biochar market report via Google Search, there are 114,000,000 and 1,250,000 results to be found (Google, 2023; Google, 2023). After getting this first impression of available material, the team started to look for high-quality research papers, initially with a narrow geographical focus. From there on, the members increased the radius and researched additional areas and locations. Such helped in getting a broader perspective of the topic, while also providing space for learning from regional differences. Diving more into the realm of biochar, the group was additionally able to establish contacts with researchers. Through them, access to further reading materials was provided, aiding the understanding of the topic.

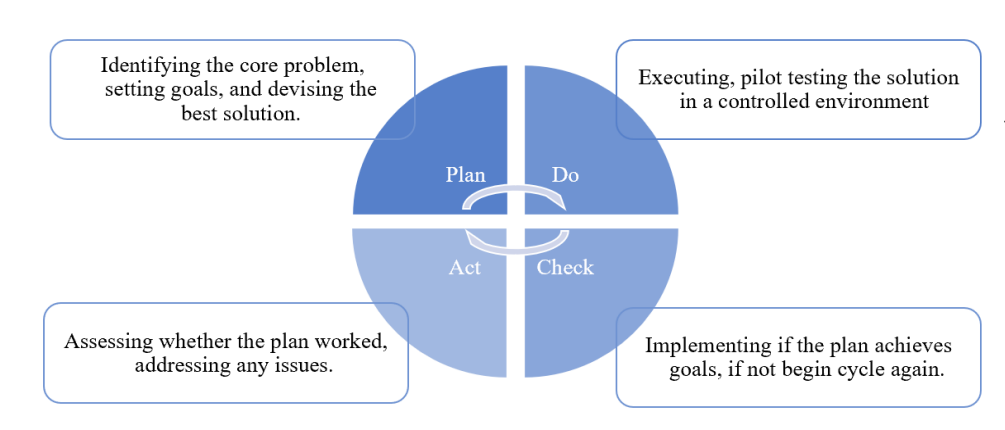
2.2 Interviews: primary research

Expert interviews were conducted to better understand the Carbon Bridge customers and their pain points to complement our secondary research on the market. In-depth interviews with industry stakeholders such as Ibero Massa Florestal, LignoCarbon, IconCarbon, Biatex, Arigna Fuels, Bioenergie Frauenfeld AG, bionero, Skånefrö AB, Stiesdal, ProE Bioenergie, Sonnenerde NSR, and Varem Energie. were conducted. This was done to initially test the team's assumptions about the biochar market and in later stages validate the minimum viable product (MVP). Many of the learnings gathered by the interviews can be found throughout the following document and especially in the individual parts of the thesis in chapter 5, 6 and 7.

2.3 Framework: Plan-Do-Check-Act

During Carbon Bridges entrepreneurial journey, the founding team underwent various phases of reassessing ideas and gaining insights from solution testing and setbacks. The Plan-Do-Check-Act (PDCA) framework best illustrates the team's progress. It is part of the Lean management philosophy and lays the foundation for the continuous improvement of people and processes. The PDCA framework enables the Carbon Bridge team to learn from mistakes and improve the product. The PDCA process comprises of four critical stages: plan, do, check, and act. This initial stage involves thorough planning, addressing key concerns such as identifying the core problem, finding the best solution with the available resources, and determining the goals. Once the plan is agreed upon, the next step is to proceed with its implementation. This second stage involves executing the plan and potentially testing it on a smaller scale in a controlled environment. The checking stage focuses on evaluating the plan's execution to verify if it worked as intended. It involves identifying and rectifying problematic areas and analyzing the root causes of any issues that arise. In the final stage, actions are based on the outcomes of the previous stages. If the plan achieves the set goals, it can be fully adopted. If not, the cycle will begin again. However, it's important to continuously revisit and refine the plan for ongoing improvement. Each stage is integral to the PDCA cycle to ensure continuous improvement.

Figure 2: PDCA Framework



Carbon Bridge underwent many cycles, as resource constraints hindered feasible solutions for many challenges. In some cases, heavy market or technological restrictions did not allow the team to progress with their idea. Despite encountering some setbacks, the team regrouped after every setback to discuss alternatives and options, rooted in the conviction of creating an impact. This iterative process allowed for a deep reflection on the team's capabilities and adaptability.

3 Journey: establishing a feasible project

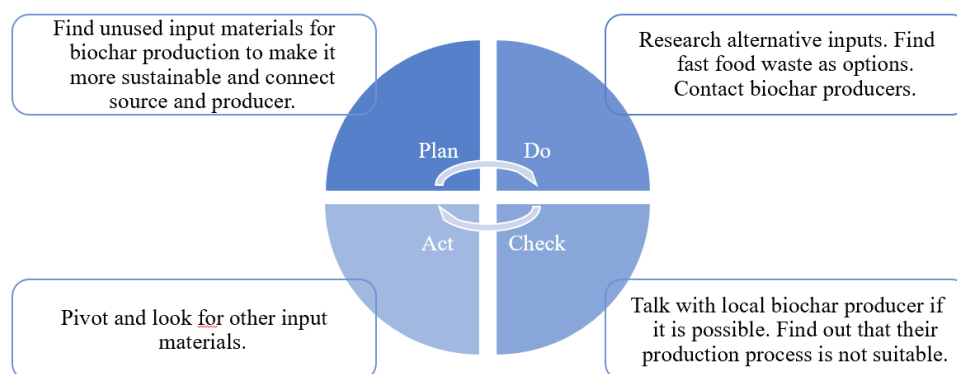
The following chapter will illustrate the different cycles of the PDCA framework the team underwent which led to the starting point of Carbon Bridge's current vision and product. This context is crucial to understanding the reasoning of where Carbon Bridge came from and where it is going.

3.1 Cycle 1: A circular economy facilitator – food waste input

The spark of interest in biochar was ignited in the team member Katharina last year during an internship in a climate tech start-up. While the contact with the topic was brief, the concept of biochar stuck due to its immense projected environmental potential. The journey as a group began in the first semester of the group's master studies as the idea of working with and around biochar was discussed. Working in an emerging market with so much positive environmental potential inspired the team. The first cycle was shaped by looking mainly at the Portuguese biochar market. It is characterized by unexploited feedstock options, the input material for the production, such as unused agricultural waste or even municipality household waste. Biochar producers use mainly wooden inputs, when sustainably sourced they are leftovers of the paper industry or wooden cuttings from municipalities parks. But this can also lead to unsustainable practices as sometimes trees are grown specifically to be cut down for biochar production. This restricts the sustainable production of biochar as the amount of input materials are limited. Yet, there is a need for biochar as Portuguese soil is relatively dry (Garcia, 2022) and many businesses would benefit from reducing their emissions with biochar in Portugal. The team

identified those two loose ends with the desire to connect them (“Plan”). Research on alternatives was conducted and the initial idea was to produce biochar out of food waste, which could have been collected from a fast-food chain restaurant. If this type of input is suitable for biochar production also needed to be confirmed by producers (“Do”). The team had chosen this input because this kind of food waste is already standardized as the composition of the waste rarely changes and is available in significant quantities. The value for the biochar producer was a cheaper input material as the waste is abundant and is otherwise incinerated. The value for the fast-food company would have been that they could have made their waste management more sustainable. During the checking phases, the team realized that the idea is not feasible. While secondary research showed that in general there is a possibility to produce biochar out of food waste, the primary research conducted by the team consisting of interviews with industry experts halted our idea. Ibero Massa Florestal, the primary producer of biochar in Portugal, informed the founders that their production facility would not be suitable to work with such an input due to its moisture content. The team needed to pivot the project according to the production possibilities of the underlying technology (“Act”). The key learning was that we need to conduct a lot of research and consult with experts about what is possible, doing so as early as possible in the process.

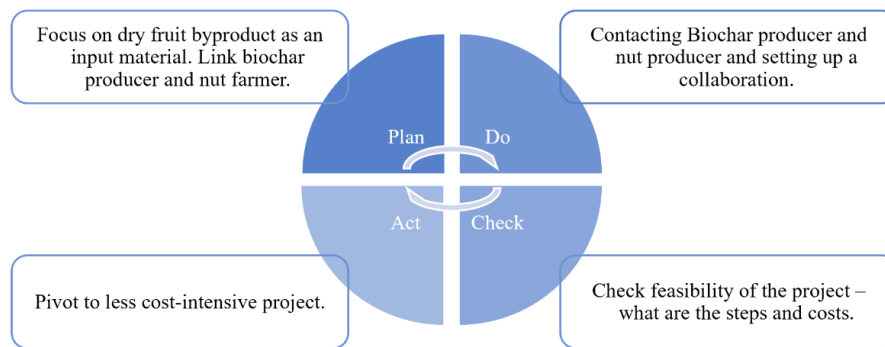
Figure 3: PDCA cycle one - Using fast-food waste as biochar input material



3.2 Cycle 2: A circular economy facilitator – nutshell input

The team entered cycle two with the learnings of cycle one as a foundation. The project needed to change according to the production possibilities of the underlying technology. It was decided to focus on dry fruits as they have low moisture contents. The aim was to bridge the missing link between biochar producers and nut producers. An ambition of the project was to become a point of reference for the disposal of agricultural byproducts (“Plan”). The team contacted Ibero Massa Florestal to verify that obtaining biochar out of nut shells would be feasible with their technology. It also had to be confirmed that the producer was willing to do a test run and determine if one can produce biochar out of nutshells specifically out of the hulls. As this was affirmed, the founding team contacted several nut producers. The team collaborated with Vera Cruz, a Portuguese almond producer, and PortugalNuts, an association for Portuguese nuts, on making their operations more sustainable and finding another revenue stream for farmers, in them selling their unused byproduct – the hulls – to us to make biochar (“Do”). In the checking phase, the team analyzed the feasibility of the project after receiving the necessary information, estimations on the costs, and having found collaborators. The idea proved to be too capital-intensive. Making an upfront payment for the acquisition of the unused agricultural byproduct, transporting it to a biochar production facility, transforming it, and then shipping it back to the farmer for application to their soil was not feasible. The estimation of the costs for one hectare of soil transformed would be 7,753€ (a break-down of the costs can be viewed in appendix 1). This is not completely unfeasible but indeed it was for the team, as combined savings would not allow the team to go forward with this plan. The founders realized that a pivot to a more feasible project was necessary (“Act”).

Figure 4: PDCA cycle two - Using nut byproducts as biochar input material

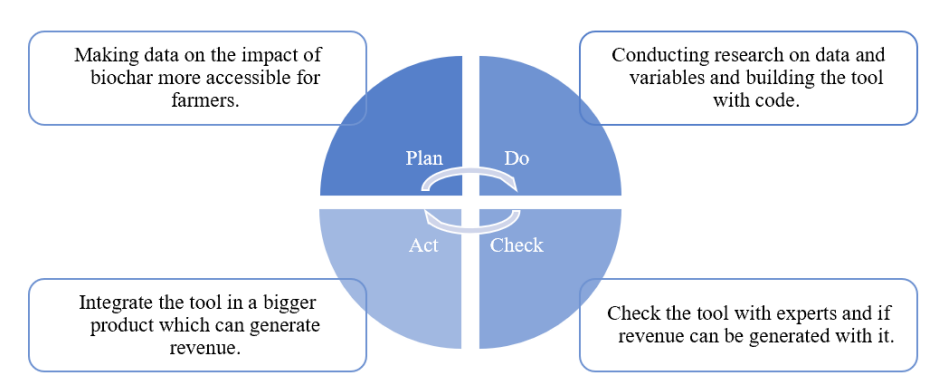


3.3 Cycle 3: An impact assessment service

The pivot was grounded in the reasoning of seeking a less capital-intensive project which is feasible for a student team. The class ‘Data Science and Innovation’ reinforced the team how crucial data is for businesses. Additionally, a workshop on Social and Environmental Evaluations with Graça Fonseca on April 4th, 2023, made the founders realize how crucial data is for sustainable development and how most businesses will be required to report their impact on the planet and society (European Commission, 2023). A decision was made to include more data on the benefits of biochar in our project as data is not easily accessible to the end user since it is hard to gather and interpret. The idea was to do an impact assessment tool that gives farmers who are contemplating to integrate biochar into their soil a tool to check the potential impact (“Plan”). The doing part consisted of conducting research and building the tool. In the beginning, finding the right research paper and identifying the most relevant indicators and variables was most important. Building on that an algorithm was needed to calculate the impact based on the input of the farmer (see tables for the calculation basis in appendix 2). This was also translated into Python code and then later to an HTML code to create an online version of the tool (see code in appendix 3). The verification stage (“Check”) of this cycle was done by talking to experts and inquiring about their judgement on the tool. Internally, the team also contemplated on how to monetize the tool and integrate into a business model. As no convincing revenue model could be based solely on the tool the decision was made to keep the

tool as it proved to have value as confirmed by experts, but for it to only be part of a bigger product which is able to generate revenue (“Act”).

Figure 5: PDCA cycle three - Impact assessment service for biochar



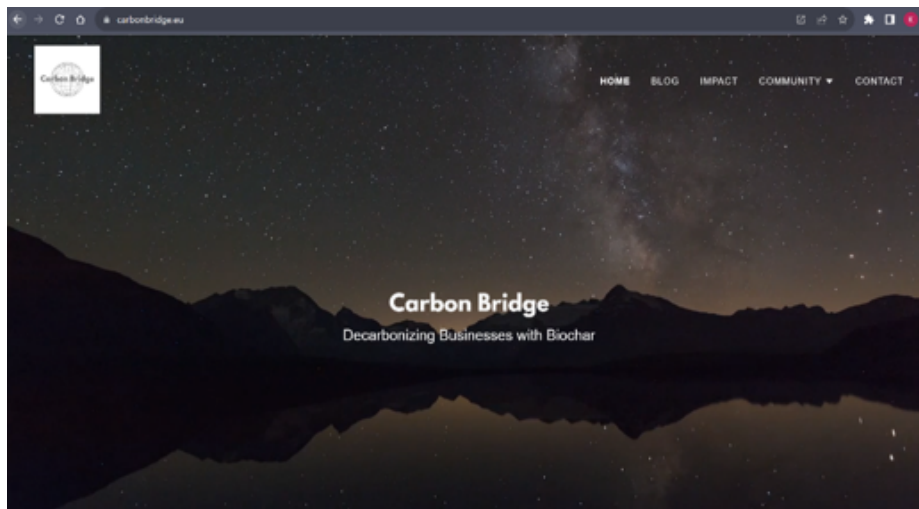
In Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.** it will be explored in depth how this tool was later developed and integrated into the final product of Carbon Bridge.

3.4 Cycle 4: A marketplace, marketing, education, and community platform

The last cycle was entered with the team’s previous journey in mind. In the founder’s own research on biochar and its markets many issues stood out. The lack of awareness of the existence of biochar in the first place limits its sales. Biochar seems to face a marketing issue. Learning about biochar can be difficult as a beginner, it is an abstract concept. It can have many applications from soil amendment to construction material. Yet, an overview on the potential with data and easy to comprehend information is lacking. Finding the most suitable biochar for the user’s needs is also a challenge. While there are some companies which list biochar producers, it is not clear which type of biochar is being sold for specific use cases. The team also found that the communication on the topic seems to be not entirely effective. Biochar producers naturally market the product biochar, yet the general public is not aware of biochar itself and what it does. Consequently, marketing a product that potential users do not know the function or benefit of makes the effort less effective. The product envisioned by the team aims to solve these issues. It will be an aggregator for biochar as it will include a marketplace for biochar, do marketing with a focus on the effects of biochar, decarbonization especially as it is

a pressing issue for businesses, educate on biochar suited for beginners including an impact

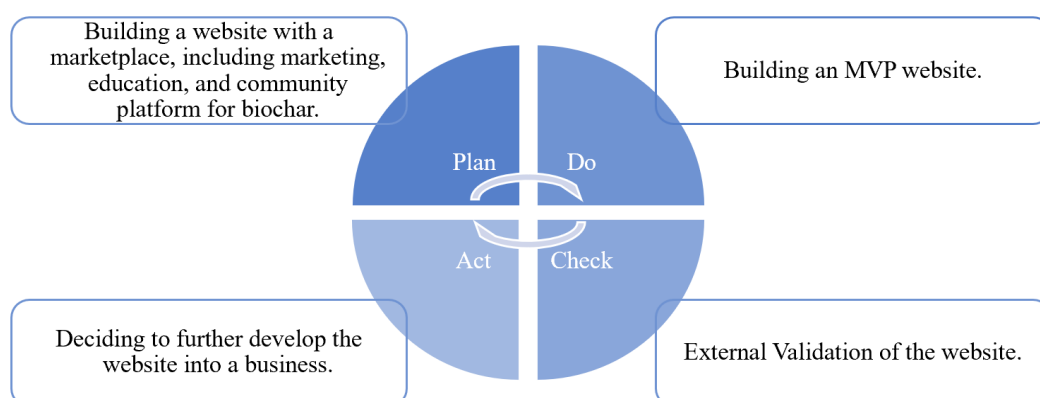
Figure 6: The Carbon Bridge website: carbonbridge.eu



assessment tool, and build a community (“Plan”). The doing consists of building a website which encapsulates all the above. An MVP

was built on a website builder and the impact assessment tool was coded. The team decided to do extensive external validation on the MVP and talk to many biochar producers to determine if they see the value in such a website, and later on would be willing to list their product on it (“Check”). As the founders receives a lot of interest and positive feedback it was decided to stick with the idea of a website and further develop it (“Act”). The development of the website and code is further elaborated in chapter Fehler! Verweisquelle konnte nicht gefunden werden..

Figure 7: PDCA cycle four – Website for biochar



4 Structure: leveraging the Lean Business Model Canvas

The Lean Business Model Canvas is used to deconstruct the team’s ideas into the key components of the impact business of Carbon Bridge. The Lean Business Model Canvas,

created by Ash Maurya, is an adaptation of the Business Model Canvas of Alex Osterwalder. The Lean Business Model Canvas is the chosen instrument for analyzing the team's development as it is designed for start-ups which are operating under conditions of uncertainty and for quick, dynamic changes. The Lean Canvas provides a holistic overview of the business with key components such as value propositions, customer segments, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure covered (Maurya, 2012).

The Lean Business Model Canvas was also compared to the “Disciplined Entrepreneurship” framework by Aulet which is a guide on how entrepreneurs can successfully launch a venture. It presents a 24-step guideline which introduces a systematic approach of bringing products to market (Aulet, 2013). However, the decision to use the Lean Canvas was made as the visual format of the Canvas makes it easy to use, understand, and communicate. It also allows for quick iterations, making it the most suitable lean tool for the team. The following figure displays the Lean Business Model Canvas of Carbon Bridge and the next chapters will cover each aspect of the Lean Canvas in detail.

Figure 8: Lean Business Model Canvas - Carbon Bridge

Problem	Solution	Unique Value Proposition	Unfair Advantage	Customer Segments
1. Lack of knowledge and awareness of biochar 2. Impact of biochar is not clear 3. Biochar producers struggle to market themselves 4. Biochar sales are hard to generate	Raising awareness with a website that includes a blog, an impact assessment tool, and a marketplace for biochar.	For biochar producers: increased product awareness and biochar sales. Focus on community building, leading to an organically high retention rate.	Phase 1: ecosystem, costs, size Phase 2: network effects	Sell-side: biochar producers Other users: businesses mostly seeking to decarbonize their operation/product
	Key Metrics	For biochar users: accessible information on how to reduce emissions	Channels	
	Sales volume and revenue; Profit and profit margin; CAC; End-user retention rate; CO2 sequestration; Market awareness and education; Community engagement	Direct; paid; organic; SEO; Social media (YouTube, LinkedIn); Google shopping		
Cost Structure		Revenue Streams		
Website maintenance; domain registration; travel expenses		Monthly subscription fee, revenue commission fee		

4.1 Prevailing issues: pain points

The problem that Carbon Bridge is tackling is sequential: On the one hand, Carbon Bridge is tackling the lack of knowledge and awareness of biochar as a resource itself. The general public is not aware that the product exists. Secondly, the impact of biochar is not clear in terms of environmental, social, and financial benefits. The third and overarching problem, resulting directly from the first two issues, is that biochar producers struggle to market themselves and drive visibility and quality traffic to their websites to generate a sale, as was confirmed by many biochar producers during the team's primary research. The producers are facing the question of how to market a product and its positive impact that no one knows of. Additionally, if a potential user of biochar knows of the product, there is an abundance of biochar types with different specifications which are suited for different use cases. This can be overwhelming for potential consumers of the product. This communication complexity hinders the growth of the market and restricts sales. Biochar has a significant potential to aid us in achieving climate goals and limit the emissions of businesses and industries (Bier, et al., 2020), yet currently does not have the scale necessary to facilitate that due to lack of effective communication.

4.2 Healing solutions: product definition

Carbon Bridges solution to the aforementioned issues is formulated in a three-step approach of education, impact awareness, and increasing sales through a marketplace. All aspects are encapsulated in the Carbon Bridge website. Having this unique three-pillar approach is not a nice-to-have but a necessity. It follows the logical order of what? – why? – and where? It initially answers the question of what biochar is. This knowledge base is being supplemented by responding to the question of why it should be used, given the products' beneficial characteristics. Finally, a translation from theory to practice is established, a bridge on its own: the reply to the question of where it can be bought.

4.3 Measurements of success: key metrics

In the pursuit of realizing the potential of biochar for making businesses greener, it is imperative to establish clear, measurable key metrics. These metrics not only serve as indicators of Carbon Bridge's business success but also reflect its environmental impact and contribution to sustainable practices. Yet due to the initial stages of Carbon Bridge, where empirical data is yet to be gathered, the focus is placed on defining theoretical key metrics. The key metrics are divided into categories: business performance metrics (1), (2), (3), (4); environmental impact metrics (5); and additional metrics (6), (7). The following table includes sub-metrics under each category and the rationale for their importance to Carbon Bridge.

Table 1: Carbon Bridge's key metrics

<i>Key metrics</i>	<i>Sub-metrics</i>	<i>Rationale</i>
(1) <i>Sales volume and revenue</i>	• Total commission from biochar sales • Number of units of biochar sold	These metrics will provide insight into the market demand and financial viability of Carbon Bridge.
(2) <i>Profit and profit margin</i>	• Number of renewals (subscribers) • Number of paying customers • Net profit earned	Profitability is essential for long-term sustainability. The margin will reflect our operational efficiency and pricing strategy (considering industry norms).
(3) <i>Customer acquisition costs (CAC)</i>	• Average cost to acquire a new customer	Evaluating the effectiveness of marketing strategies hinges on a critical metric for Carbon Bridge, where the goal is to strike an optimal balance between efficient customer acquisition and the commitment to sustainable practices.
(4) <i>End-user retention rate</i>	• Percentage of returning end-users	For Carbon Bridge, it is important that high retention rates reflect end-

		user satisfaction, which are crucial for establishing a loyal customer base for biochar producers.
(5) <i>CO2 sequestration</i>	• Estimated amount of CO2 sequestered per unit of biochar	Central to our environmental mission, this metric quantifies the contribution businesses could have in applying biochar to combating climate change.
(6) <i>Market awareness and education</i>	• Reach and engagement metrics on educational content	Critical for increasing the understanding and adoption of biochar. Effective education and awareness campaigns can drive market growth.
(7) <i>Community engagement</i>	• Engagement level with customers, partners, and industry experts	A measure of our effectiveness in building relationships and collaborating with key stakeholders, which is vital for our growth and impact.

4.4 Exclusivity: value proposition

Providing a unique value is a way of setting a particular business apart from all the existing ones. To identify the one of Carbon Bridge, the competitive landscape was mapped out and it was looked at the features of competitors. Doing that, the team identified a chance to gain unique value by rearranging existing features and supplementing them with a new trait.

4.4.1 Is there anybody out there: competitive market analysis

As aforementioned Carbon Bridge stands distinguished in the market through its integration of three core pillars: education, impact assessment, and marketplace visibility. This tripartite approach not only addresses key pain points of our group but also establishes a robust value proposition and a distinctive competitive edge.

In our market analysis within the German target market, we've identified significant players operating across these three pillars. Predominantly, the competition operates primarily as

research platforms and consulting firms with a focus on sustainability. However, a comparative overview reveals that none offer a comprehensive solution such as Carbon Bridge:

Table 2: Carbon Bridge's competitive market analysis

	<i>Educational Purpose</i>	<i>Impact Assessment</i>	<i>Marketplace Visibility</i>	<i>Community</i>
<i>Biochar Zero</i>	✓	✗	✓	✗
<i>Carbonfuture</i>	✗	✓	✗	✗
<i>EBI Consortium</i>	✓	✗	✗	✗
<i>Carbuna</i>	✓	✗	✓	✗
<i>HempConnect</i>	✓	✓	✗	✗
<i>Klimafarmer</i>	✗	✗	✓	✗
<i>Carbon Bridge</i>	✓	✓	✓	✓

In regards to the horizontal layer of Carbon Bridge's business model, the community aspect uniquely connects across various layers, offering a vertical coherence and a more holistic perspective on value creation. This distinct approach, not evident among competitors, ensures an integrated network of stakeholders and customer segments, fostering a collaborative and sustainable business ecosystem. This strategic integration demonstrates that while there is competition, Carbon Bridge remains unmatched in offering a holistic solution. Interestingly, current market dynamics show a trend among biochar producers integrating educational aspects into their platforms, aiming to maximize revenue through increased market awareness. Despite this, within the scope of this research, such biochar producers are not considered competitors to Carbon Bridge.

4.4.2 Beyond the existing: unique value proposition

Most of Carbon Bridge's competitors follow an educational purpose. A few of them provide an impact assessment, and hardly any of them offer marketplace visibility enhancement. Unlike

the competitors, the team sees something missing when there is only educational content, just an impact assessment or solely a marketplace. Such is the reason for the width of the solution, integrating education, impact assessment and marketplace. In that, Carbon Bridge differentiates itself from competition. But the real uniqueness comes from depth. Community is at the core of each of the three features. Climate change mitigation in terms of carbon sequestration is unlike many other transactions. It does not resemble the typical purchase of a good for consumption, it is rather about realizing the consequences of our actions and understanding the bigger picture. Storing carbon through the acquisition of biochar is not an independent process concerning solely the individual, it is by its nature systemic. The effects of less atmospheric carbon have global significance to everybody. Hence, community is a natural trait of carbon sequestration. The unique value of Carbon Bridge is in amplifying this trait within each of the products' features through a relentless focus on a shared community. Achieving this depth of community in every part of the product has a very tangible impact. It means a higher retention rate for buyers of biochar. Feeling as part of a community and actively engaging with the platform leads to two outcomes. It has positive effects on recurring sales of existing buyers, and it triggers word of mouth, the foundation for new buyers in the future.

4.5 What's different: unfair advantages

An unfair advantage allows a business to outcompete other companies providing a similar product or service. The advantage is rooted in a source that is not easily replicable for competitors, leading it to be unfair. For Carbon Bridge, the unfair advantages can be categorized in initial, first phase advantages and the following, second phase advantages.

4.5.1 Phase 1: ecosystem, costs, and size

Carbon Bridge possesses something very few companies share: having a well-known business school on their side. This advantage unfolds in two ways, internally and externally. From an internal perspective, the ecosystem of Nova SBE provides a pool of great resources for aspiring

entrepreneurs. It starts with mentoring, having access to the expertise of professors, grounded in the first-hand experiences of founding a company themselves. Such is a highly beneficial source of value when it comes to receiving feedback and learning from real-world examples. Secondly, there are many departments who can aid in both dealing with questions and establishing contacts with outsiders. A special remark can be made here for Nova SBE's Haddad Entrepreneurship Institute and the Corporate Relations Department. These are valuable addresses for connecting both with people and companies. Externally, Nova SBE allows for signaling. Putting it as a reference for establishing contact with the many European biochar producers, mentioning the name provided additional credibility for the project. Furthermore, it helped in telling the story of how this idea was developed throughout the master's program and why it was chosen to leverage it by making it the master's thesis.

The second pillar for initial advantages is low costs. Carbon Bridge is tailored to a resource-constrained environment. Especially due to the team's boundaries in time and financial capacity, which will be deeply explored in chapter 5 the team looked for ways to deliver the solution with the highest leverage on resources. The result was the platform covering education, impact assessment and marketplace. Competitors offering marketplace solutions usually handle the biochar transactions themselves, leading to higher margins. Carbon Bridge deliberately decided against processing the physical transactions as it would have led to become considerably more capital-intensive. The chosen approach allows for a maximum leverage when it comes to sales, while keeping costs at a low level. Doing that, the service can be provided at a much smaller price.

The association with the team's university and the minor resource commitment translates into the third initial advantage: small size. While it is large size that is commonly referred to as an unfair advantage as it leads to increased market power, the group sees a clear benefit in the initial small size. Reason for that are the characteristics of the current biochar market. Within

a market that is in the process of establishing itself, large size can lead to a huge bet on the wrong path. Being small allows for easier tinkering and adaptation to structural changes. In addition, there is a second part of the small size advantage. Carbon Bridge is hardly known to its competitors. Such is especially beneficial as the long-term unfair capability can grow particularly well through that.

4.5.2 Phase 2: network effects

Building a community takes time. There needs to be agreement on a foundational idea everybody shares. Trust must be established, and relationships formed. Organic growth of such does not happen overnight. Such is the reason why the build-up of the project's unique value proposition takes time. But it is this steady enlargement of a sustainable customer base that makes the difference. Starting in a realm largely unnoticed by competition, the team can rely on the factors that grant an unfair advantage in the first place. Simultaneously, it is the chance to experiment on a small-scale with different ways of creating a community. Based on these learnings, Carbon Bridge can aim for network effects in the second phase. The term network effects refers to a situation in which the value of a product or service depends on the number of users (Stobierski, 2020). For customers of Carbon Bridge, having a larger community means a larger pool of potential buyers of biochar. In that, it leads to an increased willingness to pay for the solution. Having an organically grown community is difficult to replicate, even more so if switching costs prevent people from changing product. Establishing Carbon Bridge as the go-to solution for the industry in the long-run is a path that begins with the first satisfied customers. The way in which the team aims to acquire them is described in the following chapter.

4.6 Strategic selling: channels

As Carbon Bridge transitions from its nascent stage to the launch of the MVP and beyond, it becomes essential to consider the role of channels in our sales strategy. In the business context,

a 'channel' as defined by (Dent, 2015) serves as a route to market for a supplier. While sometimes the term is used to refer only to the indirect or trade channels, it more accurately encompasses any specific route to market, including direct channels. This comprehensive understanding of channels is fundamental to the development of Carbon Bridge's strategy, as it shows the different ways we use to reach and serve our customers effectively. Therefore, we will delve into our methods for acquiring customers and driving traffic to our website, a critical aspect of our platform's attractiveness. An in-depth analysis of channels will be conducted in the individual part on impact: elevating customer success.

In the short term, our sales strategy is focused on presenting the comprehensive benefits of our platform to potential biochar producers. Therefore, engaging in one-on-one selling, on a direct, personalized approach where we actively demonstrate how subscribing to our platform can improve their market profile. This strategy includes emphasizing the multifaceted benefits of increased market awareness for biochar enabled by our platform and the unique value of our impact assessment tool to encourage potential customers to buy biochar, creating a compelling case for producers to join our platform. Driven by our belief in the growing value of our platform, we will provide free trials to our first customers. This approach, based on research, has proven to be effective in converting trial users into engaged subscribers (Templeman, 2016). Furthermore, in order to gain traction to our website and prove our value to our main stakeholders, we will be engaging with influencers in the biochar community, who have been using YouTube and other forms of social media platforms to spread knowledge and insights about the benefits and applications of biochar. Acknowledging the 'chicken-and-egg' dilemma, which refers to the challenges of attracting both sellers and buyers to a platform, our approach addresses the interdependency between biochar producers and potential customers on our multi-sided platform. This collaboration will enable us to leverage their established audiences and credibility, thereby effectively amplifying our message and facilitating the achievement of

a critical user mass essential for sustaining positive network externalities and further growth (Stummer, Kundisch, & Decker, 2018).

In the medium term, as our brand gains recognition, our strategy will focus on leveraging our established digital presence and working with Search Engine Optimization (SEO) to enhance our online visibility, attract a wider audience, and drive more organic traffic to our platform. Additionally, by implementing robust client management practices, we aim to not only retain existing customers but also to deepen their engagement with our platform. We plan to achieve this through a dynamic cycle of continuous improvement and adaptation, incorporating feedback to refine our offerings. Furthermore, Carbon Bridge will regularly update our community with the latest advancements in biochar through newsletters and blog posts. This strategy not only informs potential biochar purchasers but also supports our ambition to become a leading knowledge resource for biochar producers, thereby enriching our value proposition for all stakeholders.

In the long term, given the still niche nature of the biochar market, we anticipate that word-of-mouth referrals, fueled by our subscribers' positive experiences, will significantly contribute to our growth and market penetration.

Long sales cycles are a reality in the business-to-business (B2B) industry (Jones, 2023), and our strategies need to account for the costs and efforts involved in managing these cycles, as potential customers who do not immediately convert into sales.

Furthermore, it is important to point that this strategy is not static, it is expected to evolve as we move from the initial stage to a full-fledged market presence. Continuous learning, adapting to market feedback, and refining our strategies will be key components of our journey.

4.7 The market and its people: customer segments and market analysis

Carbon Bridge is a two-sided platform, with its success hinging on the participation of both groups. The following explains first who these two groups are, and which end users result thereof. Consequently, the market size for the initial beachhead market is being calculated.

4.7.1 Of customers and visitors: market segmentation and end users

Increasing the awareness for biochar is an objective that is beneficial for many different stakeholders. It was a process to find the right target customer for the solution and its associated second group. The array of 12 different options that was identified can be traced in appendix 4. The process was concluded by deciding on biochar producers in the German market as paying customers. The decision to target German biochar producers is based on a dual rationale that encompasses both empirical and strategic dimensions. Empirically, the extensive outreach initiatives have shown that this group demonstrated the highest level of engagement, evident in their willingness to attend meetings and contributions to market understanding. Strategically, this decision is in line with Germany's prominence as the leading producer, representing approximately 32% (appendix 5) of the total European biochar production capacity (EBI, 2023). This leadership position not only implies a denser cluster of potential customers, but also indicates a more mature market landscape conducive to deeper business penetration and the potential for accelerated growth.

The functioning of the business relies on having a second group participate. The Carbon Bridge platform aims to attract people who could benefit from using biochar (from here on referred to as end buyers). They are provided with education on the product and their personal advantages in applying it. Consequently, the platform allows them to connect with sellers of biochar. The decision on who should be initial target in that regard was a direct consequence of the paying customer that was chosen. From the conducted interviews, the team has been able to identify that the most common customers from biochar producers are from following industries: cement

production, feedstock processing, wastewater treatment and agriculture. However, due to the range of diversity, it was decided that for the MVP the focus will be on individual farmers and agriculture companies.

Breaking it down to the individual level, there are three different end users on the platform. On sides of the paying customer, it is the biochar facilities' product manager. For the end buyers, it is two primary user groups: individual farmers and purchasing managers of agriculture companies. Product managers initially use the platform to set up the presence of their respective brand. From there on, the community functions lead to a continuous engagement. Both sets of action are directed towards the goal of increasing biochar sales for the company. The decision-making unit comprising the individuals who effect the buying decision can be separated in champion, primary economic buyer, and veto power holder (Aulet, 2013). Both the champion, as the one who wants to have the product, and the primary economic buyer, as the one who can buy it, are represented by the product manager. A veto can be put in force through the action of the company's CEO (Chief Executive Officer). End buyers leverage the platform through learning more about biochar, the benefits obtainable through applying it, and at which localities to buy the product. For individual farmers, end user and decision-making unit overlap completely. It is in every case the individual who benefits from applying biochar to the soil to improve its conditions. While there are initially no costs for platform participation on the buyer-side, the decision-making unit will become relevant as soon as new revenue streams are put into place. Purchasing managers of agriculture companies can be considered both end user and primary economic buyer in terms of the decision-making unit. The champion can be identified as the company's sustainability officer, who aims to enhance the environmental impact through carbon sequestration. Finally, a veto can be exercised by the director of the purchasing department.

Since it is the biochar producers who are paying for the product, the team directed its further efforts in understanding the paying customer towards them. Based on the conducted interviews, a persona profile was created: Dr. Martin Becker (appendix 6). An experienced environmental chemist with over two decades in the field, Dr. Martin Becker has continuously evolved alongside the industry, shaping his vision for GreenChar Solutions around innovative, market-driven applications of biochar. His professional commitment is evident in his focused approach, which includes expanding market reach, influencing policy for more favorable conditions for biochar production, and relentlessly advocating for collaboration with industry to overcome market and regulatory challenges. This combination of experience and dedication makes Dr Becker's profile, effectively synthesizing the collective insights of industry experts into a single, actionable character. His aim is set up the presence of the respective brand on the Carbon Bridge website. From there on, the community elements lead him to active participation with the objective of enhancing biochar sales for his company.

4.7.2 Opportunity quantification: market size

To achieve a balanced estimation of total addressable market (TAM) that is both conservative and reflective of realistic market potentials, Carbon Bridge adopted a comprehensive approach, integrating both bottom-up and top-down analyses. In this two-sided marketplace, only one side is paying for the product, therefore, the TAM is based on the revenue generating side.

Bottom-up analysis: counting noses

The bottom-up analysis begins by identifying the number of biochar facilities in Germany, which, in turn, informs about the number of potential paying customers, represented through product managers. Through the comprehensive research efforts, aimed at establishing a robust database for outreach initiatives, the team successfully identified 16 biochar production facilities in Germany among the 58 potential (appendix 7) contacts.

Top-down analysis: market overview

To complement the bottom-up analysis, the group looked at the overall growth and trends in the European biochar market. With an estimated 180 production plants at the end of 2023, cumulative production is projected to exceed 50,000 tons (EBI, 2023). Germany's leading position in the European biochar market translates into a substantial presence of biochar-producing companies, with expectations of around 58 plants being operational by the end of 2023. The average price of biochar at €800 per ton serves as a crucial data point in understanding the revenue streams of these facilities. Based on these figures and assuming each facility in Germany sells their products at the market rate, therefore, generates a combined annual revenue of €15,232,000. For a deeper understanding of this calculation, as a productivity factor and other measurements have been taken into consideration, please refer to appendix 8. Through applying a baseline monthly subscription fee of €89 per customer combined with a commission fee for the provided services to the amount of 7.5% of revenues, the TAM for the initial market stands at an estimated €1,203,000. While this figure seems small compared to market sizes of many other industries, it is important to remark that the European market for biochar is currently in establishment. The expected three-year compounded annual growth rate of 68% between 2020 and 2023 is one indicator thereof (EBI, 2023). As certification of biochar is becoming more and more relevant, the website will only offer visibility to certified biochar. According to the study conducted by (EBI, 2023), from the total production capacity available by end of 2023, almost 70% is product certified. Therefore, the serviceable available market (SAM) is calculated at €842,100. Going back to the bottom-up analysis, assuming to obtain the 16 out of the 58 biochar producers, the serviceable obtainable market (SOM) is €235,788.

Table 3: German biochar market (TAM, SAM, SOM)

<i>Number of biochar production facilities (2023)*</i>	58
<i>Expected total production capacity*</i>	28,800 t
<i>Average price per ton of biochar*</i>	800 €/t
<i>Commission fee</i>	7.5%

<i>Subscription fee (12 x €89)</i>	€1,068
<i>TAM (EUR/year) *</i>	€1,203,000
<i>Product certified**</i>	70%
<i>SAM (EUR/year) *</i>	€842,100
Number of serviced biochar production facilities	16
<i>SOM (EUR/year) *</i>	€235,788

*based on assumptions & primary research **factual data from EBI Market Report

It is imperative to note that these calculations are based on current market dynamics and projections, and should be periodically revisited and adjusted in accordance with evolving market conditions and emerging data.

4.8 Outflows: cost structure

Given that Carbon Bridge operates a two-sided platform, where biochar producers are the paying customers and a diverse user base forms the marketing audience, this dual dynamic is crucial to comprehend. It significantly impacts our company's profitability and long-term viability, influencing our strategic approach and the CAC calculations.

In the first year following the MVP launch of Carbon Bridge, we anticipate a significant initial investment in in brand building and market penetration. As aforementioned in previous chapter, will prioritize one-on-one selling to biochar producers, a strategy suited to the niche nature of the market and tailored to meet the specific needs of these producers. While this personalized approach is expected to yield higher conversion rates, it will also lead to higher acquisition costs. Simultaneously, we will implement broader marketing strategies targeting potential users of biochar, focusing on educational content and awareness campaigns about biochar's benefits. This dual strategy of direct selling to producers and widespread marketing to users is anticipated to drive modest customer acquisitions for both segments, leading to a higher cost structure in the first year. This significant initial investment in sales and marketing is essential for establishing a solid foundation for Carbon Bridge, ensuring clear understanding and

appreciation of our platform among both biochar producers and users. A detailed analysis of these upcoming strategies will be included in the section on elevating customer success.

Consequently, our fixed costs to date have amounted to €20,98 and have primarily covered IT infrastructure expenses such as monthly website maintenance, accounting for €15,99 and a yearly domain registration of €4,99. Additionally, the company has benefited from significant cost savings by not incurring expenses for salaries and office space at this stage. Variable costs include travel expenses, which were essential for visiting biochar producer sites and gaining first-hand knowledge of their activities. Thus far, our total expenditure has reached € 171,60.

4.8.1 How much is it: product pricing strategy

A firms' profitability is highly sensitive to the prices set for their offerings. Hinterhuber & Bertini (2011) showed that a 2% increase of prices for a subset of S&P500 (Standard & Poor's 500) companies enhances operating profitability by 14%. The pricing strategies companies might apply can be divided into three different types: cost-based, competition-based, and value-based. In agreeing on the right strategy for the services offered by Carbon Bridge, the founders evaluated market conditions, competition, and the unique setting of the company.

Carbon Bridge operates in the B2B segment. In that, the number of potential customers is commonly more limited compared to services offered in a business-to-consumer (B2C) market. While there are high growth rates for the number of biochar production plants in Germany, with an expected increase of 16 production sites from 2022 to 2023, the market in general is currently in development (EBI, 2023). As participants need to adjust for increasing competition, the landscape of it might change substantially.

To establish a benchmark for potential prices, the strategies of competitors can allow for valuable clues. Online retailers offering marketplace solutions typically apply commission fees based on revenues. The fees charged commonly account for up to 20% of revenues (Engine Themes, 2017). Providers of impact assessments typically allow for service packages

dependent on the customer's need. Given this tailored approach, their pricing is calculated through a demand-based method. While other competitors offer educational content through their website, information is freely available. Hence, the content is not used as a base for a recurring revenue stream.

A third consideration should be performed in relation to the status quo of Carbon Bridge. The value of the service provided depends on platform traffic, being converted into buyers of biochar. Due to the recency of the platform, this customer base needs to be established first. In addition, it is important to note that the number of monthly platform visitors will vary, leading to potential seasonal effects. Therefore, given the nature of the business, large upfront payments are not feasible.

Considering this information, the team decided to emphasize a value-based pricing strategy, accounting for the volatility associated with website traffic. The trade-off between establishing a sustainable revenue stream and lowering barriers for potential customers by offering a no-cure-no-fee pricing model led to a two-fold strategy. To participate on the platform, biochar producers must pay a monthly subscription fee of €89. The price, which is discounted initially to attract test users, is set low enough to mirror the expected willingness-to-pay. Simultaneously, it is high enough to associate value with the provided services. The subscription fee is complemented by a revenue commission fee. This fee is established at 7.5%, with initial discounts for test users. Having this performance-based component makes it possible to enhance trust in Carbon Bridge as costs only occur with successful sales obtained. Combining the two, the pricing strategy allows for a reliable revenue stream in terms of subscriptions, while commission fees based on transactions complement the former.

4.9 Inflows: revenue streams

Carbon Bridge as a platform solution relies exclusively on its online presence and the leverage in sales it offers to customers. As indicated in the preceding chapter on pricing, there are two revenue streams: subscription fees and revenue commission fees.

4.9.1 Stream 1: subscription fees

Every biochar producer wanting to be listed on the Carbon Bridge marketplace must pay a monthly subscription fee of €89. An ongoing subscription in combination with a pricing that displays value is estimated to have positive effects on customer engagement levels. As the platform is centered around community, it is critical that customers feel they have an active role in the process, something a monthly financial commitment further emphasizes. Moreover, subscription fees are a predictable revenue stream for Carbon Bridge. That is especially important in the beginning as costs to attract buyers are immediately incurred while the occurrence of first sales is expected to take more time. The financial significance of subscriptions will decline over time as the second revenue stream becomes more prominent.

4.9.2 Stream 2: revenue commission fees

While subscription is the foundation, commission is the extension. This performance-related pricing of 7.5% of revenues allows customers to protect their downside, which is an important argument to attract early adopters. Furthermore, the scheme makes it possible for Carbon Bridge to benefit from the mediated sales. While this revenue stream is more volatile in the beginning, an established community base and insights into the consumption patterns of the members will smooth out the achieved earnings. Commission fees will become the major source of revenues as the sales per customer increase over time.

5 Reflections: learnings and limitations

As Carbon Bridge was the first entrepreneurial endeavor for the entire team the journey consisted of several pivots and many learnings. The team reflected and concluded that the

knowledge and experience gained in the field of entrepreneurship makes the project on a personal level successful. The theory of the master's program was complemented with the practical experience of the beginning of founding a business. From a business perspective the founders acknowledge the current limitations when it comes to approval. A successful broad external validation which includes signed Letters of Intent indicates that the team is on the right track. Yet, as sales determine if a business can be sustained, the ultimate judgement on the business' success can only be determined in the future due to the limited time available for successful implementation.

In the following table each team member reflected on their three most impactful learnings along the journey.

Table 4: Key learnings of each team member

Sara Serra Siebels
1) Although cold email campaigns are often time-consuming and initially yield few responses, persistence is key. As we found out even a small number of engaged participants can open doors to significant opportunities. This emphasizes the importance of perseverance in building a network of interested and valuable contacts.
2) Starting interviews by seeking to understand the interviewees' needs was an effective way to engage them. Prioritizing active listening over direct selling, fostered a more open dialogue, capturing their interest and setting a collaborative tone for the interaction.
3) Constantly adapting to feedback, making a product tailored to the needs of the customers is more demanding than expected. During our journey we had to learn that not everyone can be pleased.
Sebastian Immervoll
1) Act and wait for the response. We often get caught up in preconceptions, limiting ourselves without putting these assumptions for a test. Overcoming this initial barrier by putting ideas just into practice allows for a great insight: that there is a lot of things possible.
2) It is neither as good nor as bad. There are days where you do not get as far as you wish, you experience several obstacles, and it feels like it cannot be done. On the next day,

everything works out, progress is way better than expected and it feels like it must stay this way. Both is temporary, so focus on the process.

3) Things take longer than expected. It is important to account for that and to make good use of your time when you feel most productive. Personal note: I thought I would have written this paragraph here earlier...

Katharina Brunner

1) Don't be afraid of doing something you never did before. Everything will be new especially using code was a novel task for the team but one cannot give up before trying it. Learning new skills and being overwhelmed is part of the journey.

2) Talking to people was crucial for us. A lot of insights were gathered especially as it is such a young and unexplored market. You will only really know what the pain points are if you talk to the ones affected.

3) The entrepreneurial journey won't be linear or easy. Especially setting up a business with impact is more complex. Finding a working business model which aims to solve a societal/environmental is an immense challenge but still worthwhile and rewarding to pursue.

6 Horizons: Carbon Bridge's future

In writings these lines, it is less than a month until the defense of this project is to happen. The four weeks in between will be used to sort certain things out, enhance the perspective on the overall progress by raising the gaze from details and devote time to the development of the product. The defense as a next landmark in the entrepreneurial path is going to be leveraged for insights of people that allow for learnings from an outside perspective. It is then that the team will come together to assemble all the key pieces collected while working on this project of Carbon Bridge to decide on how to shape its future. Having this well-functioning team with shared perspectives and complementary skills, an advancing knowledge of the segment, the established network of producers interested in the product, and environmental issues that scream for change, the stage is set. It was the realization that as soon as paying customers are listed on the platform, it means one is bound for the ride. With clear excitement for this ride, the team wanted to be sure of the actions it took. Therefore, the decision on which step to take

next is going to be settled deliberately at the start of the year. The team is looking forward to it.

Part II: individual work

7 Impact: elevating customer success

This individual part covers all major decisions related to Carbon Bridges approach to customer centricity. It is crucial to first understand our blueprint behind this and how we can help to drive sales on our marketplace in a way that biochar producers have thus far been unable to do so themselves effectively. This approach will also consider the initial stages of the sales cycle as well as look at influences ahead and post-purchase which in turn makes Carbon Bridge and our customers more successful jointly. From this, we can directly measure the impact and value that we create.

7.1 Carbon Bridges hypothesis

The founding team's hypothesis is that the biochar market, characterized by its diversity and potential for growth, presents unique challenges and opportunities. Biochar producers vary in scale and focus, ranging from small, local operations, to larger more industrialized entities. Different input materials in the production of biochar will influence the quality of the output material, this creates different types of biochar each with its own distinct application. This diversity allows biochar producers to reach a broad spectrum of end users across numerous industries, such as construction, wastewater management, and agriculture, among others. This diversity through a range of applications whilst on a scientific and ecological level is extremely rewarding, it comes with a heavy burden. The very thing that makes biochar a super product is the very thing that is holding it back, already there is a lack of awareness and understanding of the material and this further adds a layer of complexity that is prohibitive.

In the primary research conducted, Carbon Bridge aimed to gather diverse perspectives from biochar producers of varying scales and focuses.

7.2 Identifying customer needs and expectations

Identifying customer needs is fundamental for ensuring customer success, as it enables the creation of tailored solutions that are specifically designed to meet those needs and facilitate

the achievement of customer goals. This understanding forms the foundation of developing a sustainable and profitable biochar ecosystem.

Among the 13 outreach efforts predominantly in Europe, we found that the majority of biochar producers are small to medium-sized operations, with a significant focus on serving the agricultural sector as their primary customer base. This process involved a thorough review of our fieldwork, including in-depth interviews with industry stakeholders such as Biatex, Arigna Fuels, LignoCarbon, IconCarbon, Bioenergie Frauenfeld AG, Sonnenerde, bionero, Ibero Massa Florestal, Skånefrö AB, Stiesdal, Glanris, ProE Bioenergie, NSR (appendix 9), in order to guaranty the product-market fit. To ensure a robust validation process, we adopted a mixed methods approach, combining the qualitative findings from these interviews with quantitative market data to enable a comprehensive testing of our initial hypothesis.

In the majority of interviews from our fieldwork, respondents confirmed our core hypothesis that biochar producers struggle to maximize their sales potential due to insufficient market awareness and ineffective marketing tools. This finding also highlights a wider problem of a general lack of public awareness and understanding of the benefits of biochar and presents a great opportunity for targeted education. In addition, our discussions with various companies have highlighted the wide range of possible applications for biochar, which vary depending on the quality and type of biomass used. This underscores the need for a more nuanced approach to market outreach in order to appeal to a wider range of potential biochar users.

One of our key findings that validates our hypothesis is that many biochar producers struggle to earn a profit from biochar alone, therefore, a few of the producers we spoke with capitalize on other byproducts of the pyrolysis process, such as bio-oil and syngas.

From the fieldwork, following key needs regarding the selling of biochar were articulated in our interviews. Firstly, producers in the biochar industry emphasize the differentiation of biochar qualities and the necessity of certification, now established through the European

Biochar Certificate (EBC), to gain market acceptance (EBI, 2023). Secondly, further validating our hypothesis, market access challenges are intensified by limited awareness of biochar's benefits and its competition with environmentally harmful materials such as brown coal and traditional fertilizers, long-used despite their negative impact on the planet. Following on this the third need is also validated, addressing this limited awareness requires significant marketing support to increase visibility and open new market avenues, enabling biochar to realize its environmental and commercial potential across various industries.

Within our interviews, stakeholders expressed specific expectations from Carbon Bridge. To educate potential end-users on the benefits of biochar. It was often mentioned that even when potential consumers are interested in purchasing biochar, they face the barrier of not fully understanding what that purchase would specifically mean for them. In addition, there has been an expectation in a simple, straightforward impact assessment tool that is able to effectively communicate the key benefits and impacts of biochar use. They emphasized the need for comprehensive marketing support, which in turn would help to develop a new market channel. Another critical aspect was community building, which emphasized the importance of creating a platform for knowledge sharing and collaboration within the biochar community and the biochar end users.

To meet these needs and expectations, Carbon Bridge has been developing an MVP accordingly, to strategically position itself as not just a service provider but an educator, that delivers impact whilst facilitating a new market. Developing tailored services that address the specific challenges faced by biochar producers will be key to our joint success.

7.3 Carbon Bridges vision

Our vision is thereby to become the one-stop shop for the biochar market, aligning the capabilities of our producers with the desires of end users. By achieving this alignment, we create a marketplace that thrives on the success of every participant, fostering a sustainable

biochar market. Without delivering value to our customers on both sides of the marketplace, the demand side and supply side the need for a business like ours to even exist is completely negated. We must become the trusted advisor in this space.

On the demand side, our aim is to provide a user experience that not only educates about biochar and measures its potential benefit when applied, but also simplifies the selection and purchasing process. This approach aims to enhance the satisfaction and confidence of buyers, resulting in recurrent engagements and a greater market presence.

For biochar producers, our focus is on amplifying their market presence and sales opportunities. Understanding their challenges and providing targeted solutions will empower them to expand their reach and streamline their operations and sales processes. Therefore, in order to enhance the biochar producers' success; our strategic plan offers the tools and visibility they need to thrive in the market. This array of initiatives such as targeted marketing initiatives, sales support, and community-building efforts, will highlight the unique benefits of their products.

7.4 Building trust-based relationships

Carbon Bridge is aiming to be the trusted advisor for our biochar producers, placing their interests ahead of our own. In niche markets, where trust is pivotal, we must exhibit a genuine commitment to our customer's success. Customer success and our success are deeply intertwined and we must cultivate lasting partnerships with our limited pool of biochar producers.

Hence, Carbon Bridge is committed to adopting a customer-centric approach. In this context, customer-centricity is understood as a company's commitment to deeply understand their clients' needs and provide the solutions they seek. This approach encompasses a management style focused on comprehending customer desires, delivering them efficiently, and organizing the company to meet these needs profitably. It embodies the concept of creating value both for

the clients and the business itself (Faluba et al., 2020). Only then can we cement ourselves as indispensable strategic partners in the long run.

As illustrated in Table 5 from 'The Trusted Advisor', the progressive layers of relationship engagement are visually described, ranging from service-based to trust-based interactions, each characterized by unique focus areas and corresponding indicators of success (Green et al., 2001).

Table 5: Characteristics of relationship levels

	Focus Is on	Energy Spent on	Client Receives	Indicators of Success
Service-based	Answers, expertise, input	Explaining	Information	Timely, high quality
Needs-based	Business problem	Problem-defining, solving	Solutions	Problems resolved
Relationship-based	Client organization	Providing insights	Ideas	Repeat business
Trust-based	Client as individual	Understanding the client-as-person	Safe haven for tough issues	Win-Win

Carbon Bridge positions itself as a platform that extends beyond being exclusively a needs or relationship-based platform for businesses. Our approach is deeply committed to fostering trust-based relationships, recognizing that trust is not only a core value, but a significant impact factor for our prospects. Building this initial trust and understanding that each biochar producer will have different needs from the others. This has been a conscious choice of Carbon Bridge out of necessity because we cannot offer the same service of customer success for all through a one-fits-all approach due to the multifaceted needs of our diverse customers, as highlighted before. This commitment is reflected in our rigorous efforts in every interaction, whether through extensive interviews, as documented in appendix 9, or through our dedicated field trip to Avenal, Portugal. The founding team invested their time to truly understand and adapt to the needs of potential customers. Our hands-on approach is supported by the tangible results: out of 13 biochar producers interviewed, an impressive 5 signed a letter of intent (LoI), signaling

their willingness to work with us (appendix 10). This not only underlines our commitment to building meaningful relationships, but is also a testament to the trust and value we create for our customers.

7.5 Customer success, and the impact we can create to our customers

By being customer-centric rather than customer-serving will be the key success to Carbon Bridge. The role of customer-centricity emerges not just as a business strategy but as a fundamental necessity for growth, survival, and customer retention. It impacts the complete customer lifecycle. A lack of customer success can lead to reduced customer satisfaction, trust, and increased churn rate, all of which negatively impact a business's financial performance (Wilson, Daniel, & McDonald, 2002). The concept of customer success as described by Kleinaltenkamp et al. is attained when customers achieve their goals, and the perceived value by the customer is a measure of how well these goals have been achieved.

In the pursuit of refining our understanding of what constitutes success for our customers, and their goals, Carbon Bridge proactively reached out to the previously interviewed biochar producers via email, with a hypothetical scenario that contemplates an engagement with our platform for three months. They were asked to consider this scenario and share what their quantifiable measures of success, priorities and considerations for renewal would be (appendix 11).

Based on the collective insights of our respondents, we conclude that success, for them, is multifaceted. Nevertheless, the main goal and most important success key metric, for all the respondents is the tangible increase in sales and purchase volumes. Further critical key figures recognized as indicative of success encompassed were the number of long-term contracts secured, the frequency of requests for quotations, the potential for cooperation and the effectiveness of our marketplace as a means of generating leads and initiating projects.

Specific quantifiable goals were identified as follows:

- Current sales volume low, sales must increase by 50%.
- Current sales volume high, sales must increase by 10 %.
- An increase in requests for quotations by more than 15%.
- Increase in cooperation requests regarding large projects, aiming for 2-3 per year.

To enhance our customers' success and effectively meet their targets for perceived success, we developed a strategic approach that is tailored to their specific needs. This approach, which we will detail in the next chapter, is designed to align closely with their expectations and goals, ensuring a more impactful and meaningful alignment based on a trust-based relationship.

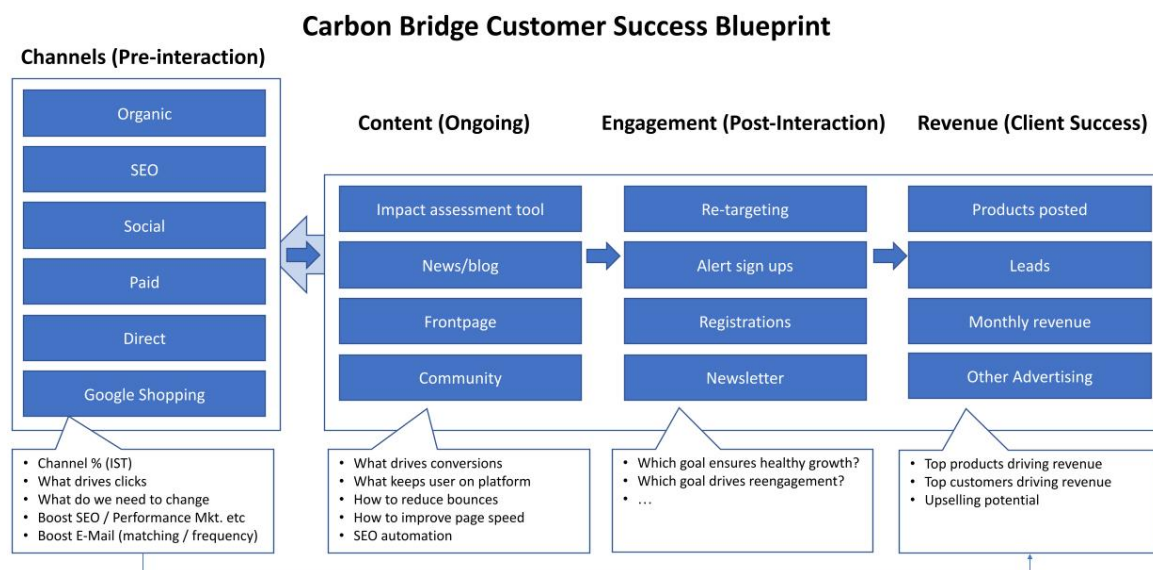
7.6 Carbon Bridge's blueprint and strategic approach for customer success

In Carbon Bridge's case building a brand and a successful marketplace means that the majority of the work that needs to be achieved and implemented is ahead of the end purchase. Building the path of least resistance for the end buyers so that they can convert into a legitimate sale without the need for time consuming conversion efforts. This chapter will look into how Carbon Bridge can influence the success of our biochar producers whose product is displayed on our marketplace, making sure that end buyers are of quality, informed, and engaged in a meaningful way. The emphasis of these strategies focuses on building awareness, educating potential customers, and by natural extension positioning Carbon Bridge as an invaluable resource within the niche biochar market.

Illustrated in figure 9 is Carbon Bridge's customer success blueprint. It is divided to follow the three-pillar approach that we have discussed in the earlier part of this paper: education, impact assessment and market visibility. Behind this, there is a blueprint of the multitude of different outcomes that would be beneficial to our biochar producers, those of which we have the end goal to make more successful. This commitment to success is based on our trust-based approach, which is why we offer a comprehensive range of options and strategies. By thoroughly understanding our customers and prioritizing a customer-centric model, we ensure

that our solutions are not only diverse, but also precisely tailored to the unique needs and aspirations of each individual biochar producer. Therefore, this chapter will assess the four different streams of key priorities for our biochar buyers as end potential consumers move down our structured funnel.

Figure 9: Carbon Bridge customer success blueprint



7.6.1 Channels (Pre-interaction)

Channels and our subsequent reach are key to delivering market visibility before end buyers have any interaction with Carbon Bridge’s digital footprint. Carbon Bridge opted for a multi-channel approach, in order to ensure meeting potential end buyers wherever they are.

Before a click has even been made on our website SEO, search engine results page (SERP), and content marketing, will be key for organic reach. From then on we can build upon best practices for SEO, this will further enhance our online visibility, ensuring that search results that appear prominently in organic form for biochar-related queries are best optimized. Initially, driving traffic and then more importantly quality traffic to the website and eventually our marketplace, is of utmost importance. Without this initial visibility in the initial awareness stage, the need for our marketplace is completely negated.

As a natural extension to this strategy will be the importance of growing backlinks. Domain Authority is a score from 0-100 designed to predict how likely a website is to rank in SERPs. Backlinks are the foundation of SEO and hold particular importance for Carbon Bridge in the long-term establishing trust and building up our Domain Authority. Backlinks will be key for the two-sided platform. Ahrefs, an SEO software tool, found that consistently acquiring new backlinks can lead to improved brand visibility and recognition (Backlink Checker ,n.d.). Each new backlink serves as an opportunity to expose the marketplace to a new audience. As we will be the meeting point of biochar vendors, products, and end buyers this increased brand visibility will attract both new end buyers and more biochar vendors, thereby growing the Carbon Bridges network and reach.

Within the initial SERP, Google Shopping will also be an additional resource we will leverage to increase visibility and reach. By utilizing the XML schema for Google Shopping, Carbon Bridge can take advantage of this free traffic when end buyers navigate towards the purchasing stage on Shopping search results of biochar-related products. The feed contains detailed product information, including titles, descriptions, prices, availability, and images, formatted according to Google's specifications.

Another source is social media and YouTube, in particular, has emerged as a promising platform for market visibility, as evidenced by the success of Sonnenerde, one of the companies interviewed. Sonnenerde has effectively utilized YouTube to engage with their audience, achieving a significant online presence with over 54,300 subscribers and more than 5 million video views in total (appendix 12). This impressive reach demonstrates the potential of YouTube as a valuable channel for Carbon Bridge to connect with an audience, share knowledge, and build a community around the sustainable use of biochar.

Additionally, Carbon Bridge plans to leverage Google Ads as a strategic tool for crafting diverse advertising campaigns tailored to various market segments in the future. The initial

investment for these campaigns is projected to be €70 per week (appendix 13), aiming to achieve significant market outreach and potentially attain an average conversion rate of 9%. This approach ensures that when we do initiate our Google Ads campaigns, they will be supported by a robust and engaging online presence, thereby maximizing the effectiveness of our advertising efforts and optimizing the return on investment. Carbon Bridge has proactively prepared four advertising campaign specifically tailored for our primary target audience: individual farmers and purchasing managers of agricultural companies (appendix 14). It encompasses a carefully selected range of relevant keywords that we believe are pivotal in capturing the current market trends and aligning with the specific needs and interests of our end buyers. Upon launching our campaigns, key metrics such as engagement rates, click-through rates (CTR), and conversion percentages will be tracked and displayed via Google Ads. This data will provide invaluable insights, enabling Carbon Bridge to identify which campaigns and content types are generating the most impressions and clicks. Such analysis is crucial for understanding the evolving needs within the market and for making data-driven improvements to our landing pages. Our goal is to elevate customer visibility to its utmost potential. However, the founding team has thoughtfully chosen to defer this investment. This decision is based on the priority to first enhance the platform, particularly focusing on the quality of our landing pages and blog posts.

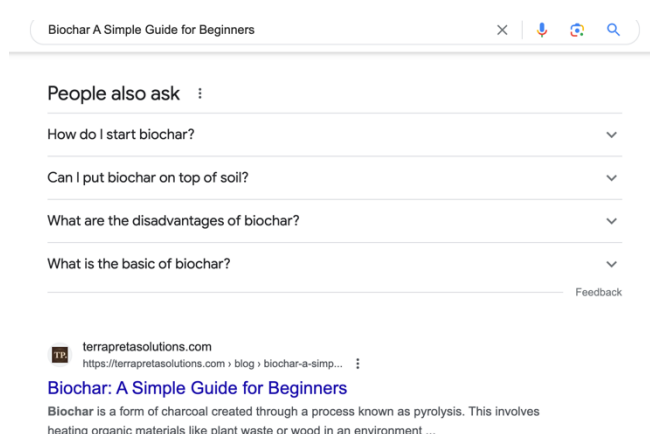
7.6.2 Content (Ongoing)

Carbon Bridge is also focusing on generating interest by sharing valuable content on our website. This includes sharing insights, trends and the latest research related to biochar, along with success stories and case studies highlighting the practical applications of biochar. Our website will serve as a central hub for this content, complemented by engaging articles published on LinkedIn and other social media platforms, including YouTube. By directly connecting with potential customers, we can effectively introduce them to the unique value

proposition of Carbon Bridge, fostering initial interest and driving traffic to our platform. Such direct engagement is instrumental for future growth and creating a loyal user base from the outset.

Each search that is relevant within the domain of biochar, whether it be falling under the category of awareness or consideration, the content will appear so that we are constantly being seen as a credible source and delivering value for the end buyer. Content marketing has proven to yield three times more leads than traditional marketing methods at 62% lower costs, as

Figure 10: Content search



reported in the (McCoy, n.d.).

Most importantly we will focus on quality content rather than quantity. Therefore, reaching out to researchers from remunerated institutes was an important part, whereby Carbon Bridge was able to gather confirmation to publish the

research work 'Biochar: Production, Applications, and Market Prospects in Portugal' on our platform (appendix 15). Social Media as mentioned in the chapter about channels will also be key for driving traffic to our website and for thought leadership our blog articles can additionally be shared to these platforms. Utilizing platforms like LinkedIn, Carbon Bridge can initiate and participate in discussions around sustainable practices and biochar applications. This will be interactive and help to spark conversations driving clicks to our marketplace while educating and engaging potential clients. Engagement through social media channels has been shown to increase B2B lead quality by 45%, as per a recent (Statista, 2022).

Equally, our interactive online impact assessment tool, is a piece of interactive content that will be personalized and enable potential buyers to better understand and estimate the impact of using biochar for their specific use case. This personalized approach aids in decision-making,

showcasing the practical benefits of biochar, coupled with the showcasing of the various biochar products posted, thereby simplifying the buyer's decision-making process by offering comparative insights and a range of options in one location.

Moreover, Carbon Bridge plans to feature newsletters on our website, showcasing the latest trends and developments in the industry. To access these newsletters, interested individuals will be required to complete a lead form. This process serves a dual purpose: firstly, it allows us to collect valuable information about potential buyers, thereby converting them into marketing qualified leads (MQL). Secondly, with this information in hand, Carbon Bridge can engage these leads through targeted email campaigns in the future, effectively enhancing our conversion rate. This strategy not only helps in building a database of interested prospects, measurable MQLs, but also enables us to maintain a continuous and relevant dialogue with them, gradually guiding them down the sales funnel.

7.6.3 Engagement (Post-Interaction)

A profound re-engagement strategy is of utmost importance for every company. According to published data, approximately 25 to 50 percent of a brand's customers become inactive, each year. Simultaneously, as Hubspot points out, the costs associated with acquiring new customers have risen by almost half in the last five years (Calica, 2021). This demonstrates the critical importance of reengagement tools.

Retargeting once an interaction with Carbon Bridge has been made will be key to engaging with potential end buyers who have shown interest in purchasing biochar products or using our impact assessment tool. Retargeting involves showing targeted ads to individuals who have already visited the marketplace but have not made a purchase. It's based on the concept that consumers who have already shown interest in your brand are more likely to convert compared to those who have never interacted with Carbon Bridge.

Due to the requirement of sensitive data that customers do not always wish to share, measuring customers' economic benefit is typically a complex task. We can leverage this however and build comprehensive user datasets through our website as we attempt to build an audience through the value that we create. This can be done in two ways, through soft reengagement tools or hard sign ups.

The soft re-engagement tools will be to receive updates about biochar and exclusive access to future blog articles that will be published. This is more to create an engagement platform so that Carbon Bridge's market presence is consistent to those who wish to receive updates from us. The harder registrations creating a profile on our website, in order to purchase biochar on the platform, will be where the majority of the data value is. From then on, we can access personal information, location buying trends, and frequency. This is also invaluable for our biochar producers and an added revenue stream we can monetize moving forward.

7.6.4 Revenue (Customer success)

In this section, the emphasis is on the translation of our strategies into quantifiable actions aligned with our overarching goal of increasing sales, which our customers have identified as the primary indicator of success.

To accurately track our progress, we have established a comprehensive set of key KPIs, which are grounded in the projected data from our 'Carbon Bridge Platform Economics' (appendix 16). These KPIs are constructed based on informed assumptions, serving as benchmarks for assessing the efficacy of our strategies and the growth trajectory of our platform. Based on this data the marketing efforts are expected to increase the average number of monthly visitors from 330 to 686, reaching a broad audience including individual farmers and agricultural businesses. This expected increase is proof of the effectiveness of our marketing initiatives and the resonance of our brand in the target market.

The economic forecast further highlights the tangible benefits for biochar producers. With an average order size of 5.70 tons and a value of €12,445 for farmers, our targeted content and outreach initiatives are fine-tuned to resonate with their commercial objectives. By converting these interactions into profitable sales, we aim to elevate the average yearly revenue per producer to an estimated €17,313.

Furthermore, looking at the German farmers metrics, with 50% of buyers classified as test buyers and a significant biochar application rate of 5 t/ha, we understand the critical nature of targeting and converting these segments into long-term, sophisticated buyers. These metrics will help us refine our messaging and outreach efforts to target these segments effectively.

Overall, these KPIs have been carefully selected to reflect not only the direct impact of our efforts on sales, but also to measure the wider engagement and interest in our platform.

7.7 Key learnings - impact: elevating customer success

To conclude this individual part, the top learnings are summarized in the following.

- (1) Throughout our fieldwork based on the interview feedback, regulations trends, and an interview with a potential biochar end buyer, Carbon Bridge identified that there was a need to change the narrative of the Carbon Bridges platform. Not focusing too much on the what, what do they need - biochar, but in order to gain more traction to the website and hopefully resulting in sales for the biochar producers, emphasizing the why business need it.
- (2) The process of establishing quantifiable success measures in the biochar market revealed unexpected complexities. Due to the significant variation in scale and sales strategies among biochar producers, setting universal goals was not straightforward. This insight highlighted the importance of adaptable, context-specific strategies for measuring success.
- (3) The emphasis on building trusting relationships with biochar producers through in-depth conversations was critical to Carbon Bridge's initial success. These conversations not only generated interest in our value proposition, but also emphasized the importance of being

perceived as a trusted advisor in the biochar market. However, this approach brought a key learning: while effective on a small scale, it is time consuming and may not be feasible when scaling up.

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Appendix 1: Costs of initial business idea

The aim was a 4t biochar production, allowing for approximately one hectare of soil application. We therefore needed around 20t of input resources. The biggest chunk of the overall costs would have been the one for production. Considering an average conversion rate of 20%, these add up to 5.332€. The second largest part is monitoring and research with 840€.

PHASE 1 - Q2 2023	
Type	Costs
Input	€ 6
Facility Transportation	€ 438
Production	€ 5 332
Distribution	€ 438
Monitoring & Research	€ 840
Salaries	€ 0
Administrative Costs	€ 200
Accounting Fees	€ 0
Legal Fees	€ 500
Customer Aquisition	€ 0
Total Expenditures	€ 7 753

Breakdown of costs for phase 1 of Terra Preta

Transportation and distribution by truck, going from the farm to the biochar facility and back, are calculated to be at 438€ each. The legal fees for contracting and setting up the business are estimated at 500€. Further costs are caused through administration (200€) and input resources (6€). Overall, the second period is characterized by the total costs of 7.753€.

Appendix 2: The basis for the impact assessment tool

Input: Impact Model - Variables and Sources

Variable	Average metric	Impacts which variables	Source
Hectares of land cultivated	Input from Farmers	Amount of biochar needed	
Crop type	The average increase in crop productivity was 30.3 % legume crops 28.6 % vegetables 13.9 % grasses 8.4 % maize 11.3 % wheat 6.6 % rice	Effect on crop productivity	Liu, X., Zhang, A., Ji, C. et al. Biochar's effect on crop productivity and the dependence on experimental conditions—a meta-analysis of literature data. Plant Soil 373, 583–594 (2013). https://doi.org/10.1007/s11104-013-1806-x
Soil type	Water storage potential coarse-textured soil: 45% saved medium-textured soil: 21% saved fine-textured soil: 14% saved	Water storage potential	Razzaghi et. al. (2019) - Does biochar improve soil water retention? A systematic review and meta-analysis
Region	North or South of Tagus river 4.6 - 5.5 = North of Tagus river 5.6 - 6.5 = South of Tagus river	Soil Acidity -> Crop Yield with biochar	https://projects.inia.pt/infosolo/
Ph level	The ideal level of PH should be between 6 and 7.5 . The increase in crop productivity was also greater (30.2 %) in acid soils (pH<5.0) than in neutral soils., crop productivity responses were generally negative (-7.9 % on average) with non-alkaline (pH<7.0) biochars though generally positive with alkali-line biochar (pH>7.0)	Crop yield with biochar	https://projects.inia.pt/infosolo/
Current fertilizer spend per year	Input from Farmers	Costs savings potential	https://store.carvazero.pt/
Price for biochar	1.2€ per kg	Costs saved	
Water consumption in l per year	Input from Farmers	Water storage potential	400€ per 1m³ -> x0,33 conversion = 333 kg for 400€ -> 1.2€ per kg

Output: Impact Model - Variables and Sources

Variable	Average metric	Impacts which variables	Source
Quantity of biochar needed	St / hectare (Recommendation)	1. Hectares of land	Duration: decrease of effects -0.013% per day in first two years = - 9.5% in this time https://onlinelibrary.wiley.com/doi/epdf/10.1111/gcb.12266 https://store.carvazero.pt/
Costs saved	(1.2€*quantity needed)/TV-current fertilizer spend per year	1. Quantity needed 2. Price for biochar	400€ per 1m³ -> x0,33 conversion = 333 kg for 400€ -> 1.2€ per kg https://www.theglobaleconomy.com/Portugal/Fertilizer_use/ 190 kg per hectare in 2020 https://www.statista.com/statistics/1316044/global-monthly-fertilizer-prices-by-category-urea-potash-phosphate/ average price of fertilizer (for december 2022) was 572,81 per metric ton -> 0,57281€ per kg -> 190 x 0,57281 = 108,83€ per hectare 6000/108,83 = 55 years until break-even
Carbon Stored	1 tonne of biochar applied = 1,45 tonne of Carbon stored	1. Quantity needed	Aggrehu et al. (2016) Benefits of biochar, compost and biochar-compost for soil quality, maize yield and greenhouse gas emissions in a tropical agricultural soil. Blanco-Canqui et al. (2020) Soil carbon increased by twice the amount of biochar carbon applied after 6 years: field evidence of negative priming. Cooper et al. (2020) Effect of biochar and compost on soil properties and organic matter in aggregate size fractions under field conditions.
Crop yield productivity	The average increase in crop productivity was 30.3 % legume crops 28.6 % vegetables 13.9 % grasses 8.4 % maize 11.3 % wheat 6.6 % rice pH Level: 4.6 - 5.5 = North of Tagus river 5.6 - 6.5 = South of Tagus river The ideal level of PH should be between 6 and 7.5 . The increase in crop productivity was also greater (30.2 %) in acid soils (pH<5.0) than in neutral soils., crop productivity responses were generally negative (-7.9 % on average) with non-alkaline (pH<7.0) biochars though generally positive with alkali-line biochar (pH>7.0)	Region pH level Crop type	Liu, X., Zhang, A., Ji, C. et al. Biochar's effect on crop productivity and the dependence on experimental conditions—a meta-analysis of literature data. Plant Soil 373, 583–594 (2013). https://doi.org/10.1007/s11104-013-1806-x https://projects.inia.pt/infosolo/
Water Saved	Water storage potential coarse-textured soil: 45% saved medium-textured soil: 21% saved fine-textured soil: 14% saved	Soil type Water consumption l per year	Razzaghi et. al. (2019) - Does biochar improve soil water retention? A systematic review and meta-analysis

Appendix 3: The code for the impact assessment tool

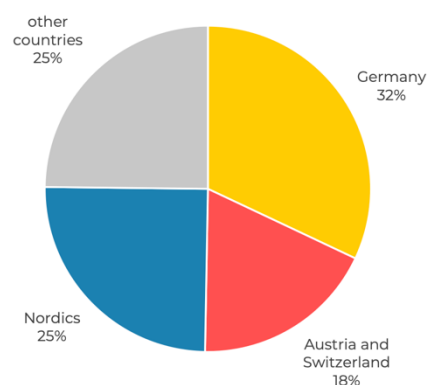
```
1 <!DOCTYPE html>
2 <html lang="en">
3 <head>
4 <meta charset="UTF-8">
5 <meta name="viewport" content="width=device-width, initial-scale=1.0">
6 <link rel="stylesheet" href="https://fonts.googleapis.com/css?family=Montserrat">
7 <style>
8 body {
9   font-family: 'Montserrat', sans-serif;
10  background-color: #f5f5f5;
11  margin: 20px;
12  text-align: center;
13  font-size: 16px;
14 }
15
16 h1 {
17   color: #333;
18 }
19
20 .report-container {
21   background-color: #f9f9f9;
22   padding: 30px;
23   border-radius: 10px;
24   box-shadow: 0 0 10px rgba(0, 0, 0, 0.2);
25   margin-bottom: 30px;
26   max-width: 600px;
27   margin-left: auto;
28   margin-right: auto;
29 }
30
31 label {
32   display: block;
33   margin-bottom: 8px;
34   font-weight: bold;
35 }
36
37 input,
38
39
40
41   margin-bottom: 16px;
42   box-sizing: border-box;
43   border: 1px solid #ccc;
44   border-radius: 6px;
45   font-size: 16px;
46 }
47
48 input[type="button"] {
49   background-color: #276221;
50   color: white;
51   padding: 14px 24px;
52   border: none;
53   border-radius: 6px;
54   cursor: pointer;
55   font-size: 18px;
56   transition: background-color 0.3s ease;
57 }
58
59 input[type="button"]:hover {
60   background-color: #1c4e33;
61 }
62
63 #reportOutput {
64   margin-top: 20px;
65   font-size: 18px;
66 }
67 </style>
68 </head>
69 <body>
70 <h1>Impact Report Generator</h1>
71 <div class="report-container">
72   <form id="reportForm">
73     <label for="hectares">Number of Hectares of Land:</label>
74     <input type="number" id="hectares" required>
75     <label for="soilAcidity">Soil Acidity (pH):</label>
76     <input type="number" id="soilAcidity" required>
77     <label for="cropType">Crop Type:</label>
78     <select id="cropType" required>
79       <option value="legume">Legume Crops</option>
80       <option value="vegetables">Vegetables</option>
81       <option value="grasses">Grasses</option>
82     <!-- Add more options as needed -->
83   </select>
84   <label for="fertilizerUse">Fertilizer Used (kg per hectare):</label>
85   <input type="number" id="fertilizerUse" required>
86   <label for="waterConsumption">Water Consumed (liters per hectare):</label>
87   <input type="number" id="waterConsumption" required>
88   <input type="button" value="Generate Report" onclick="generateReport()">
89 </form>
90 </div>
91 <div id="reportOutput"></div>
92 <script>
93   function generateReport() {
94     const hectares = parseFloat(document.getElementById('hectares').value);
95     const soilAcidity = parseFloat(document.getElementById('soilAcidity').value);
96     const cropType = document.getElementById('cropType').value;
97     const fertilizerUse = parseFloat(document.getElementById('fertilizerUse').value);
98     const waterConsumption = parseFloat(document.getElementById('waterConsumption').value);
99     const potentialCarbonStorage = hectares * 1.45;
100    const potentialYieldIncrease = hectares * 0.02;
101    const reportOutput = `
102
103      <div id="reportOutput">
104        <strong>Potential Carbon Storage:</strong> ${potentialCarbonStorage.toFixed(2)} tons CO2e
105        <br>
106        <strong>Potential Yield Increase:</strong> ${potentialYieldIncrease.toFixed(2)} tons
107      </div>
108    `;
109    document.getElementById('reportOutput').innerHTML = reportOutput;
110  }
111 </script>
112 </body>
```

Appendix 4: Potential customer segments

Industry	Biochar production	Biochar feedstock	Government	Carbon offset	Farming	Gardening tools
End User	1)R&D employees 2)Sales force	1)Sustainability officers 2)Sales force	Policy makers	1)Engineers 2)Sales force	1)Crop farmers 2)Livestock farmers	Marketing employees
Application	1)Product monitoring, product refinement 2)Education, sales process	1)Education, value chain impact measurement 2)Education, sales process	Education, impact monitoring, policy making, resource allocation decisions	1)Impact measurement 2)Education, sales process	1)Buying decision, impact monitoring 2)Buying decision, impact monitoring	Buying decision, education, product marketing
Benefits	1)Product insights+, resource need- 2)Product insights+, sales+	1)Source product insights+, ESG compliance+ 2)Source product insights+, sales+	Product insights+ impact quantification+, sustainability goals alignment+, efficient resource allocation+	1)Measurement precision+, ESG compliance+ 2)Product insights+, revenues+	1)Productivity+, sustainability+ revenues+ 2)Productivity+, sustainability+, revenues+	Product insights+, brand image+ sales+

Industry	Building materials	Aquaculture farming	Wastewater treatment	Academia	Land restructuring	Environmental organisations
End User	1)R&D employees 2)Sales force	1)Fish farmers 2)Seafood farmers	R&D employees	Researchers	Engineers	1)Policy makers 2)Marketing employees
Application	1)Buying decision, product development, product monitoring 2)Education, sales process	1)Buying decision, impact monitoring 2)Buying decision, impact monitoring	Buying decision, product development, product monitoring, impact monitoring	Hypotheses testing, impact monitoring	Buying decision, impact monitoring	1)Education, policy making, impact monitoring 2)Education, marketing campaigns
Benefits	1)Sustainability+, product quality+ 2)Product insights+, brand image+, revenues+	1)Productivity+, sustainability+ 2)Productivity+, sustainability+	Product insights+, productivity+, sustainability+, costs-	Insights+, credibility+	Efficiency+, sustainability+	1)Product insights+, efficiency+, sustainability goals alignment+ 2)Product insights+, awareness raising+

Appendix 5: Biochar production by regions/countries - cumulative biochar production capacity in Europe end of 2022



* Screenshot from (EBI, 2023)

Appendix 6: Persona Profiling

While our persona profile was derived from conducted interviews, it should be emphasized that certain elements are based on informed assumptions.

Name: Dr. Martin Becker (alias)

Age: 45

Title: Product manager

Company: GreenChar Solutions

Industry: Biochar Production

Education: PhD in Environmental Chemistry

Location: Germany

Family: Married with two children

Income: Medium-high level

Personality Traits: Analytical, environmentally-conscious, problem-solver, forward-thinker.

Background Story:

Dr. Martin Becker is an experienced environmental chemist who has turned his expertise toward the production of biochar. With over 20 years in the field, he has witnessed the rise of sustainability as a core consumer value and has dedicated his career to finding solutions that balance economic viability with environmental responsibility. As product manager of GreenChar Solutions, a pioneering biochar company, he is at the forefront of developing innovative applications for biochar that extend beyond agriculture into industries, such as construction and water treatment.

His behavior is characterized by the following aspects:

- Seeks out the latest research and technological innovations in biochar.
- Actively participates in industry conferences and policy discussions.
- Advocates for industry collaboration to address market and regulatory challenges.

Goals:

- Develop new, marketable applications for biochar to expand its use.
- Establish GreenChar as a market leader in the biochar industry.
- Navigate and influence regulatory landscapes to favor biochar production and use.

Needs:

- Marketing strategies that highlight the quality of biochar over cheaper, less environmentally friendly options.

- Innovative thinking to change traditional practices and industry standards - educate the market and demonstrate biochar's benefits.
- Clear legal definitions for biochar production processes.
- Reliable data on biochar's environmental impact to improve market perception.

Pains:

- The difficulty of proving biochar's worth in a price-sensitive market.
- Economic challenges due to underinvestment and high broker commissions.
- Seasonal demand fluctuations and a lack of year-round sales consistency.
- Regulatory barriers.

Purchasing Criteria in prioritized order:

1. **Ability to Increase Awareness:** Our product must demonstrate the capability to significantly raise awareness of biochar benefits among target audiences, which could lead to a wider adoption and market expansion.
2. **Quality of Impact Assessment:** Our product should provide accurate, credible, and easy-to-understand impact assessments for biochar's environmental benefits, influencing buyers and industry stakeholders' decision-making.
3. **Marketplace Visibility:** The platform must offer high visibility for GreenChar Solutions' products, providing an effective online presence that can compete with other marketing channels.
4. **Cost-Benefit Ratio:** The costs associated with listing products must be outweighed by the potential for increased sales and market reach.
5. **User Experience and Engagement:** The platform must provide an excellent user experience for both biochar producers and potential customers, encouraging engagement and repeat visits.

Appendix 7: List of outreaches – biochar producers

🌟 Stage	Aa Name	☰ Title	🏢 Company	@ Contact	📍 Location
Had meet...	👤 Sara Fernandes	Replacing Ana	Imflorestal	sara.fernandes@imflorestal.com	Oliveira de Azeméis
Posponed	👤 Ana Machado		Imflorestal	ana.machado@imflorestal.com	Oliveira de Azeméis
Contacted	👤 Circle Carbon		Circle Carbon	info@circlecarbon.com	Spain
Had meet...	👤 Dr. Robert Johnson	👤 R&D Manager	Arigna Fuels	robert@arignafuels.ie	Ireland
Contacted	👤 carbonauten GmbH		carbonauten GmbH	info@carbonauten.com	Germany
Contacted	👤 F. Ehrich GmbH & Co.		Ehrich Gruppe	info@ehrich.de	Germany
Had meet...	👤 Sarah Hildebrandt	👤 Project Lead	icon carbon// Ehrich Gruppe	s.hildebrandt@icon-carbon.de	Germany
Contacted	👤 BASNA d.o.o.		BASNA d.o.o.	info@basna.net	Serbia
Contacted	👤 Carbo-FORCE GmbH		Carbo-FORCE GmbH	info@carbo-force.de	Germany
Had meet...	👤 Harald Fichtl	👤 1	LignoCarbon Schweiz AG	harald.fichtl@lignocarbon.ch	Switzerland
Contacted	👤 klimafarmer	👤 1	klimafarmer GmbH	service@klimafarmer.de	Germany
In contact	👤 Florin Milla		Novocarbon GmbH	f.milla@novocarbon.com	Germany
Had meet...	👤 Hans Sanzenbacher	Dipl.-Ing.	ProE Bioenergie	hs@proe-bioenergie.de	Germany
Contacted	👤 Oxford biochar		Oxford biochar	office@oxfordbiochar.org	England
Contacted	👤 Woodtek Biochar		Woodtek Biochar	info@woodtekbiochar.com	Wales
Contacted	👤 Carbo Culture		Carbo Culture	hello@carboculture.com	Finland / UK / USA
Contacted	👤 Grassroots Biochar AB		Grassroots Biochar AB	Info@grassrootsbiochar.se	Sweden
In contact	👤 Edvard Hamilton		BIOKOL	ro@biokol.se	Sweden
Contacted	👤 CharLine GmbH		CharLine GmbH	office@charline.at	Austria
Had meet...	👤 Gerlach Dunst		Sonnenerde GmbH	g.dunst@sonnenerde.at	Austria
Contacted	👤 Swiss Biochar	👤 1	Swiss Biochar	info@swiss-biochar.com	Switzerland
Had meet...	👤 Fabian Link	👤 1 Produktmanager	Bioenergie Frauenfeld AG	fabian.link@bioenergie-frauenfeld.ch	Switzerland
Had meet...	👤 Aaron Saßmannshaus	CEO	bionero	aaron.sassmannshausen@bionero.de	Germany
Contacted	👤 Carbex	👤 1	Carbex	info@carbex.one	Germany
In contact	👤 Horst Wagner		Innovations Centrum Meißner	kundenservice@pflanzenkohle.info	Germany
Contacted	👤 CarboVerte GmbH		CarboVerte GmbH	info@carboverte.de	Germany
Contacted	👤 BioCarbo		BioCarbo	info@biocarbo.it	Italy
Lead	👤 Carbonloop	👤 1	Carbonloop	contact form	France
Contacted	👤 Carbo Centric		Carbo Centric	contact form	France
Had meet...	👤 Stefan Sziwek	👤 1	Biatex GmbH	sz@biatex.de // sz@varem-energie.com	Germany
Contacted	👤 Mash Makes		Mash Makes	contact form	Denmark / India
Contacted	👤 Bionika AG		Bionika AG	office@bionika.ch	Switzerland
Contacted	👤 Koen Cardinaels	Plant Manager	TorrCoal	k.cardinaels@torrcoal.nl	Belgium
Contacted	👤 Origin Biochar		Origin Biochar	info@originbiochar.com	Ireland
Contacted	👤 Dad's Farm Biochar		Dad's Farm Biochar	info@dadsfarmbiochar.com	Wales
Contacted	👤 DEMIO		DEMIO	contact form	France
In contact	👤 Carine COAT	👤 1	Terra Fertilis	c.coat@terrafertilis.com	France
Lead	👤 Carbonex	👤 1	Carbonex / Groupe SOLER	contact form	France
Contacted	👤 Groupe Bordet		Groupe Bordet	contact@groupebordet.fr	France
Contacted	👤 Carbons Finland Oy		Carbons Finland Oy	info@carbons.fi	Finland
Had meet...	👤 Morten Heick	👤 1	Stiesdal	mhe@stiesdal.com	Denmark
Contacted	👤 Oplandske Bioenergi AS		Oplandske Bioenergi AS	post@obio.no	Norway
Had meet...	👤 Eva Stal	👤 4 Projekt Manager	Nordvästra Skånes Renhållning	Eva.stal@nsr.se	Sweden
Contacted	👤 Envigas		Envigas	info@envigas.com	Sweden
Contacted	👤 Bussme Energy AB		Bussme Energy AB	contact form	Sweden

Had meet...	Claes-Göran Henrikss	Senior Consultant	Skånefrö AB	cgh@skanefro.se	Sweden
Contacted	Siotuu	2	Siotuu	info@siotuu.com	Austria
Contacted	Energy Ocean GmbH		Energy Ocean GmbH	info@energyocean.ch	Switzerland
Contacted	Reto o. Franziska Gro:		Grossenbacher Grüngut	info@grossenbacher-gruengut.ch	Switzerland
Contacted	INEGA AG		INEGA AG	admin@inega.swiss	Switzerland
In contact	Sandi Martin	1	CEO & Founder	amatagreenconsulting@gmail.com	Spain
Contacted	Josiah Hunt		CEO	https://www.linkedin.com/in/josiah-h	US
Contacted	Adrian Würsch		Verora GmbH	mail@verora.ch	Switzerland
Contacted	Christopher Carstens		CTO	https://www.linkedin.com/in/christop	Finnland / UK / USA
Had meet...	Bryan M. Eagle III		CEO	https://www.linkedin.com/in/bryanme	US
Contacted	Wakefield		Wakefield	Contact form	US
Contacted	Peter Burgess		Rainbow Bee Eater	https://www.rainbowbeeeater.com.au	Australia
Contacted	Sampo Tukiainen		Founder and Ex-CEO	https://www.linkedin.com/in/sampo-t	Finland
Contacted	Pyreg		Pyreg	contact form	Germany

+ New

COUNT 59

Appendix 8: Annual revenue reasoning

BIOCHAR MARKET		
Metric	Number	Details
Expected Number of Biochar Production Plants	180	end 2023
Expected Biochar Producers Germany	58	end 2023, production capacity proxy
Expected Biochar Producers Austria/Switzerland	32	end 2023, production capacity proxy
Expected Biochar Producers Nordics	45	end 2023, production capacity proxy
Expected Biochar Producers Others	45	end 2023, production capacity proxy
Growth Rate in Biochar Production Plants	25,35%	
Expected Production Capacity	90000	tons end 2023
Expected Production Capacity Germany	28800	tons end 2023
Expected Production Capacity Austria/Switzerland	16200	tons end 2023
Expected Production Capacity Nordics	22500	tons end 2023
Expected Production Capacity Others	22500	tons end 2023
Expected Actual Production	50000	tons end 2023
New Installation Productivity Factor	30%	of Uptime
Long-term Productivity Factor	80%	of Uptime
Biochar 1m3 =	0,35	tons
Biochar 1t =	2,86	m3
Biochar Price Germany	€ 800	per ton
Biochar Price Austria/Switzerland	€ 800	per ton
Biochar Price Nordics	€ 800	per ton
Biochar Price Others	€ 800	per ton
Expected Sales Germany	=(Old!B44/B4)*B16*B10*B19+((B4-Old!B44)/B4)*B15*B10*B19	

Combined annual revenue = expected sales in Germany of €15,232,000.

Appendix 9: Fieldwork notes – Carbon Bridge external validation

Appendix 9.1: Interview with Biatex

Interviewee's name	Stefan Sziwek
Organization	Biatex GmbH
Interview Date	7th of November at 5pm
Location	Online
Length	60 minutes
Interview history	1st interview

1. In general, how did the interview go?

The interview with Biatex GmbH provided insightful information on the current state of the pyrolysis industry. Stefan Sziwek was very knowledgeable, especially regarding the technical and market challenges.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Industry Challenges:** It was particularly pointed out that a significant number of biochar producers in Europe, originally established with the help of government subsidies, have gone bankrupt, indicating a systemic problem that requires attention.
- **Technical Hurdles:** The technical complexities of the pyrolysis process have been highlighted, in particular the critical temperature threshold of 400-450 degrees Celsius. Beyond this point, the release of harmful dioxins and furans becomes a significant problem, which not only complicates the operating process, but also raises doubts about the stability and safety of the resulting biochar and thus its marketability and applicability.
- **Sustainability and Certification:** The hydrothermal carbonization (HTC) process, suitable for wet materials, offers a sterilized output but lacks CO₂ certification, which is crucial for market acceptance, particularly from eco-conscious consumers and industries.
- **Quality Assurance:** The importance of consistent quality in pyrolysis products was a recurring theme, which is instrumental in making these products competitive, especially against the established chemical industry which has significant capital and influence.
- **Long-Term Prospects:** There is a clear understanding that for pyrolysis products to be a sustainable alternative, they must offer consistent quality over time, requiring a stable and homogeneous input.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

There were no significant themes or questions that were avoided by the participant. However, for a more holistic understanding, future discussions would benefit from a deeper examination of the sales strategies and marketing initiatives that underpin the sector's commercial success.

4. What themes were discussed in the most depth?

The interview covered in depth the operational challenges associated with the pyrolysis process, particularly the challenges of managing pyrolysis at specific temperatures to prevent the release of hazardous substances. The conversation also delved into the necessity of

consistent product quality, not only as a benchmark for industry standards but also as a crucial factor in competing against well-established entities in the chemical sector. Additionally, the discourse highlighted the essential role of environmental certifications in reinforcing the credibility and market appeal of pyrolysis products, particularly in sectors that prioritize ecological responsibility.

5. What were the most significant or interesting discussions within the interview?

The most important part of the discussion revolved around the comparison of the technical limits of pyrolysis and the economic pressure from the industry. The detailed explanation of temperature limits and their impact on product safety and stability was particularly informative. Moreover, it was emphasized that reaching the break-even point requires the sale of biochar at a minimum price of 500 euros. In addition, the need for consistent quality and the importance of certification for long-term sustainability were highlighted as crucial to the progress of the industry.

6. What were the least significant or interesting discussions within the interview?

While all topics covered were pertinent, the least significant discussions may have pertained to the granular technicalities of the HTC process, which, although relevant, did not directly contribute to the broader scope of the research.

7. Any improvement needed on the script or fieldwork strategy?

In the following interviews, it would be beneficial to explore the marketing strategies and initiatives of biochar producers to generate consumer interest and promote sales.

8. Final thoughts / comments?

The interview highlighted the importance of addressing both the technical and systemic challenges facing the pyrolysis industry. With a market looking for both environmental certifications and stability of product quality, the need for strategic planning and policy support is evident. Integrating strict quality controls and consistent means of production is crucial for the industry to position itself as a viable, sustainable alternative in the long term.

Appendix 9.2: Interview with Arigna Fuels

Interviewee's name	Dr. Robert Johnson
Organization	Arigna Fuels
Interview Date	9th of November at 2pm
Location	Online
Length	55 minutes
Interview history	1st interview

1. In general, how did the interview go?

The interview with Arigna Fuels was highly informative and flowed well, providing crucial insights into the operational, environmental, and market challenges of the biochar industry. The discussions about production methods, transportation issues, and market dynamics were particularly useful for understanding the complexities of the biochar market.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Production Method:** Arigna Fuels uses dense materials like nutshells and olive stones for biochar production, favoring these over wood chips due to their consistency and quality. The low pyrolysis process at 300 degrees Celsius achieves an 80% carbon content in the final product.
- **Transportation and Environmental Concerns:** The transportation of olive stones from the Mediterranean region presents a significant carbon footprint and logistical challenge, highlighting the need for a more sustainable supply chain.
- **Market Challenges:** Aspiring to be Europe's largest biochar plant, with their new plant producing 10t of biochar per hour, Arigna Fuels faces sales and marketing challenges. The biochar market is still niche, with limited buyers.
- **Benefits of Biochar:** Biochar's potential to enhance soil quality, absorb nutrients, and reduce ammonia leakage into rivers and soil was emphasized. Additionally, biochar can contribute to carbon sequestration efforts, leading to carbon credits and improved agricultural yields.
- **Regulatory and Verification Aspects:** The interviewee highlighted the importance of life cycle assessments and state approvals in legitimising biochar's environmental benefits. Ongoing trials in Ireland and the need for independent verification were discussed.
- **Cost Considerations:** Production costs are significant, with a high input-to-output ratio (3t of biomass for 1t of biochar).
- **Different applications of biochar:** The discussion also touched upon the challenge of integrating biochar into concrete. Yet a 5% application of biochar in concrete would increase cement costs by 30-40%. Furthermore, the unique issues faced in Ireland, such as the mica problem, and their impact on incorporating biochar into building materials were discussed.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

There were no answers avoided by the participant.

4. What themes were discussed in the most depth?

The most in-depth discussions revolved around the regulatory hurdles facing the industry and the market challenges, particularly in terms of reaching a wider customer base.

5. What were the most significant or interesting discussions within the interview?

One of the most captivating aspects of the discussion revolved around the ownership and allocation of carbon credits. Currently, there is a debate over whether these credits should be awarded to farmers or biochar producers. Granting carbon credits to biochar producers could significantly increase the market attractiveness of biochar, making it more price-competitive. It was noted that carbon credits could potentially fetch around 220 euros per carbon ton, providing a substantial financial incentive.

Furthermore, the discussion touched on the hesitancy of farmers in Ireland to adopt biochar. One key issue identified was the penalization of early adopters, which is a significant barrier to market entry. The conversation explored potential strategies to mitigate this challenge, suggesting that a more favorable regulatory and incentive framework could encourage farmer adoption. This part of the interview was especially significant as it shed light on both the economic and regulatory dynamics influencing the biochar market.

6. What were the least significant or interesting discussions within the interview?

The technical details regarding the specific types of biomass used and their characteristics might have been less significant in the context of the broader market challenges.

7. Any improvement needed on the script or fieldwork strategy?

To enhance future interviews, a more focused and structured approach could be employed, particularly in discussing market strategies and potential solutions to industry challenges. It would be beneficial to delve deeper into customer perspectives, understanding their needs, reservations, and drivers for adopting biochar products. Additionally, questions could be oriented towards exploring the various channels of market penetration and promotion, such as partnerships, educational campaigns, and policy advocacy. This approach would provide a more rounded understanding of the market dynamics and the potential avenues for increasing biochar adoption.

8. Final thoughts / comments?

The interview provided valuable insights into the biochar industry, emphasizing the need for greater awareness and understanding of its environmental benefits and market potential. It also highlighted the importance of regulatory frameworks and life cycle assessments in promoting biochar as a viable environmental solution.

Appendix 9.3: Interview with LignoCarbon Schweiz AG

Interviewee's name	Harald Fichtl
Organization	LignoCarbon Schweiz AG
Interview Date	9th of November at 3pm
Location	Online
Length	30 minutes
Interview history	1st interview

1. In general, how did the interview go?

The interview with Harald Ficht, while offering some insights, was somewhat challenging in terms of depth and detail. The conversation touched upon various practical applications of biochar and the challenges in its adoption, providing a glimpse into the complexities of biochar use in different industries. However, the discussion often skimmed the surface of topics without delving deeply into them. This approach made it harder to extract thorough insights, particularly in understanding the full scope of market potential and industry-specific hurdles.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Market Sensitivity:** Highlighted the price sensitivity of farmers, and on the clear divide in the market's stance: there's a lax attitude towards fertilisers, even though their negative impact are well known, in contrast with the tough approach towards biochar. This discrepancy points to a significant market barrier for biochar. The numerous tests and validations required for biochar, as opposed to the more relaxed standards for traditional fertilisers, underscore a challenging market dynamic.
- **Applications in Industries:** Noted the innovative uses of biochar in animal feedstock and the concrete and insulation industries.
- **Properties of Biochar:** Emphasised biochar's properties like being sponge-like and electrically conductive, making it valuable in the insulation industry.
- **Market and Political Hurdles:** Pointed out that the biochar sector faces not only difficulties in effectively marketing its benefits but also contends with political barriers. These hurdles are partly due to the strong lobbying efforts of the well-established fertiliser industry, which can sway policies and regulations in its favor, making it harder for biochar to gain a foothold in the market.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

Questions about how to effectively counter the influence of the established fertiliser industry, or detailed discussions on potential subsidies and incentives for biochar adoption, were only superficially touched upon. It seemed that Harald Ficht either chose to avoid these more intricate topics or perhaps was not prepared to discuss them in detail.

As a result, while the interview provided a general overview of biochar's applications and challenges, it left key aspects related to strategic market penetration and overcoming political and lobbying challenges largely unexplored.

4. What themes were discussed in the most depth?

The most in-depth discussions were around the potential applications of biochar beyond traditional agriculture, particularly in the concrete and insulation industries.

5. What were the most significant or interesting discussions within the interview?

The discussion about the potential of biochar to significantly impact the concrete and insulation industries was especially noteworthy. He elaborated on the innovative concept that concrete could be made 100% carbon neutral through the incorporation of biochar. Additionally, he discussed biochar's potential in water treatment processes, indicating its versatility and the broadening scope of its applications. This part of the conversation was particularly enlightening, as it revealed both the existing and emerging uses of biochar.

Furthermore, Harald Ficht's insights were particularly revealing when he spoke about the challenges in marketing biochar effectively, due to the lack of innovative thinking among potential users. He emphasized that, although there is plenty of information highlighting the benefits of biochar, the difficulty lies in convincing traditional practitioners, such as farmers and industrial users, to adopt this innovative solution. The challenge, therefore, is not just about providing information, but also about finding creative ways to change established mindsets and practices. This highlights a key area in the biochar industry where innovative marketing strategies are crucial to overcome the reluctance of potential users to step away from their conventional methods and embrace new, sustainable technologies.

6. What were the least significant or interesting discussions within the interview?

The least significant or interesting discussions might have revolved around more generic or widely known aspects of biochar. For instance, basic explanations of biochar's properties or its general benefits. These areas, being more introductory in nature, did not provide the depth and specificity you were seeking in relation to the market challenges of biochar.

7. Any improvement needed on the script or fieldwork strategy?

Future interviews could benefit from a more targeted approach, particularly in exploring specific market strategies and regulatory challenges for biochar. It would be valuable to include questions that probe deeper into how biochar can overcome industry lobbying, such as the fertiliser industry's influence, and strategies to shift consumer mindset towards innovative solutions. Additionally, focusing on the intricacies of market entry, especially in non-agricultural sectors, could provide a more nuanced understanding of the opportunities and barriers biochar faces.

8. Final thoughts / comments?

The interview with Harald Ficht, though informative in some aspects, left certain areas less explored, particularly in terms of in-depth market strategies and overcoming political challenges. His insights into the marketing difficulties and the need for innovative thinking in promoting biochar were enlightening. However, the conversation could have benefitted from a deeper dive into specific strategies for market penetration and dealing with established political hurdles.

Appendix 9.4: Interview with IconCarbon

Interviewee's name	Sarah Hildebrandt
Organization	IconCarbon
Interview Date	16th of November at 9am
Location	Online
Length	1h15 minutes

Interview history	1st interview
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1. In general, how did the interview go?

The interview was informative and covered a range of topics related to the use and market for biochar. The conversation flowed well, revealing both the potential and challenges in the biochar industry.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Market Perception & Impact Measurement:** The perception of biochar as a beneficial product is undermined by the difficulty in quantifying its effects. The lack of clear and quantifiable impact data is a significant barrier to adoption, as consumers and businesses alike seek evidence of effectiveness before committing to purchase. The interview highlighted that more definitive data and faster observable results could lead to increased market acceptance.
- **Economic Viability:** Concerns were raised about the economic sustainability of biochar, with a predicted 5 to 10 years of growth pains due to underinvestment.
- **Economic Challenges and Carbon Credits:** The potential for carbon credits was discussed as a game-changer for the industry. A difference of as little as 0.04 euros per ton could mean the difference between break-even and profit, showing just how critical financial balance is for biochar producers.
- **Regulatory and Definition Challenges:** The phyrolysis process, central to biochar production, lacks a clear legal definition in Germany, placing market participants in a grey area and creating a challenging business environment. This uncertain regulatory landscape necessitates pioneering work in the field, with companies having to invest in research, often in hopes of gaining a first-mover advantage.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

Detailed discussions on international market comparisons and consumer behavior specifics were not covered, given that the company is dealing with immediate issues such as market awareness, regulatory hurdles, and the economic viability of biochar in their domestic market, discussions have naturally gravitated towards these pressing concerns.

4. What themes were discussed in the most depth?

- **Economic Sustainability:** The economics of biochar production and the tension between production costs and market prices were extensively discussed. Furthermore, the challenge posed by brokers demanding high commissions, ranging from 15-30%, which are unsustainable for producers. This high cost of intermediation was identified as a key factor limiting the sales potential of biochar producers, as it inflates the cost and reduce the competitiveness of biochar.
- **Seasonality and Market Strategies:** The seasonal nature of biochar, with peak demand in October and November, was explored, including potential strategies for overcoming this seasonality to achieve more consistent sales throughout the year.

5. What were the most significant or interesting discussions within the interview?

The most significant discussion revolved around the need for increased awareness and marketing efforts. Despite understanding the need for marketing, the discussion pointed out

that even significant investments, like 100,000 euros, might not yield the desired outcomes. This can be attributed to the market's focus on cost over quality. Retailers, who are pivotal in bringing products to consumers, often seek the lowest priced items to attract cost-sensitive customers. This preference for cheaper options makes it challenging for biochar producers to convince retailers to stock and promote a more expensive, albeit environmentally beneficial, product like biochar.

6. What were the least significant or interesting discussions within the interview?

The specific details of the company's operational constraints regarding the number of plants they can manage did not yield significant insights.

7. Any improvement needed on the script or fieldwork strategy?

Future interviews could benefit from a structured approach to exploring government policies and consumer education strategies to promote biochar.

8. Final thoughts / comments?

It's evident that while there is potential for biochar in the market, especially with the recent ban on brown coal in the steel industry, significant marketing and educational efforts are necessary to increase adoption and overcome current market challenges. Additionally, the biochar industry faces a multitude of challenges, from proving its worth to navigating unclear regulations and transforming seasonal demand into year-round sales. However, the potential for a first-mover advantage and the profound environmental benefits of biochar suggest that overcoming these obstacles could lead to significant rewards.

Appendix 9.5: Interview with Sonnenerde

Interviewee's name	Gerlach Dunst
Organization	Sonnenerde GmbH
Interview Date	22th of November at 1 pm
Location	Online
Length	30 minutes
Interview history	1st interview

1. In general, how did the interview go?

The interview with Gerlach was very informative. His extensive experience of 15 years in the industry has given them a firm grasp on producing high-quality biochar and navigating the market. Interestingly, they do not face significant challenges with sales and marketing, which provided a unique perspective. This aspect of the conversation was particularly enlightening, allowing us to understand the strategies that have contributed to their success. The interview was an excellent opportunity to learn from a company that excels in areas where many others face difficulties.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Production and Market Dominance:** They produce high quality biochar and are well-known in regional markets, catering to both small-scale and larger projects. Their competitive edge lies in their technical ability to activate plant charcoal, which is not a common practice in the industry.
- **Marketing Strategy:** Sonnenerde's marketing strategy is robust and multifaceted. They utilize direct marketing effectively, have a strong regional reputation, and engage with consumers through social media channels. This approach has led to a stable and loyal customer base, as evidenced by their 20% annual growth in the home gardening sector.
- **Feedback on MVP:** Gerlach appreciated the concept of the proposed platform but expressed concerns regarding the practical challenges of making it known and attracting customers, biochar end users. They stressed the importance of transparency, certifications, and detailed information about the production process to differentiate products.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

There were no indications of avoidance, all addressed topics within the scope of the interview were answered.

4. What themes were discussed in the most depth?

The conversation delved deeply into Sonnenerde's marketing strategies. They have carved a niche in the market through a combination of direct marketing and an influential social media presence. The company's direct marketing is informed by a comprehensive understanding of their customer base, which includes both regional popularity and outreach to new demographics through platforms such as YouTube. The collaboration with influencers like 'Klimajäger' is a testament to their innovative approach to expanding their reach.

5. What were the most significant or interesting discussions within the interview?

It was significant discussion to hear Gerlachs opinion about our MVP, whilst stressing the importance of transparency and certification in the biochar industry. Given that biochar products can vary widely in terms of quality and application, the interviewee stressed that clear, accessible information and proof of quality are crucial. They suggested that certifications, detailed descriptions of the production process, and explicit benefits could help in distinguishing high-quality products from lesser alternatives. Furthermore, it was suggested that an impact assessment could be generalized with basic information, but also recommended including specific criteria such as the degree of milling which could be a positive differentiating factor for customers looking for tailored solutions.

6. What were the least significant or interesting discussions within the interview?

Discussions about water savings from biochar in different climates and the impact on farms without irrigation systems were brief and not the main focus. Similarly, the specific benefits of biochar for acidic soils were mentioned but not delved into deeply. Our conversation was more focused on understanding Sonnenerde's success in marketing and their place in the industry to help validate our product-market fit.

7. Any improvement needed on the script or fieldwork strategy?

It would be beneficial to include more quantitative data or case studies to support the impact assessment. Additionally, exploring more targeted questions to understand the direct consumer feedback on their products might provide a deeper insight into the market dynamics.

8. Final thoughts / comments?

The interview provided valuable insights into Sonnenerde's operations and the biochar industry. The need for regulatory clarity and the potential of direct marketing and social media were recurrent themes. The challenge remains in how to effectively bring customers to a new platform and how to communicate the unique benefits of their product in a competitive market. Especially in the B2B market, where apparently everyone knows everyone, it will be important to break through the established network of relationships, our platform must not only showcase superior quality and service but also provide compelling reasons for businesses to venture beyond their familiar trading circles.

Appendix 9.6: Interview with Bioenergie Frauenfeld AG

Interviewee's name	Fabian Link
Organization	Bioenergie Frauenfeld AG
Interview Date	22th of November at 4pm
Location	Online
Length	1 hour
Interview history	1st interview

1. In general, how did the interview go?

The interview with Fabian was informative, focusing on the nuanced applications and market potential of biochar within different sectors. The conversation was specific and technical, which also elaborated the market around the CO2 certificates.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Use as a Carbon Sink:** The potential of biochar as a carbon sink or as a substitute for fossil fuels was discussed, although concerns about pollutant contamination were noted.
- **Pricing Strategies:** The price of biochar could be reduced through the use of carbon credits, though farmers want immediate results.
- **Wood as a Raw Material:** The technology for biochar works well with forest wood, but political issues have inflated the price.
- **Niche Market:** The main customers are niche, with the construction industry being a potential and bigger market for climate-neutral building materials.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

Fabian did not clearly answered the question about the intent to pay, only if we were able to generate them more sales they would see the value. Instead, the discussion pivoted to challenges such as investment costs, investor hesitancy due to awareness issues, and the scale of production in relation to industry demands.

4. What themes were discussed in the most depth?

The interview deeply explored the challenges faced in the industry, including the need for investment, market awareness, and the scalability of biochar production. The potential use of biochar in the construction industry and the role of carbon credits and certification in pricing strategies were also examined in detail.

5. What were the most significant or interesting discussions within the interview?

A considerable portion of the discussion focused on the role of carbon certificates in the biochar industry, which is going to be very significant for the industry. It was noted that leveraging carbon credits could potentially lower the price of biochar, making it a more attractive option for farmers and other end-users. The current pricing of CO2 was discussed, with carbon futures trading between 80 to 200 euros per ton, reflecting a significant cost that could be offset by carbon trading.

Furthermore, it was interesting to hear about the importance of certification of biochar, as it is a critical factor for market trust and acceptance. Certifications could assure potential buyers

of the product's quality and the authenticity of its carbon sequestration claims. This is particularly relevant when marketing to industries such as construction, where there is a growing interest in climate-neutral materials.

6. What were the least significant or interesting discussions within the interview?

There was an in-depth discussion about the financial hurdles within the industry, specifically the initial investment costs for setting up biochar production, which can be substantial. The hesitancy of investors, likely due to a lack of awareness about the benefits of biochar and its market potential, was highlighted as a significant barrier. The need for a clear and compelling value proposition was evident to attract investment and scale production to meet industry demands, particularly for large-scale applications such as in the construction industry. Nevertheless, this is not directly the information we have been trying to gather with the interviews.

7. Any improvement needed on the script or fieldwork strategy?

The interview could benefit from a more structured approach to discussing financial strategies, including the intent to pay.

8. Final thoughts / comments?

The growing importance of certifications and the strategic use of carbon credits to enhance market viability. As the industry matures, these elements seem pivotal for success.

Appendix 9.7: Interview with Ibero Massa Florestal

Interviewee's name	Ibero Massa Florestal
Organization	Sara Fernandes and Paulo Correia
Interview Date	23th of November at 11 am
Location	Onsite
Length	2 hours
Interview history	4th interview

1. In general, how did the interview go?

The on-site meeting gave us a deep understanding of the complex processes in the industry. By observing the machines in action, we gained insight into the extensive investments and challenges Imflorestal faces, from procurement and maintenance to production optimization. This first-hand experience gave us a tangible understanding of the intricacies of the industry and enriched our view of the inner workings of the biochar market and the key pain points encountered by those in the industry.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Product Diversification:** The introduction of various products, such as Microbiochar for animal nutrition and upcoming Nutrichar, indicates a strategy to diversify and expand the customer base.
- **Customer Spectrum:** A wide customer base including large farmers, wine producers, rice companies, small farmers, and private individuals, reflects diverse market penetration.
- **Municipal Opportunities:** Targeting municipalities to address water conservation issues with biochar, showcasing the company's innovative marketing approach.
- **Impact Measurement:** A need for a tool to measure biochar's impact accurately was identified, as current figures are based on assumptions.
- **Competitive Challenges:** New competitors for biomass and the increased cost of materials present significant challenges, alongside the issue of cost distribution to end consumers.
- **Regulatory Push:** Biochar's role as a carbon sink within European environmental projects highlighted its ecological significance. Also emphasizing on the importance of regulations promoting biochar, with the current market in Portugal valued at 8 million euros.
- **Seasonal Demand:** Biochar sales experience high seasonality, with peaks during May and June, affecting stock management.
- **Platform Feedback:** Positive reception of our platform paired with constructive feedback on the impact assessment tool, showcasing potential for collaboration.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

There were no answers avoided by the participants.

4. What themes were discussed in the most depth?

The discussion explored the strategic market positioning of Imflorestal's diverse biochar products. They are broadening their reach by developing innovative products like Microbiochar for animal nutrition, an alternative to antibiotics, and preparing to launch

Nutrichar. Yet as of now they have been surviving on the revenue generated from their product, Carvão Zero, which they sell mostly to restaurants. The customer base is varied, encompassing large-scale agricultural operations like Nutrifarms, prominent wine producers such as Sogrape, rice companies, and small-scale farmers. Private individuals, often purchasing 10-liter sacks, indicate the retail potential. Imflorestal's market strategy also targets municipalities with strategies to alleviate water expenses by using biochar in urban gardens, which could significantly reduce water consumption. However, they noted the need for a precise tool to quantify biochar's impact, as current estimates are not 100% reliable.

5. What were the most significant or interesting discussions within the interview?

Significant discussions centered on Imflorestal's customized pyrolysis containers tailored to their production needs, enabling the daily output of 50 to 70 tonnes of high-quality biochar with over 90% carbon content. The intensive process requires 2 to 2.5 tonnes of wood to produce approximately 450 kg of biochar over 10 to 12 hours. Challenges in securing biomass due to new competitors and the seasonal nature of biochar demand were also highlighted, alongside the company's positive response to our platform and potential partnership opportunities.

The detailed production insights from Imflorestal were crucial, as understanding the operational scale and economics of biochar production directly informs our assessment of a facility's capacity and potential market reach. This knowledge is significant in gauging their willingness to invest in a platform like ours, helping us estimate a value proposition that aligns with their production economics and sales potential.

6. What were the least significant or interesting discussions within the interview?

The exact design specifics of their pyrolysis containers were less critical for the platform's scope.

7. Any improvement needed on the script or fieldwork strategy?

To enhance our research approach, future fieldwork should incorporate a more targeted investigation into the economics. This includes delving into production costs, sales volumes, and the operational efficiencies of different producers. A better understanding of these economic factors will inform our platform's value proposition and pricing strategy to meet the needs of biochar facilities.

8. Final thoughts / comments?

Imflorestal's interest in a partnership and the positive feedback on the platform were encouraging, highlighting the importance of accurate impact assessment tools.



Carbon Bridge team in Avenal
with Sara Fernandes and Paulo
Correia



Pyrolysis
containers



Testing laboratory

Appendix 9.8: Interview with bionero

Interviewee's name	Aaron Saßmannshausen
Organization	bionero
Interview Date	23th of November at 2:30 am
Location	Online
Length	45 minutes
Interview history	1st interview

1. In general, how did the interview go?

The interview was productive, offering a comprehensive overview of biochar production and the market. It highlighted how a shift to cost-effective, low-tech methodologies and refined market tactics can bolster profitability. This deep dive into operational changes and strategic market positioning illuminated potential paths for biochar producers to enhance their financial outcomes.

2. In brief, what were the main findings for each theme discussed in the interview?

The transition to a low-tech production process emerged as a pivotal response to both legislative shifts and financial constraints. Initially utilizing horse manure under strict nutrient management regulations, the operation adapted by incorporating sawmill residuals to mitigate feedstock costs. The increasing market penetration of biochar, especially in urban horticulture, underscores its growing acceptance. Crucially, the integration of carbon credits has been identified as essential, not only as an environmental incentive but also as a cornerstone of financial sustainability in biochar enterprises. Furthermore, the trend in the B2B sector is growing. Larger companies are not only increasing their investments, but also revolutionizing their marketing strategies by crafting narratives that connect on an emotional level. This storytelling approach aims to create a deeper connection with the existential crisis of planetary health and position biochar not just as a product, but as a key player in the narrative of ecological salvation.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

All questions raised during the meeting were answered. However, the conversation developed organically, so that certain aspects, such as the impact assessment on the platform, were not discussed conclusively.

4. What themes were discussed in the most depth?

The in-depth themes covered the broad spectrum of biochar sales, highlighting the adaptability of product quantities tailored for various consumer needs, from the hobbyist requiring small quantities (small-scale 5-liter bags) to the professional gardener purchasing in bulk. Furthermore, we delved into the company's distribution strategy, where retail constitutes a substantial 85% of the turnover.

A significant shift in production strategy to a low-tech method was discussed, which notably enhances output efficiency from 25% to 40% compared to the traditional pyrolysis process. The company takes an autonomous approach to marketing their product. Additionally, as we try to understand how the current distribution demographics work, Aaron mentioned that bionero has a network of dealers and franchises managed through commercial agencies, are involved in the turnover, taking a 10% sales incentive.

5. What were the most significant or interesting discussions within the interview?

The most significant part of the discussion centered around our product. Aaron recognized the potential of the educational part and the importance of reinforcing this through academic research that underscores the issues that influence purchasing decisions. He emphasized the importance of building a community of stakeholders and expressed great interest in the market visibility of the product. Aaron's willingness to invest in a platform that increases this visibility led to a discussion about a potential partnership and emphasized the need for ongoing communication to explore this prospect.

6. What were the least significant or interesting discussions within the interview?

The least significant discussion for our platform was the company's observation regarding product packaging. They noted a trend where excessive advertising and overemphasis on benefits on the packaging could discourage purchases. However, as packaging design is outside the influence and decision-making power of our platform, this detail was considered interesting but less relevant to our objectives.

7. Any improvement needed on the script or fieldwork strategy?

For future interviews, it would be advantageous to implement a more structured approach, focusing on the sales strategies. This would enable us to gain a broader understanding of the margins and strategies employed by retailers and dealers. Such insights are crucial for defining our competitive edge in the market, particularly in terms of pricing and value proposition.

8. Final thoughts / comments?

The biochar market is at a turning point where awareness and acceptance are increasing, but it faces challenges in the areas of regulation, market education and competition. Aaron emphasis on storytelling, indicating a shift towards more emotional marketing strategies.

Appendix 9.9: Second interview with Arigna Fuels

Interviewee's name	Dr. Robert Johnson
Organization	Arigna Fuels
Interview Date	27th of November at 2pm
Location	Online
Length	30 minutes
Interview history	2nd interview

1. In general, how did the interview go?

On this second meeting with Robert we fully focused on the product validation. His feedback was very insightful, showing particular interest in the impact assessment and the simplicity of the product's application for farmers. The conversation also highlighted the potential for expanding the impact assessment tool into the dairy farm sector.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Product improvement:**
 - **Market expansion:** There is potential to expand into the dairy farming sector.
 - **Sustainability:** An annual carbon savings model was discussed as a value proposition.
 - **Sales model:** A pay-per-sale approach, driving direct traffic to the company's website, was considered effective.
 - **Customer targeting:** There are opportunities for B2B sales, focusing on Scope 3 emissions for dairy producers and Scope 1 for farmers.
 - **Education:** The need for a FAQ to address certification, soil health, and fertilizer use was identified.
 - **Product information:** The importance of a specification sheet detailing various types of biochar was emphasized.

Arigna Fuels only has direct sales.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

When inquired about the intent to pay, more specifically the amount Arigna Fuels would be willing to pay for such a product, the response was not clear and the question was deflected towards a discussion about wholesale customer strategies and volume discounts. This area might require a more direct approach or a follow-up for clarification.

4. What themes were discussed in the most depth?

The themes discussed in the most depth included product differentiation, the annual carbon savings model, and the development of a FAQ to communicate the benefits and safety of the product.

5. What were the most significant or interesting discussions within the interview?

It was significant to see Roberts' strong interest in the way your product differentiates itself in the market. He emphasized that our product serving as a hub will play a central role in driving knowledge with the potential of converting potential biochar users into customers through our 3 pillars. Furthermore, the simplicity and utility of the impact assessment tool offered by our product was particularly appreciated, as he described it as farmer-friendly and

a facilitator to measurement of the potential impact that could be created through the application of biochar.

Additionally it was interesting, to have his point of view on the scalability and versatility of the impact assessment, as he recognized that it could be easily adapted for dairy farming, with the understanding that fertilizer use would still be necessary.

He suggested to change a few parameters into annual use/savings. As of for our sales, Robert seemed to find the pay-per-sale approach intriguing, particularly the idea that large volume sales would not receive the same percentage discount as smaller sales, was an interesting part of the conversation. This indicates a recognition of the complexities involved in pricing strategies and the need to balance volume with profitability.

Furthermore, there was a clear interest in the specification sheet for different types of biochar that your product offers. The desire for detailed information on the product's use and its applications signifies the importance of transparency and information in the purchasing process.

On a last note, we discussed Arigna Fuels desire to have more sales in Europe and how this could be achieved, as the transportation and other factors from Ireland can be seen as a challenge.

6. What were the least significant or interesting discussions within the interview?

All discussed themes in this call were very significant, towards the development of our project.

7. Any improvement needed on the script or fieldwork strategy?

It could have been beneficial to have a deeper exploration into customer acquisition strategies and a more detailed understanding of the challenges faced by Arigna Fuels in market expansion.

8. Final thoughts / comments?

Further interviews might focus on the execution of the sales strategy and customer feedback post-implementation.

Appendix 9.10: Interview with Skånefrö AB

Interviewee's name	Claes-Göran Henriksson
Organization	Skånefrö AB
Interview Date	28th of November at 2pm
Location	Online
Length	50 minutes
Interview history	1st interview

1. In general, how did the interview go?

The interview was productive, with Claes providing comprehensive insights into the biochar industry in Sweden. Claes also shared the company's journey, from its inception and exploratory phase conducting field trials to becoming a mature player in the market with a decade of experience. The discussion was enlightening, revealing the company's strategic decisions, such as targeting the green space sector over agriculture due to cost-effectiveness and the potential longevity of biochar in soil. The conversation was marked by an exchange of practical insights and forward-looking thoughts on the biochar industry's trajectory.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Biochar production techniques and challenges:** Claes outlined that his company is venturing into biochar production utilizing sewage sludge residues, a method that presents unique challenges, particularly in removing or managing heavy metals. This is a sophisticated area of biochar production that requires stringent quality control and understanding of environmental regulations
- **Advocacy for localized production:** Claes stressed the importance of producing biochar as close to the source of biomass as possible. By producing locally, the company aims to reduce transport and associated environmental costs. He shared that their approach includes operating dual facilities that produce heating and biochar, demonstrating a commitment to creating environmentally and economically efficient production systems.
- **Feedback on our MVP:** There was an overall recognition on the importance of tailoring biochar to crop types and soil variations, suggesting our impact assessment platform include a range of biochars and a comparative scale for user guidance. He also affirmed the value of our community feature, where showcasing diverse biochar types can enrich user interactions and informed decision-making.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

There were no indications of avoided questions.

4. What themes were discussed in the most depth?

The discussions deeply engaged on the subject of biochar's adaptability to different soil types, emphasizing the necessity for a product range that caters to this diversity, from sandy to clay soils. Which in his opinion would be beneficial for us to mention in our platform, as he delved into our platform's community engagement aspect, advocating for the showcasing of a variety of biochar qualities to bolster user education and facilitate a richer exchange of knowledge and experiences within the community.

5. What were the most significant or interesting discussions within the interview?

The discussions with most significance for our dissertation were the ones focused on our MVP. He emphasized for our impact assessment that while pH levels in biochar are not a primary concern, the type of crops it will be used with is crucial. Claes suggested that our product could see varying results based on soil type, with light soils showing more pronounced effects. Furthermore, he advised that our product offering should include a range of biochars suitable for different soil types, from clay to sandy soils, and we should consider providing a comparative scale for customers. Nevertheless, recognizing the inherent value of the impact assessment, even at with standardized data - average performance level, as it enable users to make more informed decisions based on their specific soil conditions and to better understand the potential return on investment in biochar.

6. What were the least significant or interesting discussions within the interview?

The least significant discussions may have been regarding their current non-participation in the carbon credits market due to contractual obligations, which limits the scope of their revenue streams.

7. Any improvement needed on the script or fieldwork strategy?

Claes suggested including a wider range of biochar production methods on the website, beyond pyrolysis. Additionally, he recommended focusing on environmental benefits and potential government grants rather than direct monetization through website features.

8. Final thoughts / comments?

Claes expressed an interest in the community-level impact and visibility on our website but was skeptical about the effectiveness of paying for such displayment. He emphasized that the information provided should focus on environmental benefits and societal value.

Appendix 9.11: Interview with Stiesdal

Interviewee's name	Morten Heick
Organization	Stiesdal
Interview Date	1st of December at 1pm
Location	Online
Length	45 minutes
Interview history	1st interview

1. In general, how did the interview go?

The interview was insightful and focused heavily on the future of biochar in Denmark. Morten Stiesdal provided valuable predictions and opinions on the market, as well as the practical use of biochar in agriculture as a means of carbon sequestration.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Biochar production and market:** Denmark currently produces 15,000 tons of biochar and predicts a significant increase to 100,000 tons next year. However, there are concerns about the market's capacity to absorb this increase. By 2030, the forecast suggests 2 million tons, potentially leading to paying people to offset it.
- **EU regulations and revenue models:** About 95% of the smaller biochar production facilities will most likely not be able to fulfill EU requirements in the future, due to the quality of the biochar. Smaller plants could monetize through energy and bio-oil production, which funds the process, alongside carbon removal certificates.
- **Biochar effects on soil:** Studies in Denmark are in early stages, but so far, biochar is not shown to harm soil and consistently increases its carbon content.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

There were no answers avoided by the participant.

4. What themes were discussed in the most depth?

The themes discussed in more depth, reflected the complexity of establishing biochar as a sustainable and economically viable carbon sequestration solution. The discussion highlighted both the potential and the challenges of integrating biochar into the circular economy, its role in the agricultural sector, and the importance of regulatory compliance and market readiness.

5. What were the most significant or interesting discussions within the interview?

It was very interesting talking about the specifics of current biochar market dynamics, as they are likely to change rapidly given the predicted market growth and regulatory developments, keeping up with them is a big challenge for all biochar producer.

Furthermore, he mentioned the importance of conducting awareness campaigns that educate stakeholders about the benefits of permanent carbon removal. Morten himself is involved in similar initiatives, which underscores the significance of these efforts. He emphasized that by raising awareness, the value proposition of biochar can be clearly communicated to farmers and landowners, which is crucial for market adoption.

As we were guiding him through out MVP he highlighted the potential for an impact assessment , yet one which would be more focused on biomass. This would involve educating farmers about the additional revenue potential from their land—not just from the crops they grow but also from the biomass that can be converted into biochar. By making them aware of this potential, they could be incentivized to supply biomass for biochar production. As biomass will be traded in the future at 40-50€ per ton. Wood which is the most used input for biochar production is already rising in price.

6. What were the least significant or interesting discussions within the interview?

Although still quite interesting, yet for the scope/direction of our dissertation not so relevant, the discussion extended to the sourcing of biomass for biochar production. Morten shared insights on the competition in the biomass market, the importance of utilizing real waste biomass, and the expected rise in biomass prices as demand increases. This led to a broader discussion about the sustainability of biomass sourcing and the need to balance biochar production with ecological considerations, such as avoiding the cutting of trees for biomass.

7. Any improvement needed on the script or fieldwork strategy?

A more focused approach on the economic viability and the environmental impact assessment of biochar could be beneficial. It would also help to explore the role of carbon certificates in more depth.

8. Final thoughts / comments?

Morten suggests a promising, yet rather challenging future for biochar, emphasizing the importance of understanding its role in carbon sequestration and the circular economy. Awareness campaigns and impact assessments could be pivotal in realizing the potential of biochar in Denmark's agricultural sector.

Appendix 9.12: Interview with Glanris

Interviewee's name	Bryan M. Eagle III
Organization	Glanris
Interview Date	6th of November at 4:15 pm
Location	Online
Length	40 minutes
Interview history	1st interview

1. In general, how did the interview go?

Bryan provided comprehensive insights into the biochar market in the U.S., discussing the challenges of scaling up, market immaturity, and the importance of diversification and specialization in biochar applications. He also shared valuable perspectives on Glanris' approach to producing high-quality biochar and their focus on wholesale markets for significant environmental impact.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Market challenges and scaling:** Biochar production in the U.S. has historically been on a small scale with no quality control, and scaling up requires significant capital and overcoming price point challenges.
- **Financing and market support:** For biochar plants to be feasible, diversification, electricity generation, and carbon credits are essential. Market immaturity and the need for off-take agreements are key hurdles in securing funding.
- **Market positioning:** While small-scale producers focus on retail, Glanris concentrates on wholesale, targeting significant carbon sequestration impact. They aim to replace activated carbon in water and air filtration, a mature market.
- **Pricing and market acceptance:** Achieving price parity with non-green materials is critical for scaling. Regulatory changes and market forces are gradually pushing customers towards greener alternatives.
- **Feedback on our platform:** They see potential in being listed on platforms like ours but emphasize their focus on the B2B segment. The idea of paying for listings and commissions was discussed, with considerations about the tracking of sales.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

Bryan addressed all topics within the scope of the interview.

4. What themes were discussed in the most depth?

In the interview, Bryan delved deeper into the financial and operational challenges of entering and succeeding in the biochar market. A key theme was the necessity of achieving price parity with non-green materials, which Bryan emphasized as critical for the successful scaling of biochar. He elaborated on how regulatory changes and evolving market forces are gradually nudging customers toward greener alternatives, highlighting the importance of aligning biochar pricing with traditional, non-sustainable materials. Furthermore, Bryan commented on our product, particularly on the aspect of impact assessment tools. He noted that while there are many such tools available at a high level, the challenge lies in the varying effects they have on different entities, due to the diverse primary and secondary habits that influence an individual's carbon footprint. He pointed out that most individuals are not

concerned with the granularity of these assessments, suggesting that an average approach might suffice, except for a few significant factors that greatly impact the carbon footprint. This insight into the user engagement with impact assessment tools highlights an area for potential focus in our product development, ensuring that we cater to the needs and preferences of our target audience effectively.

5. What were the most significant or interesting discussions within the interview?

One of the most interesting discussions with Bryan evolved around his suggestion about expanding our product range in order to be feasible, he pointed to the opportunity to help SMEs meet ESG requirements, similar to large players such as Deloitte, and recommended focusing on specific vertical markets, such as cement manufacturers, to effectively target industries concerned about their carbon footprint. Furthermore, he discussed the practicalities and challenges of implementing a paid listing and commission model on our platform, emphasizing the need for effective sales tracking in this revenue strategy.

6. What were the least significant or interesting discussions within the interview?

The discussions on how biomass changes the physical and chemical properties of biochar and the resulting applications were comparatively less interesting. While this topic is essential to understanding biochar production, it is one that we have encountered frequently in our research and in previous dialogs. Consequently, it offered no new insights or remarkable fascination.

7. Any improvement needed on the script or fieldwork strategy?

To refine our interview approach, we could improve the way we conduct our interviews to avoid repeating topics we have already been covered in other interviews, such as the effects of biomass on the physical and chemical properties of biochar. It could be beneficial to design our script to delve into less explored areas to ensure that each interview brings new insights and adds significant value to our research.

8. Final thoughts / comments?

Bryans' perspective on the critical role of price parity and the shift towards greener alternatives provided actionable insights for the role of our platform in the B2B sector. His suggestions on supporting SMEs with ESG requirements and focusing on specific industries such as cement manufacturing were particularly thought-provoking and will inform our strategic direction. The interview confirmed the need to further develop our fieldwork to gain new insights and highlighted the potential impact of our platform on the development of the biochar market.

Appendix 9.13: Interview with Nordvästra Skånes Renhållnings AB (NSR)

Interviewee's name	Eva Stal
Organization	Nordvästra Skånes Renhållnings AB (NSR)
Interview Date	7th of December at 8:30 am
Location	Online
Length	55 minutes
Interview history	1st interview

1. In general, how did the interview go?

The interview with Eva offered critical insights into the biochar industry, highlighting NSR's innovative approach to organic waste treatment via a medium-sized facility leveraging advanced electrical screw technology for production and energy self-sufficiency. This interview provides a blueprint for potential replication and adaptation of biochar initiatives in other contexts, like Portugal, and emphasizes the necessity for expertise in the field to advance the industry.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Investment in biochar technology:** NSR has demonstrated a strong commitment to biochar by investing in a facility that not only processes organic waste but also contributes to energy creation, with a significant portion of the output being energy (two-thirds) and the remainder as biochar (one-third). This suggests an integrated approach where waste management and energy production are mutually reinforcing.
- **Regulatory and funding landscape:** The new regulations regarding organic waste treatment have been a driving force for NSR, mandating a shift towards the production of biochar gas or biochar. Additionally, the potential for financial support from initiatives like the Bloomberg Philanthropies highlights the importance of aligning with funding opportunities and government grants to further biochar projects.
- **Community engagement and networking:** NSR's proactive steps in creating an awareness website and their involvement in educational workshops underscore the need for public engagement and information dissemination. This aligns with their larger effort to form a network for biochar in Sweden, which is supported by a three-year government project, indicating that there is a recognized need for a collective platform for knowledge and resource sharing.
- **Anticipated EU policy decisions:** The upcoming EU decisions on carbon sink policies by 2024 could have significant implications for the biochar industry. With biochar 'just on the edge' of policy considerations, entities like NSR are closely monitoring these developments to position themselves advantageously within the regulatory framework.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

The interview was really insightful, yet as the conversation flowed, due to time constraints we didn't have the chance to show our MVP. This would have been a very important part, to showcase its potential utility and gather valuable insights on enhancing its design for scalability. Demonstrating our MVP could have spurred discussions around collaborative workshops, similar to those NSR is pioneering in Sweden, which aim to educate and engage the community in biochar applications. Moreover, it would have been beneficial to explore parallels and opportunities for synergy within the network NSR is cultivating in Sweden—a network we aspire to emulate and eventually expand upon, starting in Germany with

ambitions to broaden across Europe. Such a conversation might have opened avenues for cross-collaboration, shared best practices, and perhaps even a joint effort in advocacy and educational outreach, which are critical in fostering a robust biochar industry.

4. What themes were discussed in the most depth?

The most in-depth discussions centered around NSR's efforts to foster a comprehensive understanding and adoption of biochar through the introduction of interactive workshops in Sweden. These workshops are a strategic part of their initiative to create an extensive network across Sweden, aiming to engage stakeholders from various sectors, including waste management, energy, and agriculture. By sharing their experiences and strategies in trying to building this network, NSR provides a valuable model that we can adapt and apply in our efforts to promote biochar education and adoption beyond national borders.

5. What were the most significant or interesting discussions within the interview?

It was really interesting to hear about their establishment of a 'baby pilot pyrolysis' workshop, designed as an educational tool to raise public awareness of the biochar production process, was a prominent feature of the discussion. This innovative approach, combined with the strategic development of a dedicated Swedish biochar network, provides a compelling model for promoting community engagement and knowledge dissemination. In addition, Eva emphasized the significant support from Bloomberg Philanthropies, highlighting the importance of this kind of projects to keep pushing cities commitments to sustainability. Furthermore, Eva mentioned the Biochar Summit 2023 in Sweden, in which NSR played a significant role. Underscoring this events', as testament to the vibrant growth of the sector and the increasing recognition of biochar's potential at an international level.

6. What were the least significant or interesting discussions within the interview?

Every topic raised in the discussion was met with great interest and proved invaluable in expanding our understanding and knowledge in the context of our project.

7. Any improvement needed on the script or fieldwork strategy?

For future interviews with NSR, it would be beneficial to incorporate questions focused on their approaches in addressing challenges related to the adoption of biochar among farmers and their strategies for consumer education. Gaining insight into these areas could significantly enrich the depth and applicability of our research findings.

8. Final thoughts / comments?

Eva's contributions have been instrumental in understanding the complexities of biochar as an emerging sustainable technology. Her dual focus on technological innovation and community engagement through workshops and a dedicated biochar network aligns with the current environmental priorities. The interview highlighted the critical role of knowledge sharing, the importance of supportive regulations, and the potential of biochar in the context of European carbon sink policies. Furthermore, The interview underscores the growing awareness and acceptance of biochar, its viability, and the critical timing for such initiatives.

Appendix 9.14: Interview with *ProE Bioenergie*

Interviewee's name	Hans Sanzenbacher
Organization	<i>ProE Bioenergie</i>
Interview Date	7th of December at 10 am
Location	Online
Length	30 minutes
Interview history	1st interview

1. In general, how did the interview go?

Hans provided detailed insights into the challenges and market dynamics of biochar production and usage in Germany. Additionally, he provided valuable feedback on our product, specifically focusing on aspects of our pricing strategy.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Market and product placement:** Biochar is primarily marketed as grill charcoal due to straightforward sales dynamics. Other applications are still emerging and face various challenges.
- **Political and regulatory landscape:** Uncertainty in political support and a lack of clear policies are major impediments. There's recognition of biochar's potential as a CO₂ sink, but support mechanisms are not yet fully developed.
- **Cost and economic viability:** High production costs, especially raw material costs (e.g., wood), make profitability challenging. Producing high-quality biochar for agriculture requires expensive inputs, while cheaper alternatives like old wood pose contamination risks.
- **Feedback on our Product:** Hans appreciated the product and acknowledged a market need. However, he noted the challenge in attracting people unfamiliar with biochar to our website. He valued our narrative in appealing to businesses looking to reduce their carbon footprint.
- **Sales strategy and future market development:** He discussed the sales model, suggesting an initial base fee for marketing and awareness, plus a success-based commission. He anticipates the development of dealer structures in the future, which could impact costs and market dynamics.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

There were no indications of avoidance. Hans addressed all topics within the scope of the interview.

4. What themes were discussed in the most depth?

The main discussions centered around the challenges currently facing the biochar market, highlighting in particular the high cost of production and the lack of a developed retail infrastructure. Hans' insights into the need for political support and a clear regulatory framework to support the growth of the biochar industry were very insightful. Equally captivating was our conversation about our product, on which Hans provided critical feedback. He explored the suitability of our product within these market constraints and provided valuable perspectives on how our pricing and marketing strategies could be optimized in the context of these industry challenges. His feedback was crucial in

highlighting potential areas of improvement and opportunities for our product in the evolving biochar landscape.

5. What were the most significant or interesting discussions within the interview?

The most significant discussions evolved when Hans pointed out that, as of now, there is no established dealer structure in the German biochar market, but he anticipates its emergence in the future. This led to a discussion on the implications of such a shift, particularly in terms of cost factors. He highlighted a potential challenge where manufacturers demand high prices (average 800 euros per ton) in a market where there might be limited willingness to pay such amounts. This scenario raises questions about the feasibility of incorporating a dealer's fee into the pricing structure. These discussions provided a deeper understanding of the complexities involved in biochar marketing and distribution, which are critical for the development of effective sales strategies in the biochar industry.

6. What were the least significant or interesting discussions within the interview?

While all topics discussed held relevance, the conversation around the specifics of biomass as the input material for biochar production, particularly its cost implications, was somewhat less engaging compared to other topics. However, this discussion remains critical for understanding the economics of biochar production. Hans elaborated on the challenges of profitability due to high raw material costs – for example, the requirement of 5 tons of biomass (wet, damp wood) to produce 1 ton of biochar, making the process expensive. The quality of biochar needed for agricultural and feed purposes necessitates high-quality inputs, which further escalates costs. Additionally, the use of cheaper alternatives like old wood, which may contain heavy metals, poses contamination risks, limiting its applicability. The emerging market for using such biomass in the cement industry was noted, but the financial viability without substantial political support or subsidies remains a concern, as production costs (including energy, labor, etc.) can amount to 300-400 euros per ton. This aspect, though less captivating in the interview, is essential for understanding the broader economic landscape of the biochar market.

7. Any improvement needed on the script or fieldwork strategy?

The interview with Hans met our objectives exactly and provided the precise insights and detailed understanding we were looking for in this meeting.

8. Final thoughts / comments?

Overall, the interview was crucial in shaping our approach to navigating the complex biochar market landscape. The feedback on our product highlighted the need for a strategic approach to marketing and customer education in this evolving market. Hans' perspective on the potential development of a dealer structure and the current direct-to-consumer sales model offered a forward-looking view essential for our market strategy.

Appendix 9.15: Interview with Kelvin Lockwood

Interviewee's name	Kelvin Lockwood
Organization	-
Interview Date	1st of November at 2pm
Location	Online
Length	1 hour
Interview history	1st interview

1. In general, how did the interview go?

The interview with Kelvin flowed well and was highly focused on the practical aspects of establishing a sustainable sports field. Kelvin demonstrated a strong community spirit and a keen interest in ecotourism and reforestation, with a practical approach to the immediate needs and resources for the project. The information provided is extremely useful for understanding the biochar user's perspective.

2. In brief, what were the main findings for each theme discussed in the interview?

- **Relevancy of funds:** From his previous experience, he got awarded funding in the UK for field development and materials needed for sustainability. He emphasized how funding is pivotal in this kind of projects, as it enables the initial phase of construction and indicates trust in the project's potential for success and sustainability
- **Community:** The importance of community involvement in the project.
- **Lack of awareness:** Kelvin acknowledges a gap in his knowledge regarding biochar, but he has a deep interest and commitment in soil restoration.
- **His vision:** Consideration of ecotourism and the potential for adding two cricket fields as part of reforestation efforts.

3. Were there any themes or questions which were not answered /not asked / avoided by participant? Why?

There were no answers avoided by the participant.

4. What themes were discussed in the most depth?

In our discussions we delved in more depth to his commitment to restoring degraded soil, yet there is a lack of awareness, specifically when it comes to the diversity of soil quality and which biochar application would be the most suitable. This suggests that while biochar is on his radar as a potential tool for soil enhancement, there is room for education and exploration of how biochar could be integrated into his project to improve soil health, potentially enhancing the sustainability of the cricket fields.

5. What were the most significant or interesting discussions within the interview?

It was very interesting to hear that Kelvin's project extends beyond the creation of a cricket field. The initiative aims to develop two cricket fields within a 20 to 30-hectare land area, dedicating 4 hectares specifically for sports, while enhancing regional biodiversity, complementing broader reforestation work and promoting eco-friendly tourism, creating a destination that attracts visitors and supports the local economy. Kelvin's dedication to fostering a strong community connection, as he endeavors to build a community-centric project were very evident and touched upon the challenges of community engagement. Additionally, it was clear from our conversations that Kelvin prioritizes water saving as a key

measure of the project's viability, which not only reflects the environmental realities of the region, but also serves as a valuable indicator of the priorities and concerns of end users and underscores its deep commitment to sustainability.

6. What were the least significant or interesting discussions within the interview?

Throughout the conversation with Kelvin, every topic discussed was relevant and contributed to our understanding of the project, so there was no discussion that could be described as insignificant or uninteresting.

7. Any improvement needed on the script or fieldwork strategy?

Future interviews could benefit from a more structured approach to understanding the role of biochar in similar projects, including identifying local contacts who could provide practical insights.

8. Final thoughts / comments?

The interview with Kelvin offered a beneficial perspective on the potential user's viewpoint regarding biochar, providing an initial understanding of what users might look for in such resource. However, to gain a comprehensive insight and to validate our findings, it's clear that we need to engage with a broader range of individuals and stakeholders. This will help us to gather more diverse opinions and information, enabling us to form a well-rounded view of the biochar market from the user's perspective. It would have been beneficial to have had an MVP at this meeting, in order to have demonstrated our platform and take some information how end users would engage with our solution.

Appendix 10: Letters of Intent

Appendix 10.1: bionero LoI



Letter of Intent (Declaration of Intent)

between
bionero GmbH, Industriestraße 9, 95349 Thurnau, Germany
____ (company name) (hereinafter "Client") company address,
company zip code company city, company country represented by the
____ (position title) _____ (name of signatory)
and

Carbon Bridge (hereinafter "Marketplace"), Nova School of Business and Economics
in Carcavelos, Portugal represented by the co-founder Sara Siebels

the following agreement is made.

The agreement reflects the understanding reached between the client and the marketplace (hereinafter jointly "Parties") about the use of the Carbon Bridge biochar marketplace platform offered as follows:

1. Description

In the course of the discovery process carried out by the Client for the development of a new revenue stream for their biochar product, the Carbon Bridge platform offered by the Contractor was evaluated as a suitable marketplace solution.

As a result of the previous discussions on the project framework, there is now a draft contract that has been agreed on by both Parties which needs to be adjusted.

Both Parties agree that the planned and discussed introduction of the Carbon Bridge platform for the Client can take place on this basis.

As long as the final contract and the clarification of the outstanding points are pending, this Declaration of Intent forms the common basis for further cooperation. The following area is currently still under review:

- Completion of the platform from MVP to working product.
- Further negotiations of how the client could post products on the marketplace

2. Confidentiality

The Parties agree to keep the content of this Declaration of Intent secret from external third Parties of whom we are not aware of. Neither Party shall be authorized to issue any press or other public notice relating to the transaction described in this Letter of Intent

Page1 from 2



unless the form and content of the notice is previously approved by the other Party unless such Party is required to do so by law and has coordinated with the other Parties regarding the disclosure. In particular, the Parties undertake never to disclose to any third Party the price of the transaction described in this Letter of Intent, unless required by law.

Otherwise, the provisions of the confidentiality agreement concluded between the contracting Parties shall apply after _____ (date) and continued.

3. Effective Date and Duration of the Memorandum of Understanding

- a. This Declaration of Intent comes into force when signed by both Parties and ends automatically with the conclusion of a main contract between the Parties.
- b. The Parties can terminate the contract agreement at any time without giving reasons. If a Party does not wish to continue the negotiations, it will inform all other Parties in writing.

4. Miscellaneous

- a. This Declaration of Intent is not legally binding.
- b. Changes and additions to this Declaration of Intent must be made in writing to be valid.
- c. Each Party bears the costs of legal or tax advice.

Thurnau, 18.12.2023

(company city, date)

bionera GmbH

(company name)


Aaron Sabmannshausen
name of signatory, position title

Aaron Sabmannshausen, CEO

Lisbon, 11.12.2023

Carbon Bridge

Siebel

Sara Siebels, co-founder

Appendix 10.2: Ibero Massa Florestal LoI



Letter of Intent (Declaration of Intent)

between

Ibero Massa Florestal, S.A. (hereinafter "Client") in Rua Manuel Oliveira Borges, nº75, 3720-584 Avenal, UL-Oliveira de Azeméis, Portugal, represented by the general manager Paulo Correia

and

Carbon Bridge (hereinafter "Marketplace"), Nova School of Business and Economics in Carcavelos, Portugal represented by the co-founder Sara Siebels

the following agreement is made.

The agreement reflects the understanding reached between the client and the marketplace (hereinafter jointly "Parties") about the use of the Carbon Bridge biochar marketplace platform offered as follows:

1. Description

In the course of the discovery process carried out by the Client for the development of a new revenue stream for their biochar product, the Carbon Bridge platform offered by the Contractor was evaluated as a suitable marketplace solution.

As a result of the previous discussions on the project framework, there is now a draft contract that has been agreed on by both Parties which needs to be adjusted.

Both Parties agree that the planned and discussed introduction of the Carbon Bridge platform for the Client can take place on this basis.

As long as the final contract and the clarification of the outstanding points are pending, this Declaration of Intent forms the common basis for further cooperation. The following area is currently still under review:

- Completion of the platform from MVP to working product.
- Further negotiations of how the client could post products on the marketplace

2. Confidentiality

The Parties agree to keep the content of this Declaration of Intent secret from external third Parties of whom we are not aware of. Neither Party shall be authorized to issue any



press or other public notice relating to the transaction described in this Letter of Intent unless the form and content of the notice is previously approved by the other Party unless such Party is required to do so by law and has coordinated with the other Parties regarding the disclosure. In particular, the Parties undertake never to disclose to any third Party the price of the transaction described in this Letter of Intent, unless required by law.

Otherwise, the provisions of the confidentiality agreement concluded between the contracting Parties shall apply after 13/12/2023 and continued.

3. Effective Date and Duration of the Memorandum of Understanding

- a. This Declaration of Intent comes into force when signed by both Parties and ends automatically with the conclusion of a main contract between the Parties.
- b. The Parties can terminate the contract agreement at any time without giving reasons. If a Party does not wish to continue the negotiations, it will inform all other Parties in writing.

4. Miscellaneous

- a. This Declaration of Intent is not legally binding.
- b. Changes and additions to this Declaration of Intent must be made in writing to be valid.
- c. Each Party bears the costs of legal or tax advice.

Oliveira de Azeméis, 13.12.2023

Ibero Massa Florestal, S.A.

A handwritten signature in black ink, appearing to be "Paulo Correia", written over a horizontal line.

Paulo Correia, General manager

Lisbon, 11.12.2023

Carbon Bridge

A handwritten signature in black ink, appearing to be "Sara Siebels", written over a horizontal line.

Sara Siebels, co-founder

Appendix 10.3: LignoCarbon LoI



Letter of Intent (Declaration of Intent)

LIGNOCARBON between
SCHWEIZ AG (company name) (hereinafter "Client") company address,
company zip code company city, company country represented by the
MANAGING DIRECTOR (position title) HARALD FICHTZ (name of signatory)
and

Carbon Bridge (hereinafter "Marketplace"), Nova School of Business and Economics
in Carcavelos, Portugal represented by the co-founder Sara Siebels

the following agreement is made.

The agreement reflects the understanding reached between the client and the marketplace (hereinafter jointly "Parties") about the use of the Carbon Bridge biochar marketplace platform offered as follows:

1. Description

In the course of the discovery process carried out by the Client for the development of a new revenue stream for their biochar product, the Carbon Bridge platform offered by the Contractor was evaluated as a suitable marketplace solution.

As a result of the previous discussions on the project framework, there is now a draft contract that has been agreed on by both Parties which needs to be adjusted.

Both Parties agree that the planned and discussed introduction of the Carbon Bridge platform for the Client can take place on this basis.

As long as the final contract and the clarification of the outstanding points are pending, this Declaration of Intent forms the common basis for further cooperation. The following area is currently still under review:

- Completion of the platform from MVP to working product.
- Further negotiations of how the client could post products on the marketplace

2. Confidentiality

The Parties agree to keep the content of this Declaration of Intent secret from external third Parties of whom we are not aware of. Neither Party shall be authorized to issue any press or other public notice relating to the transaction described in this Letter of Intent



unless the form and content of the notice is previously approved by the other Party unless such Party is required to do so by law and has coordinated with the other Parties regarding the disclosure. In particular, the Parties undertake never to disclose to any third Party the price of the transaction described in this Letter of Intent, unless required by law.

Otherwise, the provisions of the confidentiality agreement concluded between the contracting Parties shall apply after Dec. 18, 2023 (date) and continued.

3. Effective Date and Duration of the Memorandum of Understanding

- a. This Declaration of Intent comes into force when signed by both Parties and ends automatically with the conclusion of a main contract between the Parties.
- b. The Parties can terminate the contract agreement at any time without giving reasons. If a Party does not wish to continue the negotiations, it will inform all other Parties in writing.

4. Miscellaneous

- a. This Declaration of Intent is not legally binding.
- b. Changes and additions to this Declaration of Intent must be made in writing to be valid.
- c. Each Party bears the costs of legal or tax advice.

Lisbon 18.12.23

(company city, date)

LIGNOCARBON SCHWEIZ AG

(company name)

Lisbon, 11.12.2023

Carbon Bridge

name of signatory, position title

Managing Director
H. FICHTEL

Sara Siebels, co-founder

Appendix 10.4: Varem Energie LoI



Katharina Brunner
Biesenkampstraße 5
58285 Gevelsberg

Sebastian Immervoll
Sara Serra Siebels

Letter of Intent (Declaration of Intent)

between

VAREM Energie GmbH (hereinafter "VAREM Energie"),
Bischof Krautbauer-Str. 2; D-92436 Bruck – Germany,
represented by the CEO Stefan T. Sziwek

and

Katharina Brunner (Biesenkampstraße 5, D-58285 Gevelsberg), Sara Serra Siebels, and
Sebastian Immervoll (hereinafter referred to "Marketplace")

the following agreement is made.

The agreement reflects the understanding reached between the client and the marketplace (hereinafter jointly "Parties") about the use of the Carbon Bridge biochar marketplace platform offered as follows:

1. Preamble

Varem Energie is a company, which develops projects to produce biomethane and HTC-biochar from waste in Germany. Carbon bridge is a cooperation of Katharina Brunner, Sara Serra Siebels and Sebastian Immervoll wants to create a market platform for biochar.

Both parties want to cooperate on the marketing and selling of HTC-biochar on different sales channels.

The more preferred market places are:



- Substitute for brown coal (example: cement production)
- "terra preta" – product for soil improvement
- Peat substitute
- CO₂ storage
- Reduction of nitrous oxide emissions

2. Description

In the course of the discovery process carried out by the Client for the development of a new revenue stream for their biochar product, the Carbon Bridge platform offered by the Contractor was evaluated as a suitable marketplace solution.

As a result of the previous discussions on the project framework, there is now a draft contract that has been agreed on by both Parties which needs to be adjusted.

Both Parties agree that the planned and discussed introduction of the Carbon Bridge platform for the Client can take place on this basis.

As long as the final contract and the clarification of the outstanding points are pending, this Declaration of Intent forms the common basis for further cooperation. The following area is currently still under review:

- Completion of the platform from MVP to working product.
- Further negotiations of how the client could post products on the marketplace

3. Confidentiality

The Parties agree to keep the content of this Declaration of Intent secret from external third Parties of whom we are not aware of. Neither Party shall be authorized to issue any press or other public notice relating to the transaction described in this Letter of Intent unless the form and content of the notice is previously approved by the other Party unless such Party is required to do so by law and has coordinated with the other Parties regarding the disclosure. In particular, the Parties undertake never to disclose to any third Party the price of the transaction described in this Letter of Intent, unless required by law.

Otherwise, the provisions of the confidentiality agreement concluded between the contracting Parties shall apply after _____ (date) and continued.

4. Effective Date and Duration of the Memorandum of Understanding

- a. This Declaration of Intent comes into force when signed by both Parties and ends automatically with the conclusion of a main contract between the Parties.
- b. The Parties can terminate the contract agreement at any time without giving reasons. If a Party does not wish to continue the negotiations, it will inform all other



Parties in writing.

5. Miscellaneous

- a. This Declaration of Intent is not legally binding.
- b. Changes and additions to this Declaration of Intent must be made in writing to be valid.
- c. Each Party bears the costs of legal or tax advice.



Bruck, 18.12.2023

VAREM Energie GmbH

A handwritten signature in blue ink, appearing to read "Stefan T. Sziwek".

Stefan T. Sziwek, CEO

Lisbon, 17.12.2023

Carbon Bridge

A handwritten signature in blue ink, appearing to read "Katharina Brunner".

Katharina Brunner, co-founder

Appendix 10.5: Bioenergie Frauenfeld AG LoI



Letter of Intent (Declaration of Intent)

between

Bioenergie Frauenfeld AG, Oberwiesenstr. 124, 8500 Frauenfeld, Schweiz
(company name) (hereinafter "Client") company address,
company zip code company city, company country represented by the
Product Manager (position title) Fabian Link (name of signatory)
and

Carbon Bridge (hereinafter "Marketplace"), Nova School of Business and Economics
in Carcavelos, Portugal represented by the co-founder Sara Siebels

the following agreement is made.

The agreement reflects the understanding reached between the client and the marketplace (hereinafter jointly "Parties") about the use of the Carbon Bridge biochar marketplace platform offered as follows:

1. Description

In the course of the discovery process carried out by the Client for the development of a new revenue stream for their biochar product, the Carbon Bridge platform offered by the Contractor was evaluated as a suitable marketplace solution.

As a result of the previous discussions on the project framework, there is now a draft contract that has been agreed on by both Parties which needs to be adjusted.

Both Parties agree that the planned and discussed introduction of the Carbon Bridge platform for the Client can take place on this basis.

As long as the final contract and the clarification of the outstanding points are pending, this Declaration of Intent forms the common basis for further cooperation. The following area is currently still under review:

- Completion of the platform from MVP to working product.
- Further negotiations of how the client could post products on the marketplace

2. Confidentiality

The Parties agree to keep the content of this Declaration of Intent secret from external third Parties of whom we are not aware of. Neither Party shall be authorized to issue any press or other public notice relating to the transaction described in this Letter of Intent



unless the form and content of the notice is previously approved by the other Party unless such Party is required to do so by law and has coordinated with the other Parties regarding the disclosure. In particular, the Parties undertake never to disclose to any third Party the price of the transaction described in this Letter of Intent, unless required by law.

Otherwise, the provisions of the confidentiality agreement concluded between the contracting Parties shall apply after _____ (date) and continued.

3. Effective Date and Duration of the Memorandum of Understanding

- a. This Declaration of Intent comes into force when signed by both Parties and ends automatically with the conclusion of a main contract between the Parties.
- b. The Parties can terminate the contract agreement at any time without giving reasons. If a Party does not wish to continue the negotiations, it will inform all other Parties in writing.

4. Miscellaneous

- a. This Declaration of Intent is not legally binding.
- b. Changes and additions to this Declaration of Intent must be made in writing to be valid.
- c. Each Party bears the costs of legal or tax advice.

Framfeld 11.12.23

(company city, date)

Bieseberg Framfeld AG

(company name)

Lisbon, 11.12.2023

Carbon Bridge

Robert Hanger

name of signatory, position title

Sara Siebels

Sara Siebels, co-founder

Appendix 11: Customers defining success

Answer 1:

Aaron Saßmannshausen <aaron.sassmannshausen@bionero.de>

Para: Sara Serra Siebels

Cc: Sebastian Immervoll; Katharina Brunner

seg, 18/12/2023 18:15

doc01105120231218191423....
371 KB

Liebe Sara,

entschuldige die Verzögerung, im Anhang der unterschriebene LOI.

Zu deinen Fragen:

1. Der für uns theoretisch messbare Erfolg gliedert sich gemäß unseren beiden Geschäftsfeldern (Verkauf Endprodukt; Verkauf CDR-Credits). Den Verkauf der Endprodukte würde ich an eine Umsatzsteigerung knüpfen. Die von uns erwartete Höhe dieser Umsatzsteigerung hängt natürlich maßgeblich an den von Euch aufgerufenen Kosten für die Präsenz auf Eurer Seite. Da wir momentan noch sehr schwache Online-Umsätze erzielen, könnte ich mir auf jeden Fall Steigerungen von 50-100% vorstellen, würde diese aber eben auch nur in Korrelation zu den für uns entstehenden Kosten erwarten.
Den CDR-Verkauf könnten wir nicht an eine Umsatzsteigerung knüpfen. Wir arbeiten hier in der Regel mit mehrjährigen Verträgen und einzelnen Großkunden und es sind ja auch nur gewisse Mengen verfügbar. Die Käufer informieren sich meist sehr umfassend zu den CDR-Lieferanten und zum Thema CDR generell. Hier wäre es dann also für uns von Vorteil, wenn wir, neben unserer eigenen Website, auch auf Euch verweisen könnten und entsprechender, aktueller Content rund um das Thema CDR zur Verfügung steht und wir objektiviert als gutes Beispiel geführt würden. Zur Einordnung für uns würden wir dann den potentiellen Kunden explizit zum Wert unserer Verbindung befragen.
2. Die Bewertung würde wie folgt aussehen:
Produkte: 1. Umsatzsteigerung? 2. Klickrate? 3. Verhältnis Klickrate/Käufe verbessert?
Wir würden uns also auf die Umsatzsteigerung fokussieren und nachgelagert bewerten, ob auch die Häufigkeit des Verkaufs nach Klick gestiegen ist. Erreichen wir bspw. eine Umsatzsteigerung, der Index *Verkauf nach Klick* sinkt aber, würden wir eine Verlängerung eher kritisch betrachten, weil wir davon ausgehen müssen, dass unsere Kommunikation weniger überzeugend ist, als vorher.
CDR: 1. Kundenfeedback? Initialanfragen?
Hier würden wir unsere Kunden befragen, ob der Link zu Euch zur Entscheidungsfindung beigetragen und Mehrwert geleistet hat.
Natürlich würde auch die Häufigkeit von zufälligen Anfragen nach CDR bei uns -ausgelöst durch Euch- zur Bewertung der Kooperation beitragen

Ich hoffe Dir geholfen zu haben – stehe aber auch morgen noch kurzfristig zur Verfügung. Wenn's schnell gehen muss, kannst Du auch gerne die Handynummer nehmen

Wünsche Euch viel Erfolg beim Abschluss Eurer Arbeit und schon mal eine schöne Weihnachtszeit

Viele Grüße
Aaron

Mit freundlichen Grüßen

Aaron Saßmannshausen
Geschäftsführender Gesellschafter



Answer 2:

Claes-Göran Henriksson <cgh@skanefro.se>

Para: Sara Serra Siebels

Cc: Sebastian Immervoll; Katharina Brunner

ter, 19/12/2023 09:29

Hello Sara,

Consider following.

Most of sales today (whatever it is) goes directly between manufacturing too customer.

Customers (private or society) look for information on the web.

Those who have the complete chain from production to sales and distribution directly to the customer are the winner.

Skånefrö are in this position today.

My advice is to do investigation among other producers around Europe to find out if valid for other parts except for the cold Nordic countries which we represent.

Above is one way to tackle the opportunity!

Another one is the way you are thinking of, going as a type of "middlemen" between manufacturing and consuming.

In this position it's necessary to know the circumstances in both mentioned areas. For the reason of being enough interesting and present adequate and updated information all the time.

My advice is to "catch" a representative customer type (maybe both private and society vice) for interviewing regarding your thoughts.

Have in mind that "the customer" always are in the centre.

See you next year.

I will return to work 2024-01-10.

Answer 3:

Eva Stål <Eva.Stal@nsr.se>
Para: Sara Serra Siebels

sex, 15/12/2023 10:25

Dear Sara,

I would like to support you with giving feedback.

I just think a "market place" such as your home page could be good for the 3 reasons(pilars) you mention.
There are so many aspects to consider but I would image a seller like NSR would measure success by for instance:

- How many requests we would get through the market place
- How much sales increases through customers that has used the market place
- How many projects that could come out of a common interest in developing biochar for different applications.

Best regards
Eva

Vänliga hälsningar,

Eva Stål
Projektleddare



Direkt: 042-4001395 Växel: 042-400 13 00
Besöksadress: Hjortshögsvägen 1, 254 68 Helsingborg
Postadress: NSR AB, 251 89 Helsingborg
www.nsr.se
f in

Answer 4:

Sarah Hildebrandt | icon-carbon.de <s.hildebrandt@icon-carbon.de>
Para: Sara Serra Siebels

sex, 15/12/2023 08:32

Guten Morgen Sara,

vielen Dank für deine Mails.

Bzgl. einer Absichtserklärung muss ich dir leider absagen. Anfragen für LOIs bekommen wir sehr häufig und intern haben wir an einem gewissen Punkt beschlossen LOIs nur zur Absicherung konkret anstehender Verträge zu unterschreiben.

So ganz habe ich es noch nicht verstanden, worauf euer neues Konzept abzielt. Handelsplattform, Infoseite, Makler-Tätigkeit...? Wo setzt ihr Euren Schwerpunkt?

Auf jeden Fall spannend 😊

Meine Erfolgsparameter zu deiner Fallbeschreibung sind vermutlich die ganz Klassischen. Im Endeffekt sollte sich eine Aktion/ ein Arbeitsaufwand max. nach 2 Jahren in der finanziellen Bilanzierung positiv bemerkbar machen. Wir kommen aus dem klassischen Rohstoffhandel, eine Steigerung der Market Visibility, Community Building sind wichtig, aber im Endeffekt muss gerade bei KMUs der Handel auch stattfinden, weshalb unser Umsatz im Endeffekt die einzige relevante Größe darstellt. Eine genaue Quantifizierung ist so aus dem „Nichts“, recht schwer zu beziffern. Wichtig ist das Käufer und Händler zusammenkommen und im Idealfall auf dem Weg dorthin neue Käufer durch Aufklärung generiert werden. Durch den zunehmenden Preisdruck auf die Produzenten verlangt der Markt nach einem Direkthandel. Gerade kleinere Produzenten versuchen Vermittlungsgebühren zu umgehen.

Zu deinen zwei Punkten; hier meine „Wunschliste“ die eine Aktion/Kampagne etc für ein Geschäftsjahr bringen sollte:

1. Umsatzsteigerung, Steigerung der Kaufabschlüsse >10%, Steigerung langfristiger Großabnahmeverträge → max. 2-3/Jahr, da man genügend Zeit zum Skalieren benötigt, Steigerung der Angebotsanfragen >15%, Steigerung von Kooperationsanfragen bzgl. Großprojekten → z.B. Stadtschwammprojekte, 2-3/Jahr
2. Monetäre Kosten-Nutzungsrechnung, siehe Punkt 1

Ich hoffe ich konnte Dir weiterhelfen!
Noch viel Erfolg bei deiner Arbeit!

Viele Grüße
Sarah

Appendix 12: Sonnenerde's YouTube reach



Sonnenerde
@SonnenerdeYT 54.300 Abonnenten 409 Videos
🌱🌿 Willkommen auf unserem Kanal 🌱🌿 >
sonnenerde.at/de und 3 weitere Links

ÜBERSICHT VIDEOS SHORTS LIVE PLAYLISTS COMMUNITY 🔍



Sonnenerde | Das ist unsere Vision 🌱🌿
18.267 Aufrufe • vor 2 Jahren

Wir von Sonnenerde bauen keine Autos, wir zimmern keine Dachstühle und wir servieren Ihnen auch keine Cocktails. Wir arbeiten mit etwas ganz Anderem:

Mit dem Nährboden für ein Leben, das im Heute, aber auch in naher und ferner Zukunft liegt. Mit der Evolution und mit der Erde, auf der sie weiterhin stattfindet. Und mit den Ressourcen ...
MEHR INFOS

Appendix 13: Google Ads investment

Tagesbudget festlegen

Über Ihr Budget legen Sie fest, wie viel Sie durchschnittlich pro Tag und maximal pro Monat ausgeben möchten. Es kann vorkommen, dass für Ihre Kampagne an einem Tag bis zum Doppelten dieses Betrags ausgegeben wird. Das wird jedoch an anderen Tagen wieder ausgeglichen. Für eventuelle Überschreitungen erhalten Sie eine Gutschrift. [Weitere Informationen zum durchschnittlichen Tagesbudget.](#)

☐ 169,66 €

☒ **141,38 € Empfohlen**
 Durchschnittliches Tagesbudget

Conv. pro Woche

Kosten/Conv.

Wöchentliche Kosten

36,3

27,26 €

989,66 €

Empfohlen aufgrund Ihrer Kampagneneinstellungen, wie etwa Gebote, Ausrichtung und Anzeigen, sowie den Budgets ähnlicher Werbetreibender.

☐ 113,11 €

☐ Benutzerdefiniertes Budget festlegen

Zurück Weiter

Tagesbudget festlegen

Über Ihr Budget legen Sie fest, wie viel Sie durchschnittlich pro Tag und maximal pro Monat ausgeben möchten. Es kann vorkommen, dass für Ihre Kampagne an einem Tag bis zum Doppelten dieses Betrags ausgegeben wird. Das wird jedoch an anderen Tagen wieder ausgeglichen. Für eventuelle Überschreitungen erhalten Sie eine Gutschrift. [Weitere Informationen zum durchschnittlichen Tagesbudget.](#)

☐ 169,66 €

☐ 141,38 € Empfohlen

☐ 113,11 €

☒ **Benutzerdefiniertes Budget festlegen**

Durchschnittliches Tagesbudget für diese Kampagne festlegen

Euro (EUR €)

10 €

Conv. pro Woche

Kosten/Conv.

Wöchentliche Kosten

9,6

7,29 €

70,00 €

Ihr Budget ist niedriger als die Budgets anderer Werbetreibender. Das kann sich auf die Leistung auswirken. Sie sollten das Budget auf mindestens 141,38 € pro Tag erhöhen.

Zurück Weiter

Photo 1

Photo 2

In photo 1 Google Ads automatically, according to our website, suggest an investment in campaigns of €141,38 per week. By defining a own budget, as seen in photo 2, a weekly investment of €70 is would be needed, in order to the possible conversation rate to be higher. A smaller daily spent on Google Ads was not possible.

Appendix 14: Ad Campaigns and keyword research

Keywords:

Keyword Category (Campaign)	Keyword Group (Ad Group)	Keyword
Farmers and purchasing managers of agriculture companies	Making business greener	Eco-friendly farming solutions
		Sustainable agriculture products
		Green farming technologies
		Carbon-neutral farming methods
		Sustainable farm management
	CO2 emissions	Carbon footprint reduction in agriculture
		Soil health and carbon sequestration
		Carbon neutral initiatives
		Carbon offsetting solutions
		Farm-based carbon reduction strategies
	Biochar	Benefits of biochar in agriculture
		Biochar soil amendment
		Biochar sustainability
		Biochar marketplace
		Biochar environmental impact
Carbon Bridge	Carbon Bridge	Carbon Bridge platform
		Carbon Bridge marketplace
		Carbon Bridge impact assesemnt
		Carbon Bridge community
		Carbon Bridge biochar awareness

Campaigns:

Campaign	Target group	Headline 1	Headline 2	Headline 3	Headline 4
Generic	Making business greener	Sustainable agriculture	Green farming	Carbon-neutral farming	Learn more with Carbon Bridge!
Generic	CO2 emissions	Reduce Farm CO2 Emissions	Invest in carbon offsets	Lower farm emissions	Learn more with Carbon Bridge!
Generic	Biochar	Biochar for farms	Biochar benefits	Soil improvement	Learn more with Carbon Bridge!
Brand	Carbon Bridge Platform	Carbon Bridge: all about biochar	Join Biochar Community	Biochar knowledge center	Learn more with Carbon Bridge!

Campaign	Target group	Description 1	Description 2
Generic	Making business greener	Boost farm sustainability & eco-friendliness. Advanced green solutions for modern agriculture.	Explore carbon-neutral methods. Sustainable resource for eco-conscious farming management.
Generic	CO2 emissions	Embrace carbon-neutral farming. Effective strategies for on-farm CO2 reduction.	Implement carbon footprint reduction strategies in agriculture for healthier soil.
Generic	Biochar	Elevate soil health with biochar. Sustainable and quality biochar for agriculture.	Improve your soil with the sustainable benefits of biochar. Start now for healthier crops.
Brand	Carbon Bridge Platform	Decarbonizing businesses with biochar	Discover biochar's potential with Carbon Bridge. Join our platform to learn, measure, shop, and connect with the biochar community.

Appendix 15: Permission on publishing the research work ‘Biochar: Production, Applications, and Market Prospects in Portugal’



Sara Siebels · 19:19

Boa tarde Bruno,

Espero que se encontre bem. Sou Sara, da Nova SBE – já tivemos a oportunidade de conversar anteriormente sobre o nosso projeto de mestrado relacionado com biochar. Estou a entrar em contato para partilhar uma novidade: fizemos avanços significativos na nossa tese e estamos atualmente a desenvolver um website dedicado ao biochar. O nosso objetivo é estabelecer uma comunidade que partilhe conhecimentos e enfatize as vantagens do biochar.

O seu trabalho de investigação com os seus colegas tem sido uma fonte de grande inspiração para nós e acreditamos que seria um contributo valioso para o nosso site. A inclusão do seu trabalho poderia proporcionar ao nosso público uma compreensão mais aprofundada e estimular um interesse crescente no biochar.

Gostaria de saber se estaria confortável com a inclusão do trabalho de investigação no nosso website.

Melhores cumprimentos,
Sara Siebels



Bruno B Garcia · 17:30

Boa tarde, Sara. Sinta-se à vontade. O nosso trabalho foi desenvolvido precisamente para sistematizar informações e servir como base para outros investigadores. Encontrámos uma grande quantidade de informação nos meios de comunicação, mas notámos uma falta de suporte científico e uma tendência para o pseudocientífico. Com o nosso trabalho, esperamos ter contribuído para trazer esta temática para o âmbito científico..

Link to the research paper: <https://www.mdpi.com/2076-3298/9/8/95>

Appendix 16: Carbon Bridge Platform Economics

Metric	Number	Details
Average Monthly Traffic without Marketing	330	Only fraction target
Average Monthly Traffic with Marketing	686	Farmers + Companies + Others
Average Monthly Traffic Farmer	12	Every 10.000th
Average Monthly Traffic Company	14	Every 10.000th
Average Monthly Traffic Other	660	Twice average
Community Conversion Rate Target	7%	
Community Conversion Rate Non-Target	0,1%	
New Monthly Community Members	2	
New Monthly Community Farmer	0,83	33%
New Monthly Community Company	1,01	40%
New Monthly Community Other	0,66	26%
Community Members	30	End of year
Benchmark Buyers Retention	31%	
CB Buyers Retention	40%	
Buyers Base	12	
Average Order Size	15,56	tons
Average Order Size Farmer	5,70	tons
Average Order Size Company	40,92	tons
Average Order Size Other	0,05	tons
Average Order Value	€ 12 445	
Average Order Value Farmer	€ 4 560	
Average Order Value Company	€ 32 736	
Average Order Value Other	€ 40	
Average Order Frequency	2	per year
Average Order Frequency Farmer	2	per year
Average Order Frequency Company	3	per year
Average Order Frequency Other	1	per year
Average Yearly Revenue	€ 35 789	
Average Yearly Revenue Farmer	€ 9 121	
Average Yearly Revenue Company	€ 98 207	
Average Yearly Revenue Other	€ 40	
Total Yearly Revenues	€ 277 008	
Total Yearly Revenue Farmer	€ 19 737	
Total Yearly Revenue Company	€ 257 202	
Total Yearly Revenue Other	€ 69	
Total Yearly Biochar Demand	346	tons
Number of Customers	16	
Yearly Revenue per Customer	€ 17 313	
Commission Fee Benchmark	10%	
CB Commission Fee	7,5%	
CB Commission Revenues	€ 20 776	per year
CB Subscription Fee	€ 89	per month
CB Subscription Revenues	€ 17 088	
Total CB Revenues	€ 37 864	

FARMERS GERMANY		
Metric	Number	Details
Number of Farmers	118900	Less than 20ha
Number of Companies	143900	20ha+
Fraction Farmers	45,2%	
Fraction Companies	54,8%	
Average Hectares Farmer	9,91	ha
Average Hectares Company	107,82	ha
Total Buyer	100%	
Fraction of Test Buyers	50%	of buyers
Fraction of Convinced Buyers	30%	of buyers
Fraction of Sophisticated Buyers	15%	of buyers
Fraction of Expert Buyers	5%	of buyers
Biochar Application Rate	5	t/ha
Average Utilization Rate	23%	of land
Test Buyer Utilization Rate	5%	of land
Convinced Buyer Utilization Rate	30%	of land
Sophisticated Buyer Utilization Rate	50%	of land
Expert Buyer Utilization Rate	80%	of land