Pyropower

Innovation strategy

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Masters thesis

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Innovation strategy for Pyropower for introduction in European market

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Keep smiling!

Executive Summary

Pyropower is a new start-up established in Delft in the year 2019. Pyropower works on biochar systems implementation for communities in Malawi and Indonesia. Pyropower wants to introduce the biochar system technology in European market. The project is about innovation strategy for Pyropower to introduce the biochar system technology in the European market. There exist some challenges regarding biochar systems, regarding Pyropower as a company and regarding the market which are addressed in the project. Innovation strategy for Pyropower includes a distinguishing position in the market, gaining a competitive advantage, a future vision and a concept for the same, related business, revenue models and a strategic roadmap to follow.

Biochar is a rich source of carbon and nutrients which can be used for many applications, one of which is the agricultural application for improving soil yield. Biochar systems are a combination of 4 businesses- biochar business, waste management business, energy business and climate change action business. Each of the business model can be developed independently, and at the same time, each of the model should be considered to increase the revenue generated. Also, Pyropower needed a long term vision to look forward to, and a concept that connects Pyropower's beliefs and other projects to the European project. Accordingly, for the purpose, the vision in design process is used along with blue ocean strategy to make sure that the needs are addressed.

Initial developments made by Pyropower, regarding the business plans consisting waste management solution, energy solution and climate change action were considered as a basis for further developments whereas the biochar related plan was needed. The research showed that biggest problems were related to the acceptance of biochar and a suitable market for introduction. The most suitable market for biochar is still agriculture, but using biochar for agricultural purposes has high initial costs as well as, it is in competition with other fertilisers, so needs a suitable market for the selling. Through the deconstruction, it was understood that Pyropower works for communities and in agricultural sector, and proposes solutions that will help communities to solve their problems collectively.

A new market is identified for Pyropower to introduce and sell biochar. A future within the domain of communities in agriculture is looked at and a service is developed for Pyropower which suits Pyropower's needs. The final designs include a figma prototype of the service envisioned, business and revenue models for the service as well as for biochar systems and a roadmap for Pyropower as a timeline to achieve the results. The practices developed by clustering the factors and combining the clusters can be used to develop newer propositions as well, not only for Pyropower but for other entity also which wants to contribute to the field of communities in agriculture. The innovation strategy was validated by discussing it with internal stakeholders and external expert.

The validation part shows relevance of the concepts developed for Pyropower. The near future part of the project was well received and willingness to follow the same as well as steps in the direction are initiated. Considering the far future part, the idea of digital platform to promote exchanges of resources connects Pyropower's beliefs and Pyropower wants to move in this direction along with the biochar system implementation for CSAs. More ideas adding to the basic service design were thought of and at the same time, questions were also raised about certain aspects of business plan. The roadmap considers Pyropower's current position and market condition and accordingly, proposes a plan to achieve the end goal.

In conclusion, the project is a step in the right direction for Pyropower to develop a sustainable business in European market. But, Pyropower also needs to work out the business models on the side of waste management and energy solution in the near future part to make it a success. For far future part also, more consideration and work has to be done over the time with CSAs to scout and propose new solutions to CSAs. In the end, the solutions provided in the project should lead to a competitive position for Pyropower in near and far future and build a sustainable business.

Reading guide

The reading is to provide some prerequisite information about the project to make it more enjoyable and less confusing.

The report and chapters are divided into 3 phases- deconstruction phase, construction phase and feasibility, reflection phase. The deconstruction phase focuses on research carried out for the project, construction phase looks at all the creation of new designs and feasibility-reflection phase looks at how and why the designs should be implemented in reality.

Within the project, few abbreviations are used. While these abbreviations are described in the text, they are collectively mentioned in this section.

CSA- Community Supported Agricultures

ERRC- Eliminate- Raise-Reduce-Create

ViP- Vision in Product Design

SWOT- Strength- Weakness-Opportunity-Threat

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Until not long ago, our species (homo sapiens) shared the planet with other kinds of humans- homo Neanderthals. Homo Neanderthals were more intelligent, strong, creative than homo sapiens. Still, homo Neanderthals faced extinction over the time when homo sapiens appeared on the planet and survived. The one quality that helped homo sapiens to survive and homo Neanderthals to extinct is the ability to learn from each other. Human beings are ultra social learning machines, learning from each other as well as other species. Human beings are born to learn, bond and play. Being bright collectively, helped homo sapiens to survive whereas, not being a collective geniuses led to extinction. Human beings crave togetherness and interaction. Our spirits yearn for connection just as our bodies hunger for food. We have each other and that is why we can shoot for the moon.

- Humankind (Rutger, 2019)

Chapter 1

Assignment

The 2015 Paris agreement emphasised the need of reducing greenhouse gas emissions and removing existing carbon from environment as a means of fighting climate change. The agreement also mentions a brief strategy where carbon removal by sinks of greenhouse gases is eminent in the later half of the century. The participant countries in the Paris agreement agreed to support and facilitate the private and public entities working in the field of greenhouse gases mitigation. Tim Flannery, an Australian environmentalist, mentioned that adding biochar is one of the most effective ways of capturing carbon and atmospheric cleaning (Flannery, 2015). An addition of biochar to 10% of total crop-land will sequester 29 billion tonnes of CO_2, a researcher from Cornell University found out, which is equivalent to humanity's annual greenhouse gas emissions (Hertsgaard, 2014).

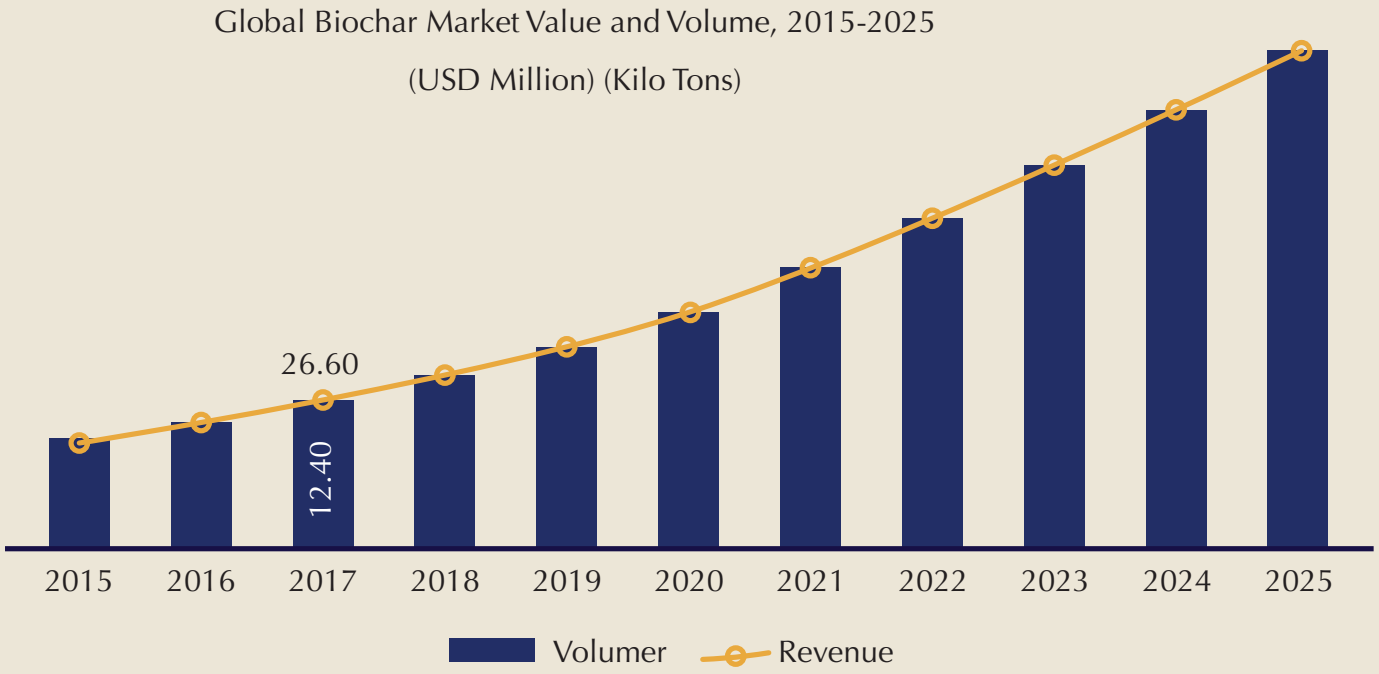


Figure 1: Increasing sales of biochar (Adroit market research, 2018)

Pyropower-
Pyropower is an initiative working in the field of biochar systems. Pyropower was established in Delft in 2019 and now, the team consists of 12 members from the Delft University of Technology and Wageningen University of research as well as professionals from the industry. Pyropower is active in Malawi, Indonesia and Netherlands. In these countries, Pyropower tries to solve the problems faced by local communities in the country of Malawi and Indonesia by implementing biochar systems. Recently, Pyropower initiated a European project with the intention of implementing the biochar system in the European market.

Biochar is a carbon rich compound which can be used for carbon sequestration and has applications in multiple fields. Biochar systems are the most conventional way of producing biochar and many of the companies operating in the field of biochar are based on the biochar systems. Objectives for companies for entering the market of biochar can be different for different businesses. These 4 objectives are- waste management, energy production, mitigation of climate change and soil improvement. A company working in the field of biochar technology usually focusses on one or some of these objectives as some these objectives are contradictory to each other. For example, a company focussing on energy production will not focus on biochar quality (Lehmann, 2017). With change in context, the objective of the company should change. Pyropower works on similar biochar systems to solve the problems of global communities. The start-up offers biochar based solutions to communities in Malawi and Indonesia suitable to their context. The market Pyropower is working on and the European market are completely different with different market needs, different infrastructure and different value chains. At the same time, Pyropower needs a vision suitable for the European project, which also lies in line with the other projects.

Missing Perspective

Biochar really got the hype after 2005 (Lehmann, 2017), after which, number of scientific literature increased, and people started to think about biochar as an organic fertiliser which can replace conventional fertilisers. Over the time, biochar as a fertiliser became less popular due to many reasons. One of the reasons is also the mismatch between biochar as a technology and people's need. In the present context, every field is boosting with technology and in future, it is expected to rise even more. It becomes necessary to look at how a relatively traditional biochar can fit in such scenarios. It is also important to understand the sustainability of the biochar system through financial and social impacts so as to make it a viable option.

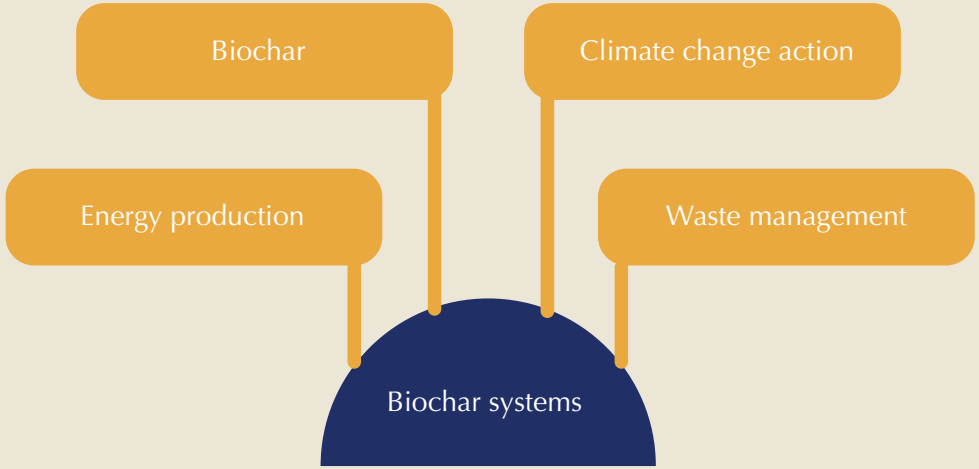


Figure 2: Biochar systems

Chapter 2

Approach

Approach

2.1 Objective

The aim of the thesis is to build a strategic sustainable advantage for Pyropower in the long run. This will be demonstrated by creating a long term vision, a suitable strategy for short term and long term goals. The approaches of strategic designing will be used to understand and develop suitable solutions for Pyropower. The project works on two different goals in parallel to achieve the goal of sustainable strategic advantage. The thesis covers the overall development of Pyropower as a start-up, through a strategic perspective, as such, it is considered that Pyropower has developed a business model and there is a need of innovation in the business model and a long term vision to sustain in the market.

Questions to be answered

Pyropower's aspiration of introducing the technology in the European market has to match the expectations of this market while keeping up with competitors. So, the questions Pyropower should answer become-

1. What is the vision of Pyropower's European project and what should be the strategy to achieve the vision?
2. What is the new business model and product/service concept and what are the steps to be taken to reach the goal?

Project scope

The thesis aims to implement biochar systems in European market and aim at establishing Pyropower in the European market. The thesis will consider Pyropower's existing projects to develop the European project. It will look at ways to introduce Pyropower and will connect the project to Pyropower's mission through development of related strategy. The project, at the same time, considers biochar systems and its implications as the focus. The project generates business models, service design, revenue model, future user interactions and roadmap as deliverables for Pyropower.

2.2 Methodology

This section describes the process that was followed during the project along with the tools of design.

The project develops a strategy to introduce the technology in the European market as soon as possible. The project also develops a vision and strategy to achieve the same for Pyropower to look forward in the future. The project complexity can be addressed using 'time' as a guide. Accordingly, project can be divided into 2 main parts, near future for Pyropower and far future for Pyropower. The near future part of the project looks at how Pyropower can establish itself in European market as soon as possible whereas far future part of the project looks at activities Pyropower should be aiming for to fulfil their mission as well as build a sustainable business in European context. The near future part looks at how biochar system can be implemented in European market quickly and effectively, whereas far future looks at how to connect the project with Pyropower's mission and build a sustainable business. Accordingly, the project is this 3 layered entity, where first layer is about near future business model based on biochar systems, 2nd layer is about biochar systems in far future setting and 3rd layer is about connecting market to Pyropower's mission in future setting.

Addressing the complexity

The ViP method-

The vision in design (Hekkert, 2011) is used as a guiding process for the project which is developed by P. Hekkert and M. Dijk. The ViP process addresses future opportunities and possibilities rather than solving everyday problems. Pyropower, being a new startup, is able to, and should, look for newer and distinctive opportunities, which will give Pyropower an attractive position and future oriented ambition to look forward to and act which justifies the use of ViP as a method. Pyropower is at a stage where it has to generate and defend the reason of existence of the startup, so as to guide the future projects, keep the members motivated and form the story around Pyropower as a brand, right from the start. The project undertaken has a focus on Pyropower as an organisation and not on a specific product as such, and the project is expanded over 5 years, thus strategic in nature. ViP process is

suitable for all types of design, but the use of ViP process for strategic purpose, with a need of strategic results is quite unusual, which this project attempts. Personally, I wanted to explore the design process through ViP to learn it more and implement it for an actual project. I believe that the outcomes through ViP process can provide unusual but highly impactful solutions, where values are more important and come first which eventually lead to competitive advantage also.

Coupling ViP method

To address the complexity due to different timelines, 3 layers and need of a strategic outputs, the ViP method is supported with strategic tools, which connect the ViP process with strategic outcomes as well as address the different timelines and multilayered complexity during the project. The ViP process ensures a distinctive and suitable position in the future but Pyropower also needs a solution which will introduce the startup in European market in a near future. For this purpose, blue ocean strategy (Kim, 2015) is considered, which helps with creating an organisation vision for coming years. Blue ocean framework is used to decide on the company direction which subsequently led to identification of a blue ocean for Pyropower. The value modelling blueprint (Bos de Vos, 2019) is used as an intermediary tool to generate revenue model from the basic understanding of business plan and ViP results.

The ViP process is divided into 2 parts- deconstruction and construction phases. The deconstruction phase focuses on understanding the current context as well as past context to learn more about why a proposition exists in the first place. The deconstruction phase allows for exploration within the existing context to understand how the context is in the present and why it is structured this way. The construction phase focuses on creating the new future setting, context and designing for that context. This chapter explains the method and tools used in the project and overall approach for the same. In deconstruction phase, the information flow is inward as information is collected and in construction phase, as content is created, information flow is outward. The tools that are coupled are shown in the diagram. The blue ocean creation is considered as an in between step between deconstruction and construction as the step comes after understanding the context around biochar and Pyropower as an organisation, but before the construction phase. The creation of blue ocean directs the project towards Community Supported Agricultures (CSA) making it specific, while keeping the abstractness from deconstruction phase intact and thus the outputs of construction phase are more specific towards CSAs. In the end, the concepts are evaluated by discussing them with Pyropower members and future directions, possibilities, limitations with the project are discussed.

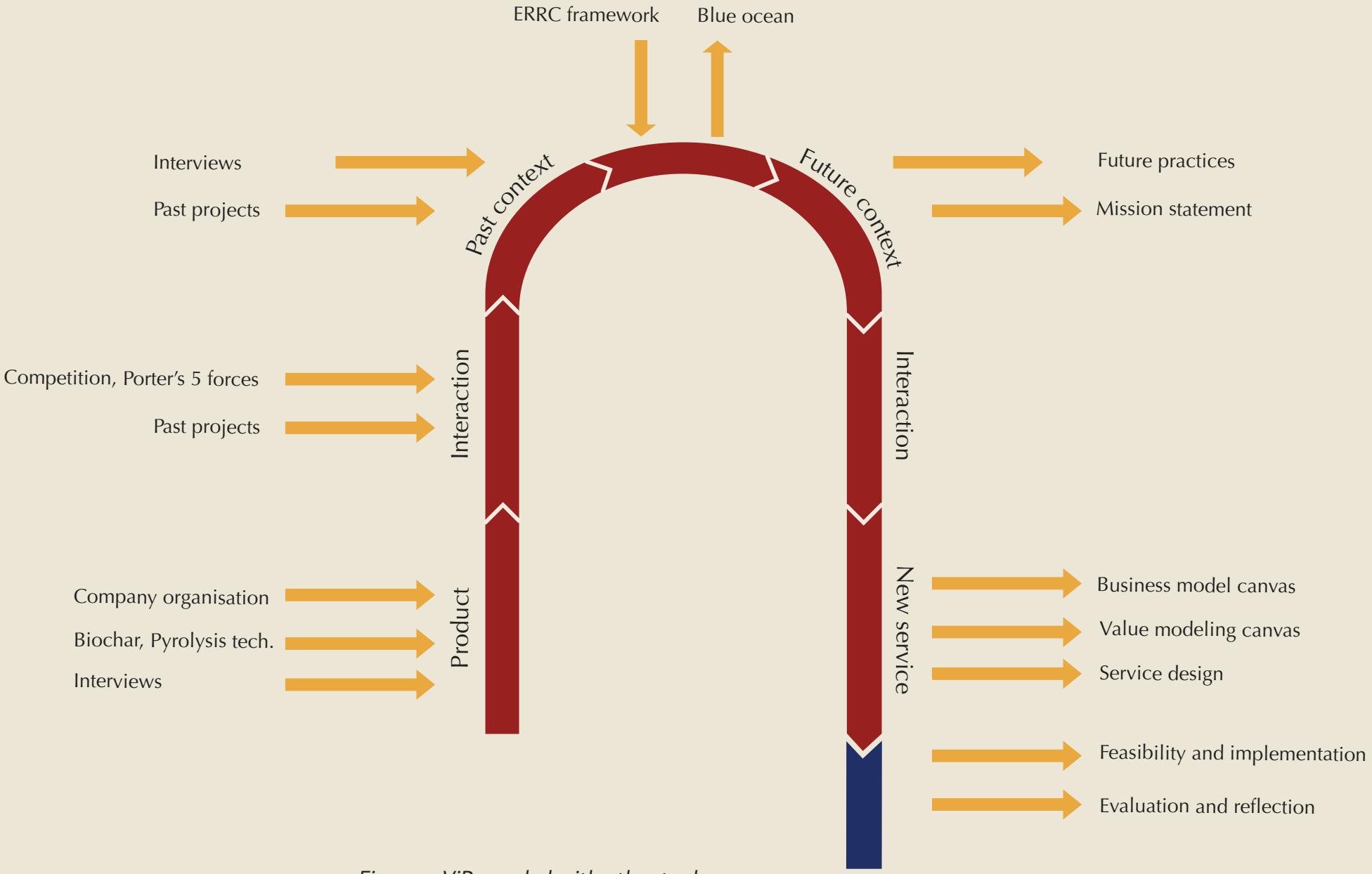


Figure 3: ViP coupled with other tools

Phase 1- Deconstruction

The deconstruction through ViP process takes place on 3 levels, product level, interaction level and context level. On product level, what product, as an independent entity is, is discussed. On interaction level, how the product interacts with its users is studied and on the context level, the world at the time of design is studied, to know the reasoning of designer behind the product. In case of Pyropower, to address the 3 levels, Pyropower itself is considered as the entity to be deconstructed. To explore the 3 levels considering Pyropower, the internal and external analysis is carried out.

Internal analysis

To develop a future direction for Pyropower, first, a deeper understanding of Pyropower and ideology is needed which is the goal of the internal analysis. In this part, Pyropower is looked at to understand the organisation, projects, ambitions, competences as well as their technology and biochar. The Literature review mainly focuses on technology of pyrolysis, biochar, carbon credits and rules, regulations for biochar. Information about Pyropower is obtained from the data that is generated by Pyropower over the past one year and through interviews of founders and a member. The 3 founders and Wageningen team lead were interviewed to know more about the idea behind Pyropower and what they see as the future of Pyropower. The deconstruction phase of ViP in the exploration phase tells about the other projects in the countries of Malawi and Indonesia Pyropower is working on and thus, forms a boundary for further activities.

The internal analysis answers some questions on the product, interaction as well as context level. The organisation structure, technology, biochar, carbon credits tells about Pyropower as a product. The insights from interviews, vision the founders have and what Pyropower will be in future, how Pyropower wants to interact with the context tells about the interaction paradigm and the study of previous projects in other countries tell about the context Pyropower usually works in.

External analysis

External analysis looks at factors outside Pyropower which have the potential of affecting Pyropower's business as well as builds a basic understanding of the market in Europe. The European context is fairly new for Pyropower and a suitable fit needs to be created between the context and Pyropower. Literature review about market related to biochar gave a better understanding

of where the biochar stands considering its applicability in a sector. The competitor analysis gives an idea of the other active companies in the sector of mainly biochar and agriculture. The competitor analysis takes a look at different levels of competition Pyropower will face with the business whereas porter's 5 forces (Porter, 1979) will explain the bargaining power of different parties related to the business. Interviews were carried out with an intention of exploration within the field of future of agriculture, biochar and problems related to it. 3 organic farmers around the area of Maasland in Netherlands were interviewed, informally, at their farms to know about their farming methods, fertilisers, cycles and productivity. A founder of an organic fertiliser company was interviewed twice to understand his view about biochar and organic fertilisers. A chief innovation officer of urban sustainable development agency was interviewed to know the future of agriculture as well as society in general we will be a part of. A professor from an agriculture related research university was interviewed to understand the problems biochar faces in the market, and to know his perspective on future of biochar.

During the external analysis, data about the past context as well as future context is collected, which helps with the future context generation, later on, in the construction phase. The data is collected from different sectors related to Pyropower. This data is collected in the form of a factor- a building block for the future context. These factors can be found anywhere, and for the project, these factors were found from literature, online research as well as past masters thesis. These factors are mentioned in the Appendix 2.

The Blue ocean creation-

This is the intermediate step between deconstruction phase and construction phase. In this step, the data collected is understood and used to develop a Strength-Weakness-Opportunities-Threats (SWOT) matrix, which helps to understand Pyropower's capabilities in the current context. In this step, the Eliminate-Raise-Reduce-Create (ERRC) framework is used which helps to determine the capabilities Pyropower should focus on, and thus, guides the project towards a blue ocean. At the same time, it also develops an organisation vision for Pyropower to guide in future activities. The blue ocean characteristics defined by SWOT matrix and ERRC framework lead to a suitable market which is then analysed. This market is considered as a suitable market for Pyropower.

The insights from earlier deconstruction phase are used to build a SWOT matrix for Pyropower which briefly state important information Pyropower should be aware of before designing. ERRC tool is used along with the information from deconstruction phase, to develop a distinctive position for Pyropower

using Pyropower's capabilities. The deconstruction phase, along with blue ocean strategy help with the formation of a central vision statement for Pyropower.

One of the most suitable customer group for Pyropower, CSAs are discussed in this step, which fits the description of the blue ocean. The basic idea of CSAs along with their working, advantages, disadvantages and how this customer group fit Pyropower is explained in the section. The information for this part is gathered from masters thesis of students from other universities who specifically focussed on CSAs as the topic to be explored. The creation of blue ocean also provides a direction for Pyropower activities to be considered while developing solutions. So, the outputs of construction phase are more focused towards CSAs.

Phase 2- construction phase-

The construction phase is divided into 3 major parts- future context generation, interaction and new product. The future context generation looks at the creation of future, interaction looks at the intended interaction between user and product and new product show the development of the concept based on the interaction and in this project, along with concept, new product shows development of other strategic results intended.

Future context generation-
Using the data from deconstruction phase and blue ocean, a domain is defined, which forms a boundary for looking for the factors in the context. From multiple disciplines, a number of factors are collected which are then clustered to form the idea of future context. These future contexts show a structure among themselves. These clusters, when combined with each other in systematic manner, show different future practices. In this project, 12 such future practices were formed and each of these future practice represent an opportunity for Pyropower. One of these practices is selected for further development and based on the practice and designer's vision, a mission statement is created which drives the next process.

Interaction
Interaction looks at the relationship that fits the context and allows for achieving the mission statement. In this step, with the use of analogies, a desired interaction is envisioned. After de-constructing the analogy, the values for which the analogy was selected were determined. The new design should make sure to transpose these values through design so as to achieve the vision.

New service-
In this step, the new service is conceptualised, with the help from interaction vision, blue ocean and mission statement. The qualitative insights are transferred into a design that has features and properties. In this project, a service is designed which allows to achieve the mission statement. The service design is explained through the service working, organisation, stakeholders and embodiment design. In this step, with the use of other tools, other strategic results are obtained. The value modelling blueprint (Bos de Vos, 2019) is used to generate the revenue models for the service designed as well as for the near future plan. A business model canvas (Osterwalder,) tool is used to structure and explain the business plans.

Phase 3- Implementation and Evaluation

This phase focuses on implementation of the designs to realise them. In this phase, reasoning is provided, to convince that the designs are feasible. The feasibility is described using technological factors, economical factors, organisational capabilities and operational feasibility. A strategic roadmap (Simonse, 2017) is added to help Pyropower achieve the goal by targeting the 3 horizons mentioned in the roadmap. The evaluation part focuses on Pyropower's view on the designs and suitability of the results for Pyropower. For the purpose, the designs are discussed with members of Pyropower in virtual meetings and their views are documented in the evaluation part. The discussion and conclusion part talk about the limitations, future research directions and other things encountered during the project and the overall result of the project.

The diagram on next page briefly shows the initial plan and process followed along with some of the tools used for reaching the goal.

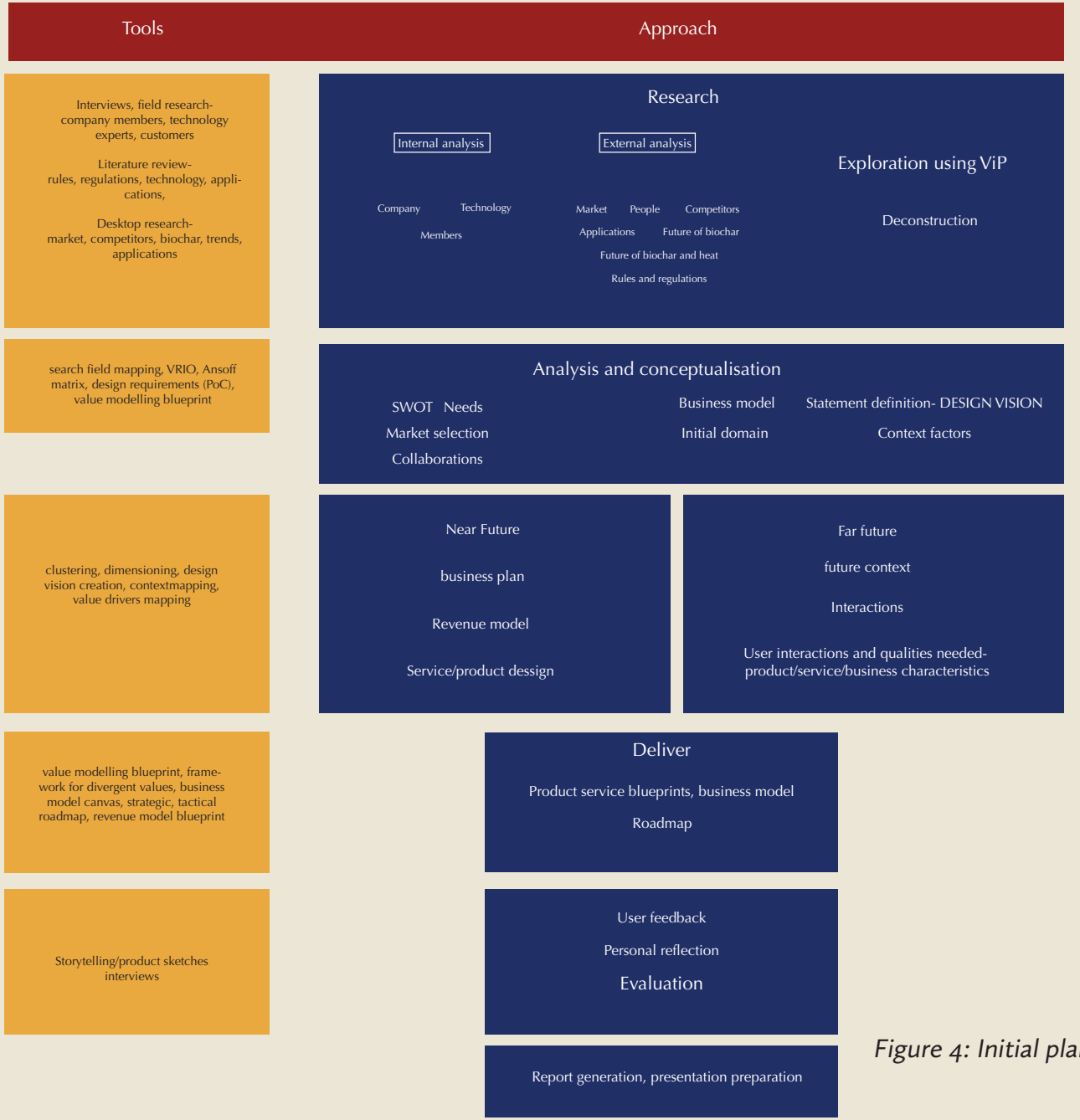


Figure 4: Initial planning

Chapter 3

Deconstruction

Deconstruction

The deconstruction phase focuses on collecting data about Pyropower, the context, and exploration within the context. The deconstruction phase consists of 3 parts- deconstruction on product level, on interaction level and on context level as described in the Approach chapter-2. Roughly, the 3 parts are addressed through internal and external analysis, which try to understand the paradigm Pyropower operates in. The factors collected are described in Appendix 2 due to the relatively large volume. Internal analysis looks at Pyropower as a company and external analysis explores the environment Pyropower operates in. This analysis forms the basis for blue ocean creation (chapter 4), which takes into account the various insights collected.

3.1 Internal Analysis

3.1.1 About Pyropower

The first question that comes to the mind is 'what is Pyropower and what do they do?' This section offers an explanation to understand Pyropower as a company, their activities, functioning and offerings. The data is collected through observation of company's activities, interviews with members, online research as annual reports were never made. The section is divided into multiple parts, each describes a specific part of the company.

Origin-

Pyropower's inception was during 2008 when one of the founders of Pyropower was introduced to biochar technology. The idea remained hidden in his mind until he met other founders and founded the startup in Delft in 2019. The initial dream was to use biochar technology for producing biochar and energy to build a business out of it. Initially, the startup first participated in Climate Launchpad, a global competition which accelerates the development of green business ideas and believes in reducing the negative climate impact through innovation and invention. Winning the Climate Launchpad and the Delft based pitch competition 'All Energy Day' gave a boost to the start-up which led to team expansion and global opportunity creation which led to creation of Malawi Project and Indonesia project.

Areas of business-

Pyropower is active in the field of agro-innovation and waste management industry and builds multidisciplinary value models to serve the market in Africa and south-east Asia. Figure 5 shows the basic value exchange the startup focuses on. Currently, Pyropower is active in Malawi, a country in Africa and Indonesia, Asia.

Communities in Malawi need a clean source of energy as well as a solution to manage the tobacco waste. For people in Malawi, Pyropower offers a solution which produces heat as well as a biochar which will improve the soil fertility significantly in the long run. Pyropower has connected with an NGO operating in the region to reach out to the communities. Recent developments with CEHSP (Centre for Environment Health and Safety Programs-an NGO from Malawi) and Malawi government showed the interest and value technology can generate for people in Malawi. As a value, Pyropower will get monetary benefit from the NGO it is connected with. The NGO will take care of the cookstove related operations in Malawi whereas Pyropower team will help with manufacturing, designing the cookstove and with consultation on the usage

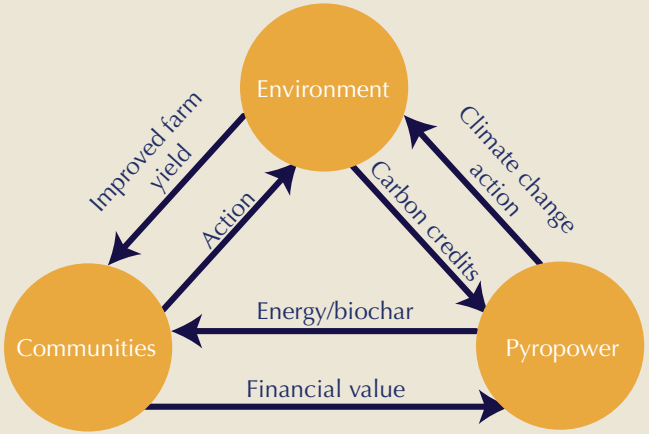


Figure 5: Basic value exchange

of biochar in farms. Although NGO will act as a middleman in the model which represents Pyropower in Malawi. The NGO acts as a service provider and collector for Pyropower in Malawi. The business model is not active and still, it is highly possible that it will change.

Communities in Indonesia need an environmental friendly way of burning the bio-waste to generate heat. For people in Indonesia, Pyropower offers a solution which allows the farmer community to burn the bio-waste to dry coffee beans in an environmental friendly way. The kilns are bigger than the cook-stove and so, biochar produced is also higher in quantity. For business model, Pyropower is experimenting with different ideas such as biochar collection and sales, leasing a kiln to a group of farmers etc. wherein, the farmers would have to pay for leasing the kiln or they have to return the biochar which becomes the property of Pyropower. Pyropower will test the quality of biochar before its application in any agriculture related activity. The business is not yet started due to the design of the kiln and loss of local connection in Indonesia, although, new connections are being made to kick start the project.

Looking forward, Pyropower still wants to be active in the field biochar systems, which are the combination of waste management, biochar production, energy generation and climate change action. The European project proposed should try and focus on the same during development to match the projects.

Mission-

Pyropower is a new start-up believing in empowering community, circular economy, biochar and energy. These values drive the projects in Malawi and Indonesia and the same are expected to drive the Europe project also. Objectively speaking, the ambition of is to capture 200 million tonnes of carbon from the environment by the year 2025 through biochar related technologies. Pyropower wants to help a million farmers globally to solve their energy and soil improvement problems with the biochar system by 2025. And Pyropower wants to treat a waste of 300 million tonnes globally by the end of 2025.

Pyropower, through the solutions, aims to support several sustainable development goals. The technology offered generates clean and affordable energy for markets in different parts of world. The technology will help to achieve economic growth by increasing crop yield, reducing cost of fertilisers for communities and at the same time, helps with economic growth of Pyropower. Pyropower believes in responsible consumption and production and tries to develop value chains based on the same. Biochar helps with climate change action, by sequestering carbon in the environment and helps with improving overall life on land.

Structure of the organisation-

Figure 6 shows the organisation structure of Pyropower. Some members of Pyropower is from Delft University of Technology and some members are from Wageningen University whereas one of the founders in the team is a serial entrepreneur from Italy. The Wageningen team brings their experience in agricultural activities and biochar and related business development whereas the Delft team develops technology and business model. The team is truly multinational with members from Italy, Netherlands, Spain, India, Malaysia and Indonesia. The team is structured based on departments like circular economy, research and development, finance, and engineering design and members from different departments work in teams on different projects. My role in the team is to participate in research, development of new technology and work on business development, marketing, whereas 2 founders head the research and development team and marketing team, the third founder acts as ceo of the company.

Partners and Collaborations-

Farmers from Indonesia showed interest in the technology proposed and so, Pyropower, in Feb. 2020, formulated an agreement with 1500 farmers from Indonesia for a pilot test of the technology. Pyropower's recent collaboration with CEHSP (Centre for Environment Health and Safety Programs) is going well with CEHSP helping Pyropower to implement the technology in Malawi. Pyropower is a member of GACSA (Global Alliance for Climate Smart Agriculture), a platform which helps to create transformational partnerships between initiatives, companies across the world. In Europe Pyropower works with Unwaste, a start-up from Amsterdam for coffee beans waste. Unwaste has agreed to provide a constant supply of coffee beans waste to produce biochar. Unwaste is also providing a place at their facility to install the technology and produce the biochar at the site.

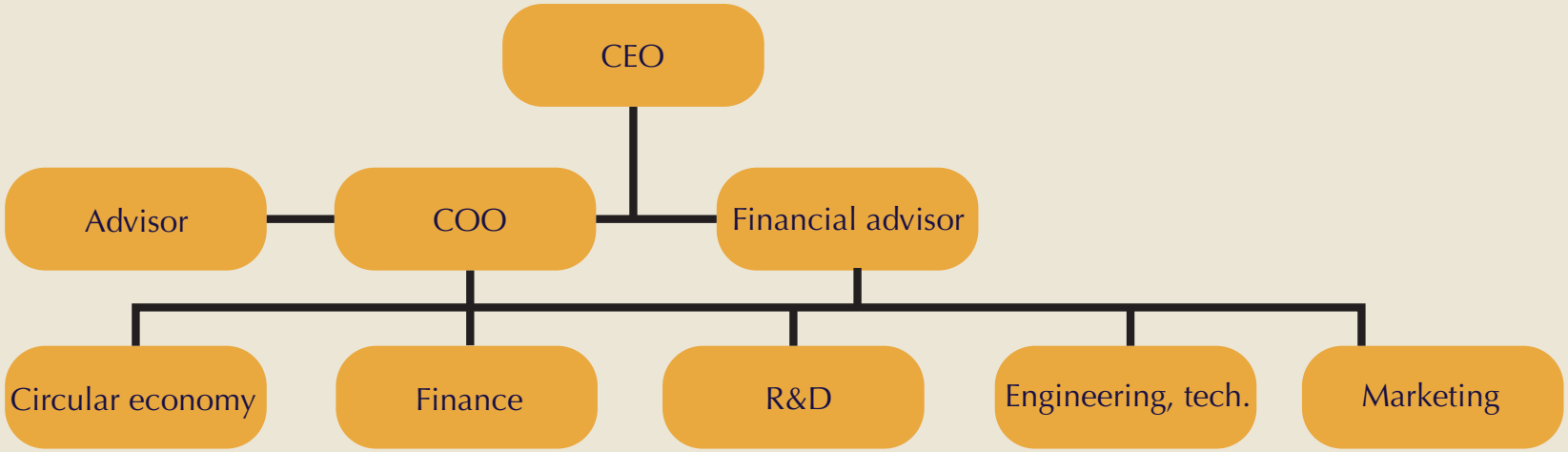


Figure 6: Organisation structure

Current aspirations-

Europe project background

Pyropower was active in Africa and south east Asia in 2019 but due to communication problems with markets, the progress was slow which led the company to focus on the relatively closer market of Europe. The European market is currently opening up opportunities for biochar but the needs of the market in Europe are different and so, a completely new value network is needed for Pyropower to introduce the technology in Europe. Pyropower intends to base the business model on the same three pillars of empowering community, energy and biochar, and circular economy. Current developments in the project led to collaboration with Unwaste, a start-up in Amsterdam which uses coffee beans waste to develop different products. Pyropower is planning to put up a gasifier kiln which will produce biochar from the coffee beans waste. Pyropower is also building an online platform for selling the biochar produced at the Unwaste facility. The direction chosen with this Europe project lacks a central vision as such that, there isn't a dedicated and targeted strategy that will definitely work for Pyropower in Europe. A strategy that will create a long term competitive advantage for Pyropower to achieve the vision is needed.

Past projects of Pyropower

In this section, Pyropower's business and projects are de-constructed to understand the domain of Pyropower. Pyropower is a start-up that currently operates in 3 countries- Malawi, Indonesia and Netherlands. In the deconstruction phase, the business models from the 3 countries is de-constructed to understand the similarities between them.

Malawi-

Malawi is a 3rd world country in the southern part of Africa. The context of Malawi is driven by deforestation, need of energy and need of increased food production. Pyropower was started with the idea of introducing a cook-stove in the country of Malawi, to help people from Malawi with a clean source of energy, while producing biochar. Malawi is also facing problems with deforestation and degraded soils due to chemical fertilisers. Pyropower offers a cook-stove to solve the problems of clean energy and biochar as a solution to deforestation and degraded soils. The biochar that is produced, is collected at a community centre from where, it is distributed to other farmers. The community centres serve as collection/distribution points for biochar or maintenance facility for cook-stove related operations and soil testing related activities. For better working, Pyropower collaborates with an NGO from Malawi, CEHSP (Centre for Environment Health and Safety Programs), which helps Pyropower with organisation. On a product level, the cook-stove helps to generate clean energy for households in rural Malawi. On the interaction level, the business models helps the community to come together and solve the problems they face collectively. On the context level, the business model tries to solve the problem of deforestation and soil degradation in Malawi. In a way, big organisations as well as small stakeholders complete a cycle of mutual benefits to achieve individual as well as common goals Figure 7 and 8 show the value model and business model Pyropower envisions in Malawi.

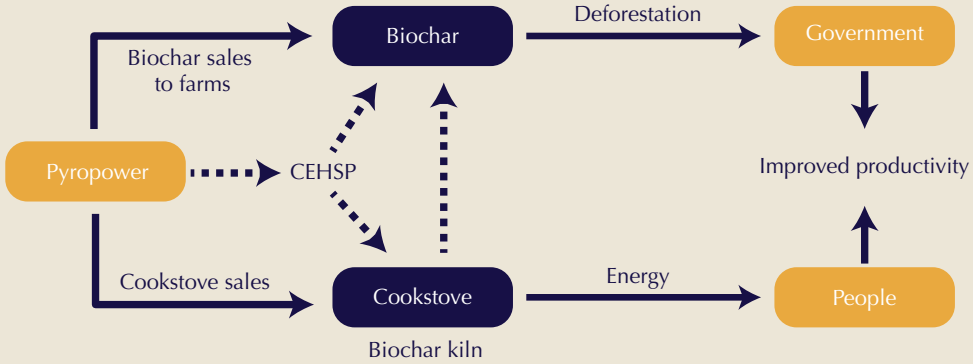


Figure 7: Malawi value model

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
CEHSP- Centre for environment Health and Safety Programmes- an NGO in Malawi which helps Pyropower International Biochar Association a European biochar association Puro earth	Long term support with biochar, support with cookstove, promoting cookstove, Coolection and distribution of biochar **Key Resources** Biochar certification Cookstove manufacturing facility Storage/collection system Inspection lab for soil test Supply chain resources	Pyropower offers cookstove to families in Malawi for cooking and energy generation Pyropower offers biochar to farmers in Malawi for using it in the farms as a soil conditioner Pyropower offers carbon credits to markets which want to buy carbon credits	Relationship handling (with locals) through CEHSP Direct contact through local language based manuals and newsletters consultation based support to labs in Malawi **Channels** Through CEHSP Door to door sale Village based centres	Households in Malawi need a clean source of energy for cooking and electric products Farmers cut down forests for charcoal and have to use chemical fertilisers for increasing productivity. Companies that want to reduce their carbon footprint buy carbon credits from companies that have negative carbon foot print.

Cost Structure	Revenue Streams
Manufacturing euipments Collection centre maintainance and operation Local workers wages Raw material costs Inspection lab costs	Sales of cookstove Maintainance of cookstoves Monitoring soil health Sales of carbon credits

Figure 8: Malawi business model

Indonesia

Pyropower's Indonesia project is based on problems that are faced by coffee farmers in Indonesia. Burning organic waste in the open is a common practice in Indonesia which the government is trying to reduce. On the other hand, farmers are looking for ways to dry coffee beans as the sunlight in Indonesia is a non consistent source of energy, due to the shady weather for multiple consecutive days. Pyropower offers a kiln to generate heat energy using the organic waste, where, the heat energy is used to dry coffee beans and kiln burns the organic waste in an eco-friendly way, producing biochar. (Figure 9 and 10) The kiln is sold to a group of farmers who use the kiln based on a schedule and the biochar that is produced is collected at a collection centre. Just like Malawi, the collection centre also serves as a maintenance point for kilns and distribution centre for biochar. The community is formed due to collaboration of a group of farmers for using the kiln as well as due to the combined efforts against organic waste management on a local level. The kiln also solves the contextual problem of pollution due to organic waste burning. The biochar is then sold to companies in Indonesia and south-east Asia for their use. The carbon credits are sold with the help of Puro earth to companies willing to buy the carbon credits. With Indonesia also, communities on lower scale as well as collaborations on a higher scale are formed to achieve the goals of each stakeholder, thus forming a community of people working together to solve problems on a bigger scale as well as their individual problems.

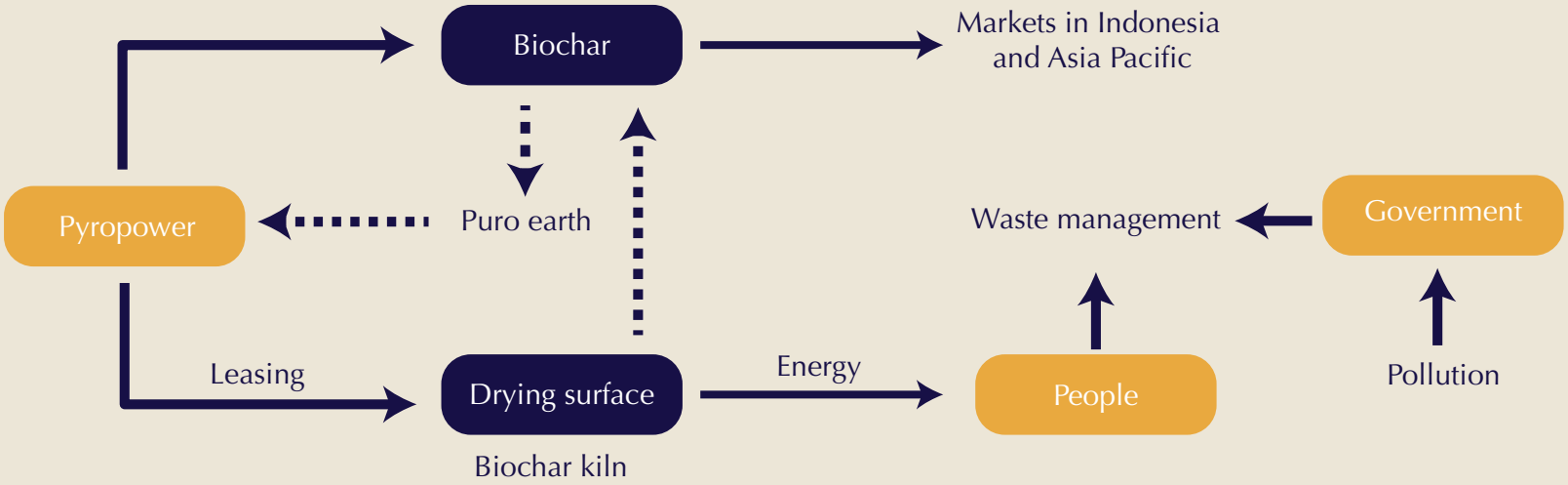


Figure 9: Indonesia value model

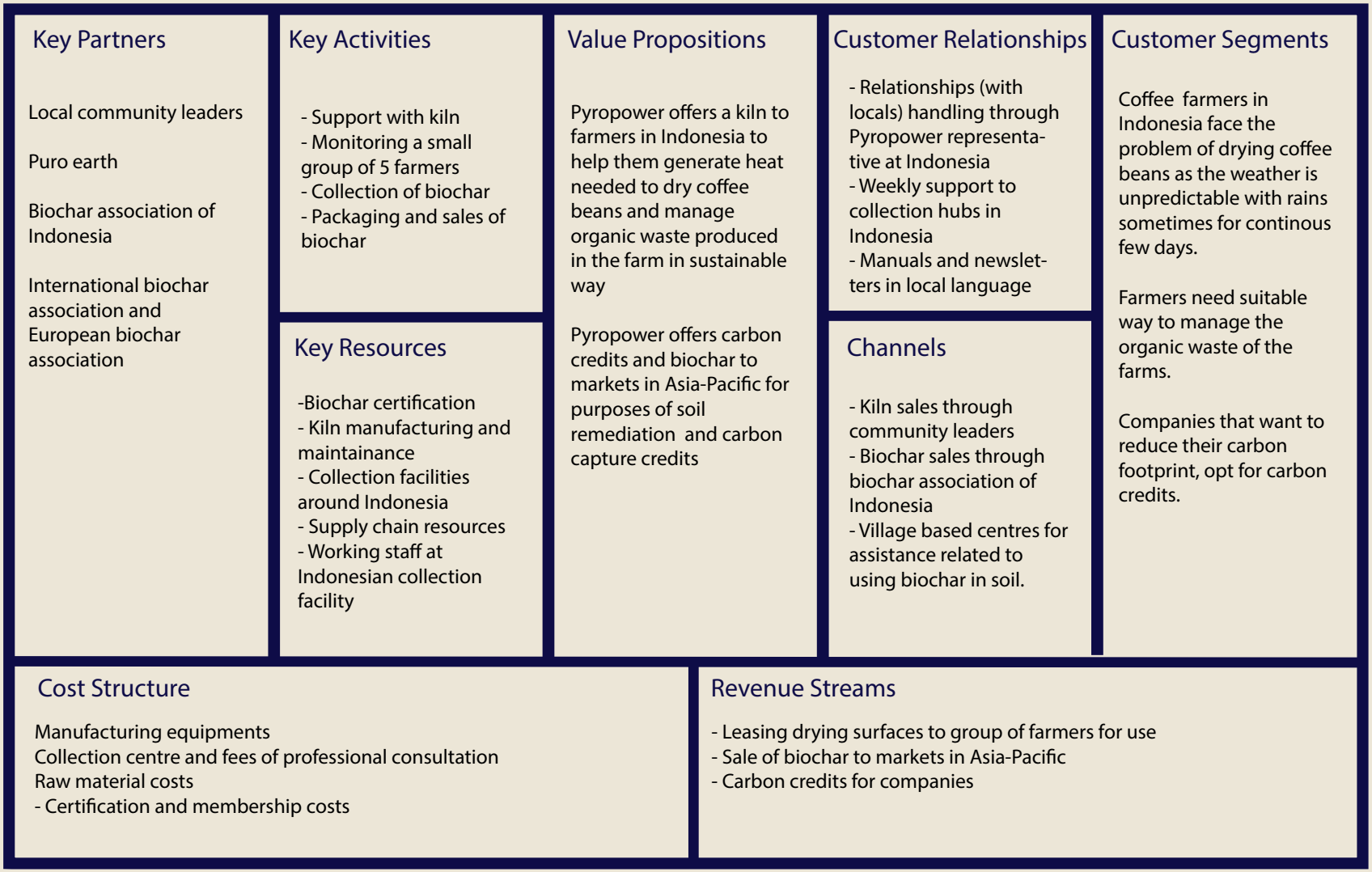


Figure 10: Indonesia business model

Europe

Europe brings a different context for Pyropower to operate in, a context where the need of decentralised energy is not prominent, soils are already rich with nutrients, and waste management industry is well established. In such a case, Pyropower is working with Unwaste to build a kiln that will help them to dry the waste coffee grounds at their facility, while producing biochar (Figure 11). Thus, through Unwaste consortium, Pyropower is helping with waste management and decentralised energy generation. The use of biochar in Europe is still unclear. The previous chapter shows a brief direction that the biochar produced through kiln is suitable for agriculture sector, still, targeting the whole agriculture sector will not yield maximum benefits for Pyropower. Accordingly, there is a need to narrow down the field of biochar systems Pyropower intends to implement in European region.

If the business model for Pyropower is divided into 4 parts, each focusing on 1 pillar of biochar systems, it shows that with the current settings and collaborations, Pyropower can build a business around waste management (Figure 12), decentralised energy (Figure 13) and climate change action (figure 14) as Pyropower has collaboration with Unwaste consortium and Puro earth. But when it comes to biochar, as of now, the business model is not developed completely. As of now, there is no dedicated market for biochar to be sold to whereas we only know that biochar is suitable for agricultural sector. Accordingly, a more suitable market is needed which can easily make use of biochar systems. As seen in the previous cases, with Malawi and Indonesia, communities were formed and a collective efforts were taken to solve a set of central problems whereas when it comes to Netherlands, the focus changes more towards commercialisation. For European case, Pyropower has not considered communities as an important element in the business model during development. In the earlier models, communities played an important part in complete implementation of biochar systems whereas with the European context, the business model is more fragmented.

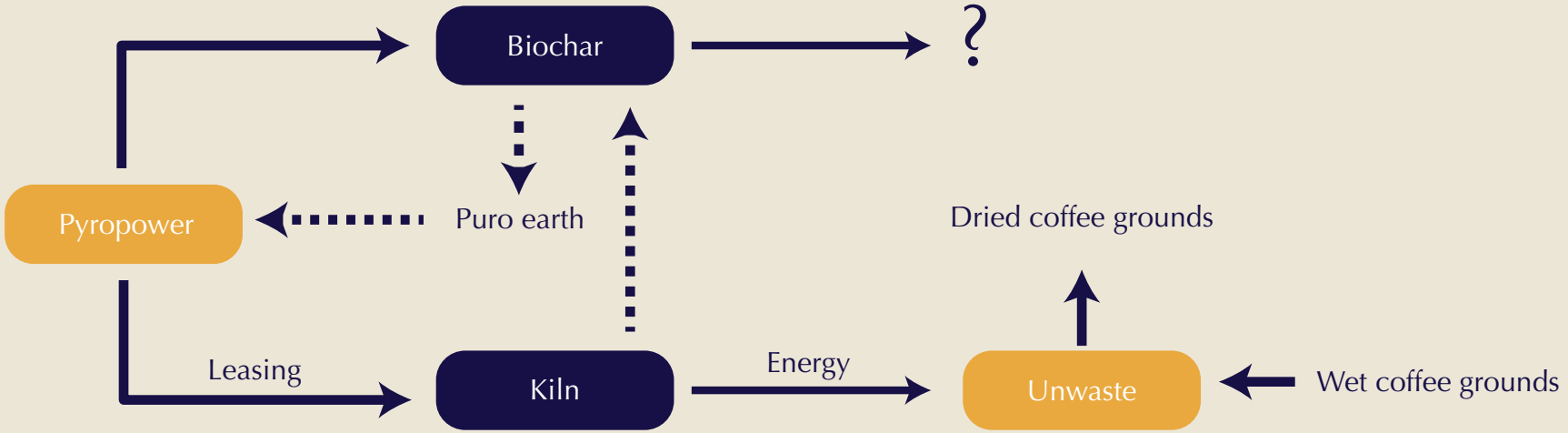


Figure 11: European market value model

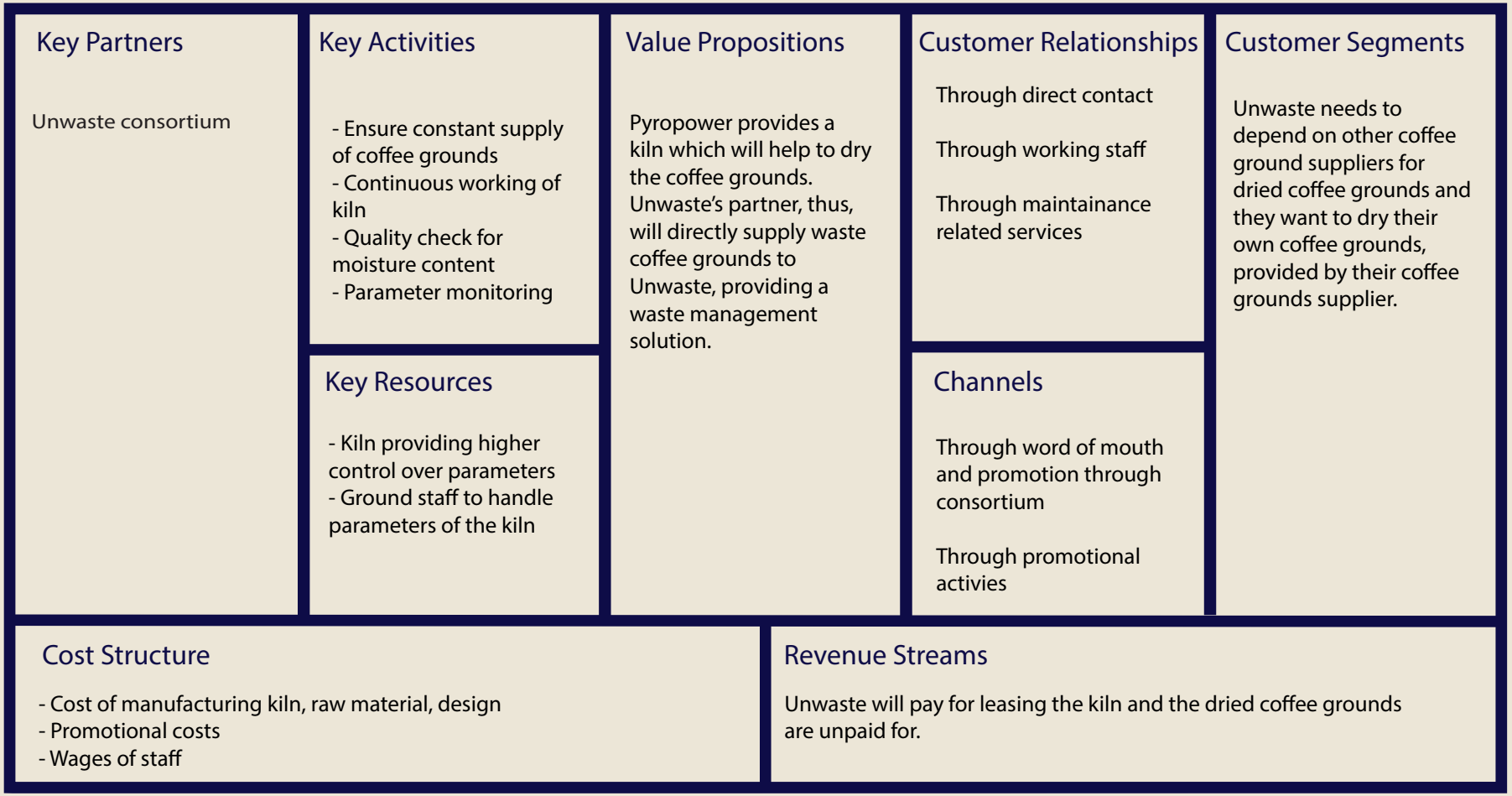


Figure 12: European market business model- Waste management solution

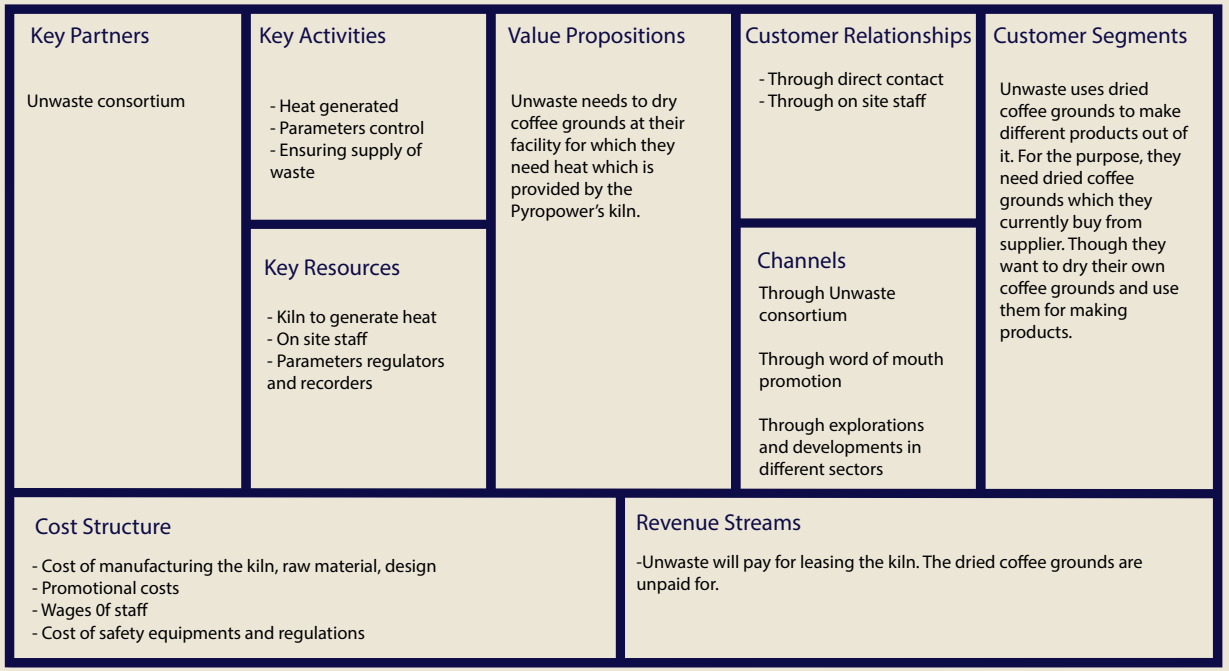


Figure 13: European market business model- Energy generation solution

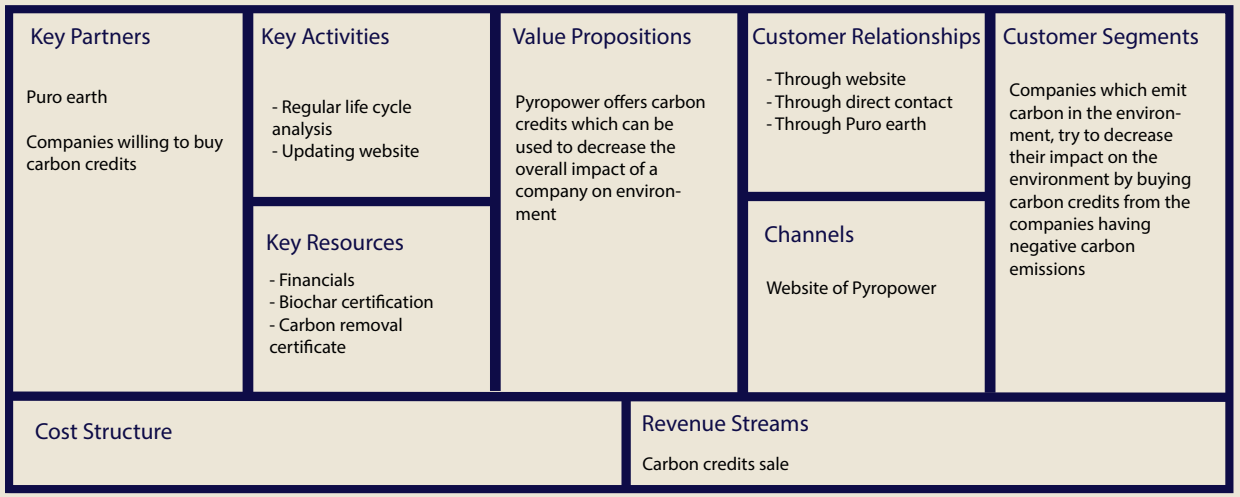


Figure 14: European market business model- Climate change solution

Technology

Biochar is a product of thermal decomposition of organic matter in the absence of oxygen. Carbonisation of biomass happens between 300°C and 1200°C and the rate at which heat is increased determines the end products of thermal decomposition (Taylor, biochar international). For instance, to produce biochar, the temperature of biomass has to increase at a very low and steady rate. For instance, some carbonisation systems have heating rates of less than 100^oC per hour. Because of high carbon content of biomass at lower heat rates, the reaction is exothermic, with the energy output of around 2 to 3.2 kJ per gram of biochar creation. In case of high heating rates, the output of pyrolysis is liquid bio-oil which is used as a substitute to petroleum oils in some cases.

Pyropower uses a natural, inverted downdraft design of a kiln. Figure 15 shows the working of a kiln. The kiln has two concentric cylinders placed one inside the other. The outer cylinder has holes on bottom side and inner cylinder has holes on upper and bottom side. The gap between inner and outer

Cylinder is airtight to prevent air entering from between. The biomass is kept in the inner cylinder and lighted. With the current technology, initially, the biomass follows a combustion process till the walls of inner cylinders are heated. Once the walls are heated, air between the two cylinders is heated which causes the air to move upwards creating negative pressure between the two cylinders. To fill the negative pressure, air from the top of inner cylinder and from the bottom holes of outer cylinder rushes. The oxygen from the air is burnt near the upper holes of the inner cylinder creating a flame. This flame is disconnected from the biomass which creates an oxygen-less environment needed for pyrolysis. The biomass thus thermally decomposes in absence of oxygen to create biochar. The flame is a high source of heat which can be used for different purposes. The technology is based on traditional way of pyrolysis where pyrolysis takes place with generation of heat. While modern pyrolysis techniques suppress fire, the Pyropower solution follows traditional way of producing biochar while generating useful heat. The technology can be scaled to accommodate larger amounts of biomass. The biomass that can be used in the kiln can be highly varied which makes the kiln flexible considering input of biomass.

The technology proposed to Unwaste consists of a pyrolysis chamber, a screw conveyor to dry coffee grounds, a heat exchanger to transfer heat from pyrolysis chamber to screw conveyor, filters for flue gases, control valve and sensors to regulate temperature. The dried coffee grounds are used in the pyrolysis chamber for pyrolysis. Once the pyrolysis starts, the flame arrester helps to keep the flame stable and direct the energy towards heat exchanger. The heat exchanger convert flame heat into suitable form of energy and directs the heat towards screw pyrolysis chamber where wet coffee grounds are kept waiting to be dried. Based on the motor speed, coffee grounds are subjected to heat to regulate moisture content. Some of the dried coffee grounds are again directed towards pyrolysis chamber to be used as a biomass for pyrolysis. Biochar formed comes out of the chamber and dried coffee grounds take place of biochar.

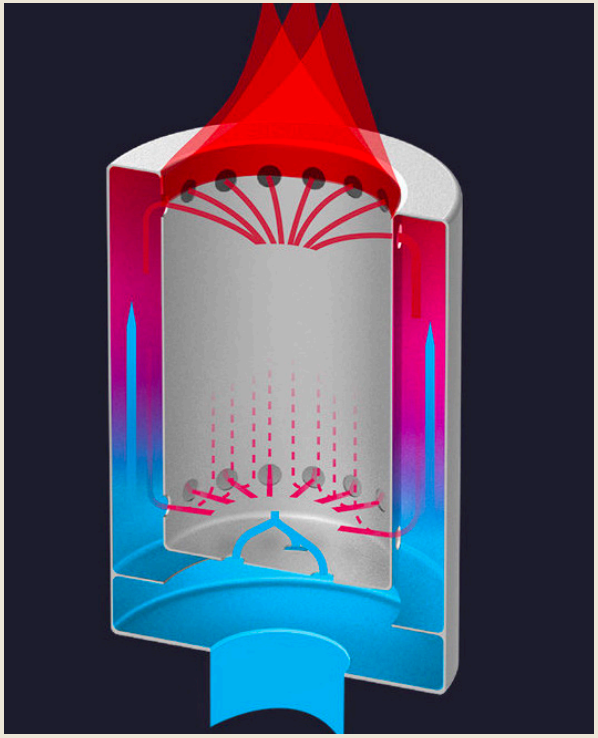


Figure 15: Working of a gasifier

Opportunity for biochar production technology

Cost of biochar production using modern technologies is higher as an inert atmosphere has to be created and a lot of parameters have to be controlled to make sure a consistent biochar quality is formed. In these technologies, heat is provided externally, using electricity or any other means which makes the process of controlling temperature parameter easier. On the other hand, these technologies can separate the by-products of pyrolysis from biochar, can automate the whole process and can follow continuous production methods. Pyropower follows traditional way of producing biochar which undergoes batch production. Controlling parameters in traditional method is difficult and most of the times, the energy of by-products is utilised to generate more heat energy. Accordingly, there is an opportunity to develop a technology which eliminates the drawbacks of both technologies and is built to provide the best of both worlds.

Biochar

Biochar is an outcome of pyrolysis of organic matter which is a carbon rich compound, along with Phosphorous or other metals such as Calcium or Magnesium and sometimes Nitrogen also. As the process of biochar production involves pyrolysis, an oxygen-intert environment, the carbon is sequestered in the biochar. Biochar production is thus one of the most efficient ways of sequestering carbon from the environment (Levitan, 2010).

Biochar's physical and structural properties are highly influenced by the process used for production and the parameters chosen. The resulting interaction of biochar with soil will highly depend on these properties induced. In turn, this interaction will lead to unique soil properties such as porosity, density, particle size distribution, packing. These properties will increase the crop yield as the porous nature holds water and air particles in them, near the root of the plant. The parameters which decide biochar quality are the heat rate, biomass characteristics and maximum temperature attained. The biomass contains high fixed carbon content and due to the lower heat rates, biochar starts forming at lower temperatures where exothermic pyrolysis reaction begins (Lehmann, 2017).

Biochar used as an additive to compositions mixture in the range of 6% to 50% enhances the quality of final compost. The properties of biochar such as porous structure, large surface area, water holding capacity interact with composting mixture which helps to enhance the quality of compost. (biochar manual) As described by Hans Peter Schimdt, biochar can be used for 55 different applications which can be classified into 10 main sectors (Schmidt, 2013)-

1. Animal farming
2. Soil conditioner
3. Building sector
4. Decontamination/re-mediation

5. Biogas production
6. Treatment of waste water
7. Treatment of drinking water
8. Divers other use
9. Textiles
10. Wellness

Considering technological perspective, biochar is most suited for agricultural field or gardening or for re-mediation of soils. Considering value generated, biochar is most valuable for fuel cells, 3d printing and gardening. Considering volume needed, large volume is needed for building materials, packaging materials, agricultural field and for livestock. Very less amount of biochar is needed for gardening and fuel cells (Finger Lakes biochar, 2015).

Biochar is a relatively under-explored field and with advancement in technology and research, true potential of biochar can be achieved. The current context directs biochar towards agriculture field as the other fields are either less explored or have shown negative impact or end up with the soil only. The applications are explained in next section and appendix 6. Considering the current context, still, agriculture remains one of the major application of biochar.

Carbon credits, rules and regulations for biochar

Biochar is a field still under exploration, which also makes it less flexible to use under different circumstances. The current use of biochar is regulated by governments as the effects of it are still studied. This section describes the regulations for biochar in European continent, if biochar is used for agricultural purposes.

Regulations in the Netherlands-

The 2008 regulations on organic production and labelling of organic products did not mention biochar as a fertiliser which complies with organic production which caused biochar producing companies to acquire license for biochar trade. Recent amendment to the regulations allowed biochar to be considered as a product which complies with organic production but with some regulations. As described in the commission implementing regulation (EU)2019/2164 of 17th Dec. 2019, biochar is a pyrolysis product made from wide variety of organic materials of plant origin and applied as a soil conditioner. The regulations states that the biochar has to be produced from plant materials, treated or untreated with pesticides for plant protection (which are mentioned in Annex 2 of Commission Regulation No 889/2008). Apart from that, the 2019 regulation also mentions a maximum value of 4 mg PAH (Polycylic Aromatic Hydro-carbons) per kg dry matter. This value has to be checked every 2 years considering the multiple accumulation sources of PAH.

Rules related to production of biochar and certifications

RHP certification helps to prove the substrates, fertlisers, composts or any other growing media
EBC certificate for biochar is a quality product in Netherlands and European countries (RHP, 2020). The certification does not provide any solid regulations for biochar production but is more based on substrates it is used in and the quality of substrate rather than the biochar as a product.

European biochar certificate provides a guideline for producing biochar in Europe and its uses in agricultural field or as a feedstock or in any other application. The guidelines are developed by European biochar foundation, Switzerland, in 2012 and has been constantly updated over the time. The EBC certificate aims to guarantee sustainable biochar production, processing and sale (Ithaka institute, 2020). It is introduced to provide customers a reliable quality basis while giving producers a proof that their product meets a well defined and recognised standards.

The EBC certificate states following guidelines for production of biochar, which can form guidelines for Pyropower to develop their technology.

1. Only organic substances can be used for production of biochar.

2. Plastic or any other inorganic materials are adequately removed from the biomass

3. Feedstock must be free from paint solvent or any other chemicals or contaminants

4. Biomass grown only in Europe to be used for biochar production. In case of Pyropower, the biomass comes from coffee waste which does not follow the guideline. But upon further research, it is found that the guideline was created to make sure that the biomass is generated at a close location to reduce carbon footprint caused by transportation of biomass. Also, the guideline is proposed to make sure that the environmental systems in developing countries are not exploited for biomass. Although, Pyropower is reaching out to Peter Hans Schmidt, a professor from Ithaka institute, Switzerland who formulated the guidelines.

5. Complete records of feedstock must be kept.

Considering biochar quality, several conditions apply for a certified biochar production-

1. The pyrolysis temperature in degree Celsius should not fluctuate more than 20% in the system.

2. Interruption of production is allowed as far as production parameters are kept same after restarting the production.

3. Continuous recording of temperature is expected for quantities more than 50 ton per year.

4. The composition of biochar should not change more than 15% based on feedstock mentioned by the EBC.

The new technology to be proposed should be capable of producing a biochar using a process which follows all the guidelines mentioned by the EBC to produce a quality biochar.

Carbon credits system-

Currently, Puro.earth, a company which trades carbon credits on an online platform. The company has developed a platform for companies who want to buy carbon credits as well as sell carbon credits. The platform brings together suppliers of carbon net-negative technologies and climate conscious companies. Puro.earth offers a service of measuring the total carbon emissions of a company and helps the environmentally conscious companies to reach carbon neutrality. The company measures carbon emissions using life-cycle analysis tools, in which the company considers cradle to grave as a system boundary. The company offers a certificate- CORC (Carbon Removal Certificate) which is a measured amount of carbon captured and is verified by their partner DNV GL (an ISO certification company). The price of the certificate depends on the carbon captured, which in turn depends on biochar quality- carbon captured in it.

3.2 External analysis

The external analysis looks at the factors in the market that can affect the business of Pyropower. In this section, the market of biochar as well as biochar related companies is analysed. The experts from the field as well as actual farmers are interviewed to understand their views about biochar.

3.2.1 Market analysis

Pyropower, being a startup in the field of biochar system, needs to look at the future of biochar industry and industries related to biochar to make sure the future looks promising for startup. The section, thus looks at markets related to biochar and other promising markets to understand the future prospects of biochar systems.

3.2.1.1 Biochar market-

The global biochar market is expected to reach USD 3.82 billion by the end of 2025 at an annual growth rate of 14.5% per year (Zion market research, 2019). The demand of biochar in 2018 was 395 kilo tons and will be increasing in the future. People shifting towards organic product consumption and biochar's ability to help enhance soil productivity will be the major forces behind the increasing demand of biochar. The biochar industry can be divided into organised and unorganised sectors, where organised sector contains few very large companies dealing with biochar and unorganised sector contains small to medium companies working in the field of biochar. The number of small to medium size companies in the field of biochar is rising in European continent. The lack of advanced technology needed to produce high quality biochar has forced some companies to exit the market place of biochar (grand view research, 2019). According to the Grand view research, and research carried out, the full potential of biochar and value created in fields other than agriculture is yet to be discovered.

3.2.1.2 Waste management and energy in Europe-

Of the total waste produced in European continent, only 1% accounts for agriculture related waste and 8% accounts for household related waste. The share of municipal waste has decreased in the Netherlands since 2004 and almost 53% of the municipal waste has been recycled and composted. Considering Europe, almost 47% of total municipal waste is recycled and composted (Eurostat, 2018). As found out by ECN (European Compost Network), still almost 27% of organic waste is incinerated in Europe. Projects like are proposed and ongoing which relate to using waste as a source of energy (ECN). To reach the European target of recycling 65% of municipal waste, it is crucial that recycling of bio-waste takes place. EEA (European Environment Agency) identified the method of pyrolysis to convert biomass into higher value chemicals but also adds that more developments are needed to make pyrolysis economically viable option to treat the bio-waste (EEA, 2020).

3.2.1.3 Organic farming-

Recent production and market trends show the importance organics has gained over the last decade. Organic farming responds to specific consumer demand of sustainable products, promoting more sustainable farming processes contributing to protection of environment and improved animal welfare. EU organic area increased by 70% over the last decade with retail sales reaching EUR 34 billion in 2017.

However, the yields on the organic fields is lower than the conventional farming methods. These yields range between 40% to 85% of conventional farming methods. The significant yield gap is compensated by price of organic products. This range is largest with wheat, which has a yield of 40% in German organic farm and has a yield of 85% in Italian organic farm. The organic yield gap leads to variations in profit. This suggests that the innovation in farming practices and research could help with bridging the yield gap. Although the margins on organic products is higher and value added is also higher than the conventional farming methods.

Health concerns are the main driver behind using organic consumption along with environmental benefits. The growing concern regarding overuse of pesticides and chemicals have a negative effect on health is reorienting the society towards more natural alternatives. The intention to actual purchase remains triggered by level of income as well. The strong growth rate in the field of organic farming and the consumption of organic products show that the field hasn't yet matured and further growth is still to be expected (DG agriculture, 2019).

Increasing size of biochar market around the world and Europe is an opportunity for Pyropower to go ahead with the project. At the same time, it becomes an attractive opportunity for other entrepreneurs also to enter the market. On the other hand, increasing recycling of waste is an opportunity as well as a threat for Pyropower. It becomes an opportunity as more compost will be available which when mixed with biochar, enhances soil productivity for longer time. The increase in recycling of bio-waste becomes a threat as if all the bio-waste is recycled, then Pyropower will have to shift to non-organic waste materials for biochar production. The field of organic production is rapidly growing which is an opportunity for Pyropower to introduce biochar in the field as biochar itself is an organic substance and can be mixed with organic fertilisers before the application in the field.

3.2.1.4 Applications of biochar

The biochar has several applications which can be classified into 8 main sectors-

1. Animal farming
2. Soil amendment and agriculture related
3. Construction industry
4. Water treatment
5. Treatment of waste water
6. Treatment of drinking water
7. Divers other use
8. Textiles and wellbeing

The use of biochar in some of these sectors is explained in Appendix 6. The biochar applications are compared with each other using the axis of value created and implementation of biochar, it is evident that agriculture still remains as one of the high value sector with immediate implementation. The Figure 16 shows comparison of different sectors in which biochar can be used.

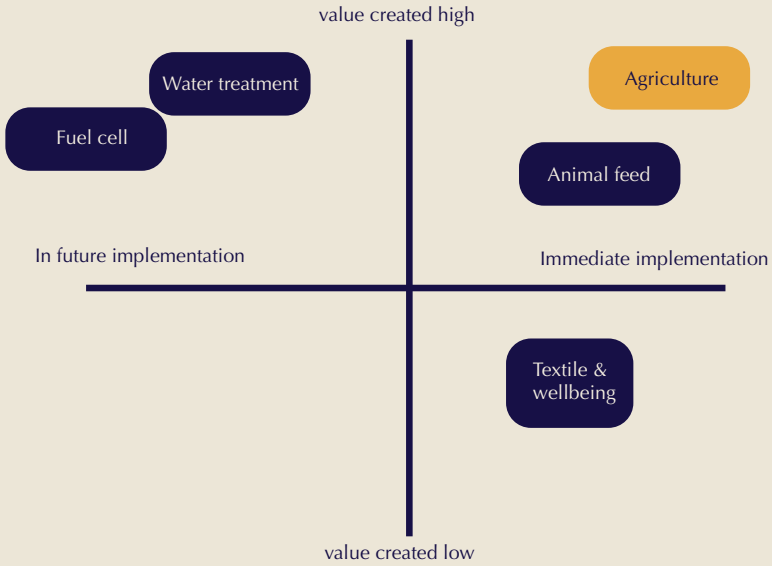


Figure 16: Application sector comparison

3.2.2 Competition analysis

Biochar systems is a vast industry and so, while considering competition, a balance has to be maintained, to not to select too many competitors or very few competitors. For the scope of project, companies around the European region are only considered, which serve the European market. The competitors are analysed by the levels they resemble or offer a similar value to customers.

3.2.2.1 Level of market competition-

Each level in the competition set gets broader in perspective with one level exactly resembling Pyropower's solution and with next levels, the perspective gets broader. Figure 17 shows the biochar as a product competition within European market.

Product form competition-

The first level of competition is based on value propositions exactly same as Pyropower or serving the same customer as Pyropower is serving. This includes a biochar selling companies with a focus on agricultural field. These companies have similar features and value and they are labelled under the name 'biochar for agriculture'. The companies operating in this field are -

- carbon gold, UK
- Etia technologies- biogreen energy, France
- Oxford biochar technologies UK
- Biofire Sia Latvia

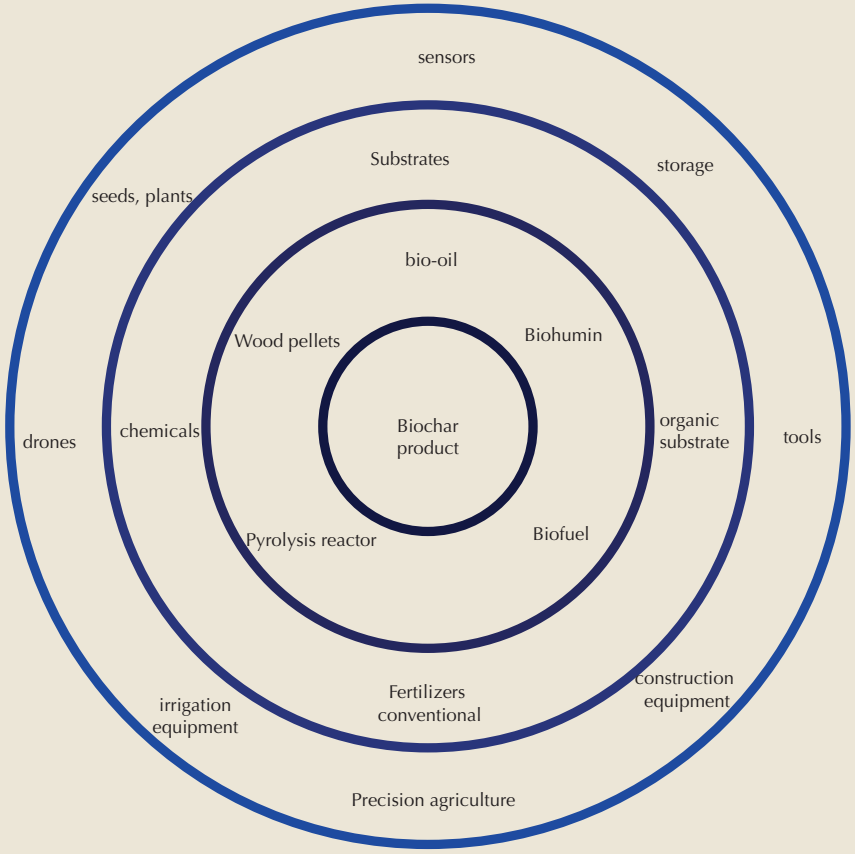


Figure 17: Biochar market competition

Product category competition-

The second level of competition is based on companies which produce biochar but use biochar for applications other than agriculture related. The biochar in this level can be used for construction purposes, or for cosmetics etc. For this level, it is relatively easy to enter the market Pyropower is aiming for. They are labelled as biochar based products. The companies active in this field are-
- Clean Electricity Generation (CEG) Amsterdam
- Biophenol
- Pyreg gmbh

Generic Competition-

This level of competition offers a completely different product but can fulfil the same customer needs. Hence, although offering a different value proposition, the product of this level provide customer the same level of benefit. In case of Pyropower, these companies are the ones who produce substrates or fertilisers for use in agriculture. Here, they are labelled as soil improvement products. Substrates manufacturers from Netherlands, organic as well as conventional form a competition, unless Pyropower decides to collaborate with an organic fertiliser company. Such companies include-
1. BVB substrates
2. Culterra holland
3. Farmofeed Netherlands
4. Nutrichem chemicals Netherlands

Budget competition-

The last level focuses on solutions which compete solely on the economic factor. The consumer considers this competition as an alternative to the Pyropower's proposition. It gives the consumer another field to invest the money into. They are labelled as agricultural products.

3.2.2.2 Porter's 5 forces-

The model is developed by Porter and it helps to understand the underlying structural factors affecting the field of biochar. This analysis helps to understand dynamics on the category level.

Threat of new entrants-

The threat of new entry is a fact that the position of a company can be weakened by new entrants in the same market. The threat of new entrants in the same market is considered to be high. For biochar, the market is still evolving and new entrants will enter the domain of biochar as it still shows new opportunities. In the present context, the best way to implement the technology is through the agricultural field and so, any new entrant trying to enter the market will first think about a similar model. Producing biochar is not that difficult and capital needed is relatively small. Still, the new entrant has to get to know the biochar market and has to gain their trust for selling biochar. The technology that is proposed by Pyropower has little protection to it which can be beneficial for the new entrant. So, threat of new entrant in this case is considered to be high.

Bargaining power of suppliers-

Supplier power is determined by how easy it is for a supplier to increase his prices? Bargaining power of suppliers is considered to be low. The input to pyrolyzer comes from Unwaste itself which means as long as Unwaste wants dried coffee grounds, a part of dried coffee grounds has to be put inside the pyrolyzer. The parts of technology used to develop the pyrolyzer are also, pretty common which leads to less bargaining about the manufacturing of technology. The platform is operated by Pyropower employees only so, bargaining power of suppliers is considered to be low.

Bargaining power of buyers-

This bargaining powers talks about how easy it is for the buyers of Pyropower to switch to the rival of Pyropower? Bargaining power of buyers is high. Currently, there are many other options available which can be used as a fertiliser. The cost of biochar is also relatively high. So, buyers can fulfil their temporary needs with the other product which has lesser price but has slightly lesser quality. Also, a competitor of Pyropower, carbon gold is working in the same field which gives buyers an immediate solution to look

towards. Hence, bargaining power of buyers is considered to be high.

Threat of substitution-

It is a likelihood of the Pyropower's customers finding a different way of what Pyropower is doing. In case of Pyropower, is there any other way for people to solve the issue of improving productivity? Pressure from substitutes is judged to be high in the Pyropower's case, due to that fact that biochar is costly and organic/inorganic fertilisers are available in the market at a relatively lesser costs.

Competitive rivalry-

Competitive rivalry looks at the number and strength of Pyropower's rivals. In case of Pyropower, the competitive rivalry is high. Some of the competitors already have an established business in the field of biochar production and sales. The competitors also have certification for biochar products which Pyropower is working towards. In such a case, Pyropower seems to be lagging behind their rivals. So, competitive rivalry is high for Pyropower.

The porter's 5 forces help to understand the competitiveness of the business environment and for identifying strategy's potential profitability. In case of Pyropower, 4 of the 5 forces are indicated as high threat environment which is a bit alarming. At the same time, they form an opportunity for Pyropower to work on and build relevant strengths.

High new entrant threats immediately affects the position of Pyropower, which is expected, considering Pyropower is a new startup in the field of biochar. This also shows a direction for Pyropower to work on their brand value and customer relations to gain a place in the market.

High bargaining power of buyers leads to lower and lower margins and a constant threat of loosing a customer to the competitor. Pyropower has to gain a deeper understanding of their customers and create new value propositions that will build a characteristic product than can make a difference in purchasing process.

High threat of substitution asks for a long term planning on how to maintain and attract consumers towards the Pyropower's offer, how to convince them that the solution offered is better than what is available in the market.

The current degree of competition Pyropower will face calls for rethinking of the unique selling points (USP) of Pyropower value proposition. The new USP should be strong enough to differentiate the Pyropower's offer from their competition. This is also important so as to keep marketing expenditures within limit and do not face any price eruptions.

3.2.3 User analysis

The initial stage interaction with possible group of customers, industry specialist, professor and innovation officer was carried out to explore the field of biochar and future through their eyes. These people were interviewed to understand their practices, their pains, their plans and what they think about biochar and future of farming. Accordingly, an understanding of biochar is built using their views which are explained in this section. Figure 18 shows overall information of the interviewees.

Interviewee	Interviewee role	Setting	Intention
Organic farmer	Farming	Informal	Understanding farming methods, pains, plans, biochar information
Organic farmer	Farming	Informal	Understanding farming methods, pains, plans, biochar information
Organic farmer	Farming	Informal	Understanding farming methods, pains, plans, biochar information
Organic fertiliser company	Founder	Phone interview	Views about biochar, viability aspect of biochar
Urban development company	Chief innovation officer	Virtual meeting	Future of agriculture, urban cities
Wageningen University of Research	Expert on biochar	Virtual meeting	Suitability of biochar in European context

Figure 18: Interviewee information

More and more farmers moving towards organic farming

2 of the 3 interviewees talk about the increase in number of organic farmers in their neighbourhood. The interviews were informal, and the help of a native dutch person was taken, to form the initial contact with the farmers. The duration of the interviews was 15-20 minutes considering the farmers were working. One of those interviewees owns a cattle farm whereas the other has cattle as well as vegetable farm. The third interviewee, owns a small organic farm Delft and supplies his harvest to the restaurant which is right across the road. He has been trying organic farming methods for past 4-5 years and do not use any conventional fertiliser. He uses one of their shelters for composting purposes. The organic waste is left to compost in the shelter and that compost is again applied to the soil. He has been working at the farm for more than 4 years now and he said he noticed a difference in productivity of the farm. Along with the use of compost, they also change the site of planting a specific crop in a cyclic manner. According to him also, more and more people are shifting to organic farming because the benefits now are noticeable. The organic farms have their productivity on the rise whereas conventional farming methods have caused some of the farms to decrease the fertility. In a way, he himself has a small circular economy implemented at his farm.

What is biochar?

During the talks with farmer, they were asked to answer one specific question about biochar and the question was simple- 'what do you know about biochar?' and the answers received were in the same line- 'what is biochar?'. This leads to another question 'How are we going to sell biochar to people who don't know anything about biochar?' May be there is a need of putting biochar out in front of people first before directly selling it to them. Or is it the wrong consumer segment selected? May be the consumer for biochar is someone else and we are targeting someone else?

Biochar is not a soil conditioner. What value does biochar add in the soil?

A talk with an organic fertiliser company revealed his perception around biochar. According to him, biochar does not add any value in the soil and so, there is no need to add biochar in the soil. Adding only organic fertiliser will do the same job without biochar. To state, 'Frankly, I am not a big fan of biochar. I have organic fertilisers which can provide better nutrition to the crops, then why should I choose biochar?' Till date, biochar has been considered as a soil conditioner but looking through the eyes of organic fertiliser company, it can be seen that the biochar does not act as a conditioner in any way. If every notion related to biochar is removed, the only property that remains with biochar is its very small tubular structure made of carbon which holds the nutrient together for longer duration of time. So, rather than saying that biochar is a soil conditioner, is it the time to re-brand biochar to something it truly is?

Biochar at what cost?

The usual cost of biochar ranges from 80 Euros to 2500 Euros or even more, per ton. 80 Euros biochar is relatively low quality biochar, whereas the quality increases with increase in price of biochar. As per the calculations made by an expert, a farmer gets 700 kg of carbon in 1 ton of biochar at a cost of around 400 Euros. On the other hand, the organic fertiliser company offers another fertiliser which contains 450 kg of carbon in 1 ton of chicken or pork manure which comes at a cost of 150-200 Euros. These cost related information was revealed while talking to the founder of a organic fertiliser company. The founder was not a big fan of biochar, as, for him, there were better available solutions to increase productivity. In his opinion, paying extra 200 Euros for another 250 kg of carbon is not justifiable. In which case, do we need to reduce the cost of biochar to make it an attractive opportunity?

People want temporary solutions for productivity of soil

The statement might seem debatable but when

it comes to fertilisers, the company has this conception that people want fertilisers only when the fertilisers are necessary and they want to see an immediate effect on the crop yield, within next 90-120 days. After which, people again refurbish the farm with new organic fertiliser. Every time the organic fertiliser is mixed with soil, some part of nutrients available in the fertiliser is lost due to emissions such as nitrogen. This information is pretty much known everywhere. Addition of biochar to compost has shown immediate effect by decreasing the nitrogen emissions. In such a case, is it true that people want temporary solutions or they don't have an option?

Why this should be trusted?

As of now, biochar is a hefty investment, due to the cost of biochar. Farmers have to pay a large sum to apply biochar in their farms and there is no way to test the credibility of the biochar except for the eyes, and scientific examinations after several months. In a way, application of biochar forms an unpredictable burden on the farmers chest. Case studies are specific to a certain farm and under some control contains whereas application of biochar on large scale is completely different. What can be the solution in this case?

The future is about local communities and economies

Future is about development of small cities and building a local communities, having their own economies and following all the rules from Earth chartered cities (a manifesto of principles for urban sustainable development), seemingly utopian conditions which will need radical changes to existing systems and conventions. The cities will be developed for humans and not cars, where the only moral question is 'does our children have a world to live in?'

The interviews were taken to understand the overall opinion of people on agriculture, future of agriculture, future of cities, biochar problems, agriculture related problems, experts views on biochar. The interviews reveal information that was earlier not available. It can be seen that biochar is not a trusted compund which can be used for improving soil health. If is considered as a compound, then it has to compete with organic fertiliser, in which case, biochar falls short as organic fertlisers are manufactured by mixing components. If the biochar is to be used at agriculture, then it will cause high initial costs, which might not be suitable for farmers and overall, not many farmers know about biochar. On the opportunity side, it is found that the future is about these small communities and economies which try to strive on their own and farmers are shifting towards organic farming more and more.

Conclusion- deconstruction phase

The deconstruction phase helped to understand current as well as past context around Pyropower, biochar etc. The insights are mentioned below.

Pyropower is a new entrant in the market, which already has established companies serving the market. From Porter's 5 forces analysis, it was found that 3 of the forces are high.

From interviews, it was found that high cost of initial investment for biochar can be a problem, along with acceptance of biochar instead of organic fertilisers. On the bright side, more and more farmers are moving towards organic farming, which can create demand in future.

Considering other applications of biochar, agriculture still remains the best suited sector for application of biochar.

Pyropower is a new startup in the field of agro-innovation, which believes in 3 pillars- empowering community, circular economy, biochar and energy.

The past projects of Pyropower show that the company helped people to solve their problems collectively.

The deconstruction phase leads us to the blue ocean creation in which, after considering the insights from deconstruction, a new market is identified which the company can target its activities towards.

Chapter 4

Blue ocean creation

Blue ocean creation

After the deconstruction phase, the blue ocean creation part identifies a new market for Pyropower to enter into, which has the potential to successfully introduce Pyropower. Blue ocean strategy tool is developed by Chan Kim and Rennee Mauborgne which helps to identify uncontested spaces for businesses to enter (Kim, 2020). Before going to blue ocean strategy, A Strength-Weakness-Opportunity-Threat analysis is carried out to understand capabilities on which the blue ocean strategy can be based on. Later on, the blue ocean identified is explained, which directs the next chapters within the project.

4.1 SWOT analysis

SWOT analysis involves collection and portrayal of portrayal of information internal to the organisation as well as external to the organisation, which can or has impact on the business, which puts the organisation relative to other organisations (Pickton, 1998). Strengths and weaknesses represent the internal aspects of the company whereas opportunities and threats represent the external aspects of the company. Strengths are the characteristics that give a company an advantage relative to the other company whereas weaknesses are the characteristics that put company at a disadvantage relative to others. External development that can be possible markets or provide a chance to company to enter are the opportunities and external aspects that have the potential of harming the business of the company are threats. The SWOT is relative, as such, some strengths can be perceived as weakness as well as some opportunities can be treated as threats by someone else too. In the end, the research question will steer the direction.

Strengths

As of now, considering Pyropower is quite new initiative, Pyropower needs to establish itself in the market. The current collaborations with coffee consortium, in this case, become a strength for Pyropower as they help Pyropower enter the new market. Pyropower uses a technology which follows traditional way of biochar production, with energy and biochar as an output, which is a strength for Pyropower as the other reactors have to be supplied with energy to produce biochar. The design of the pyrolyzer for Pyropower is quite simple as compared to other pyrolysis equipments. This simpler design reduces the cost of development as well as, makes it easier to use. The scale at which the kiln can be implemented can be easily changed, which makes the technology customisable, and so, specific needs of customers can be catered. As Pyropower is a new startup, which as of now, can afford to fail, exploration of new markets is among one of the strengths.

Weaknesses

As stated earlier, SWOT matrix is relative, where a strength can also look like a weakness. In case of Pyropower, the technology that Pyropower currently has, cannot control the parameters of Pyrolysis which leads to inconsistent biochar quality. As Pyropower is a new entity in the market, Pyropower has lesser credibility and brand trust which leads to less acceptance towards Pyropower's solutions. As of now, Pyropower does not have a unique selling proposition and Pyropower is exploring the existing biochar markets to look for opportunities. As well as, the stand Pyropower takes in other countries, is not really clear with European project, leading to ambiguous stand for customers as well as Pyropower. The activities within the startup are a bit disorganised, where dedicated teams are not working on projects leading to slow progress in projects and confusion with roles. As Pyropower is quite new in the European context, the context is not completely understood which can lead to assumptions for European project based on the other projects. Biochar that is produced through pyrolysis by Pyropower is not yet certified which leads to less trust among consumers about the quality of the biochar.

Opportunities

As Pyropower is the new entrant, it can look at how to make use of digital aspect and change the value they are offering in the market. People who think organic farming is the future practice, can be a potential customer in the case. Combining the traditional technology of biochar production with modern technology to innovate will lead to better quality of biochar with added advantage of energy. The investment for farmers, willing to use biochar for farming is high, so, Pyropower can look at ways to reduce the high initial investment for farmers and make biochar an attractive opportunity for them. Biochar as of now, has less trust among farmers, as the proof of the concept is not yet there, as well as, biochar, in the market, is compared with other soil conditioners which are sometimes better than biochar. So there is a possibility that biochar can be re-branded to make sure that it forms a distinctive position in the market, where it will not be compared with other solutions.

Threats

More and more farmers are moving towards organic farming but at the same time, population is also increasing, which means that the food production has to increase. To increase the food production, if farmers discard the traditional way of farming, and if they select conventional farming, then Pyropower will loose it's business.

At the same time, as the technology is quite familiar to many, it is always a threat that a competitor will easily subside the technology of Pyropower which leads to problems for the company. The trust issue also forms a threat as, if people are not trusting biochar, then they will not be interested in buying it.

4.2 Blue ocean- ERRC framework

Looking at the swot analysis, certain factors are quite distinctive considering Pyropower which can be used to create the distinctive position Pyropower needs. For creating the position, blue ocean strategy framework is used. The Eliminate-Reduce-Raise-Create framework (ERRC) is used which allows to create a blue ocean opportunity for Pyropower. The ERRC framework tries to eliminate existing competing factors, and create new factors, raise certain factors above industry standards while reducing certain factors below industry standards (Kim, 2020). Figure 18 shows an ERRC framework used in this project. The framework helps with simultaneous pursuit of low cost and differentiation, helps companies to stop the continuous pursuit of development and creation and helps them to select a path to new market. It is easily understood by people in the company and by following the

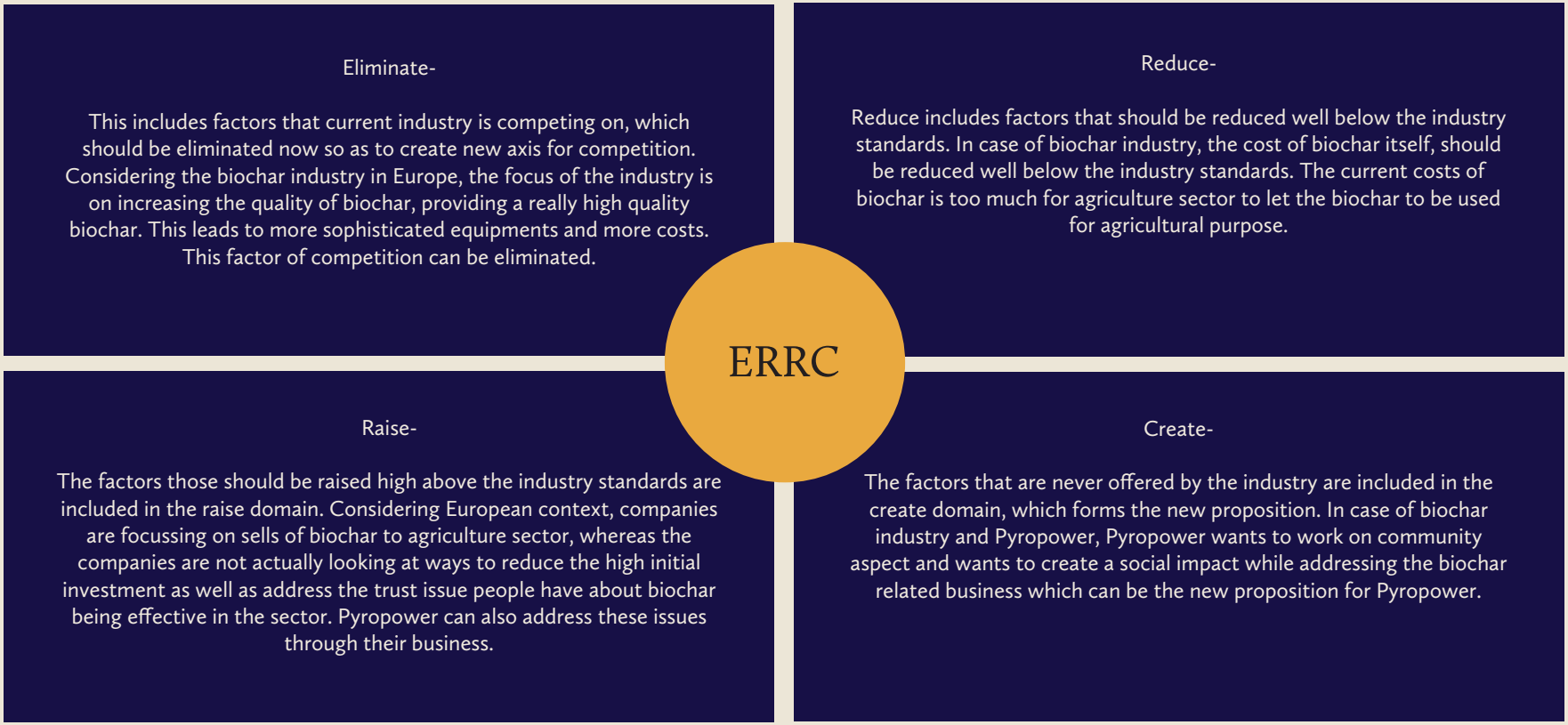


Figure 18: ERRC framework

framework, company learns newer things about the market. The ERRC framework thus provides a basic direction for Pyropower which can lead to differentiation and low cost simultaneously, while being connected to their other projects. Although, it has to be detailed more to make it a suitable direction which can guide Pyropower's overall efforts. The framework shows that the solution Pyropower will propose, should focus on reducing the cost of biochar, focusing on trust and financial issues related to biochar while addressing community aspect in European market.

By following the framework, Pyropower will move towards production of consistent quality biochar at a low cost, application of biochar systems in agricultural sector, while addressing trust issues and investment issues related to biochar, while also proposing new solutions to create a social impact through the solutions. Looking at these factors and zooming out, certain values become prominent. By pursuing this direction, Pyropower will be providing solutions to people, which will bring people together, the solutions which are based on biochar systems. In other words, Pyropower provides solutions which bring people together to act for betterment of their surroundings as well as environment. For Pyropower, a vision statement can be 'carbon negative solutions to bring people together to build a better community'.

'Carbon negative solutions to bring people together to build a better community'

The red ocean

If level of the competition faced in the market is high, the market can be identified as red ocean. Considering the market Pyropower operates in, the market already has many established competitors which is why, the current market of biochar can be called as a red ocean.

This red ocean currently is driven by the quality of biochar and costs. Multiple companies are producing their biochar and trying to sale in the market, and based on the technology used, the cost is changed. Pyropower in this case, will already face problems related to quality of biochar and technology used by Pyropower. At the same time, there are other issues related to biochar which are still unaddressed.

4.3 Blue ocean- The Community Supported Agricultures

This section is dedicated to understanding the community supported agricultures. The chapter also talks about how the biochar system can be implemented in the context of an agricultural community. Accordingly, Community Supported Agricultures (CSA) were selected as a target group as they match the Pyropower's vision of implementing biochar systems with a focus on communities. The chapter starts with introduction to CSA followed by working of CSA and value generated by CSA for consumers. The problems discussed with CSA form an opportunity for Pyropower to introduce the new service and technology in the regime of CSA. The next chapter, then, takes us through the steps for implementation of the service and technology in CSA.

CSA Community Supported Agricultures

Community supported agricultures are the groups of people who come together with a farm in the vicinity, to share the costs of farming, and farming activities and as a return, they get a share of the produce from the farm (Volz, 2016). The idea that was originated in Japan, is now considered as one of the main alternatives to traditional farming methods as it goes beyond the usual boundaries of producer and consumer. It is about the direct relationship between consumer and producer with an emphasis on local production and ecological sustainability and economic viability and about local production (Vijfeijken, 2015). CSAs not only help with sharing the costs of farming and sharing of farm produce, but also develop a dedicated community which is dedicated towards the biodiversity, landscape, new culture and modernity. CSAs create new rural as well as urban spaces for agroecological and organic products and also showcase the commitment to a sustainable development in Europe.

"What is needed is a new creation of the imagination that is of unprecedented importance..., a creation which would put at the centre of human life other meanings than the mere expansion of production and consumption ' (Castoriadis 1996)

The first ever CSA in Europe was formed in 1976 in Switzerland and since then, the number of CSAs is ever increasing. It is estimated that there are 2783 CSAs operating in Europe in 2015, producing food for almost half a million people. In Netherlands, in 2015, there were 47 CSA and now, there are 90 CSAs operating as reported by Urgenci (Klingen, 2020) with a bottom-up approach of development. The numbers are still accelerating with more and more people interested in such initiatives. Although, such initiatives are regarded as 'not for everyone' which makes them a niche sector due to various factors.

In its core, CSA are a contract based relationship, in which consumers agree to pay an annual/monthly or weekly fee to farmers for a share of fresh produce at their farms for the specified time. This type of commitment is advantageous for both the sides, for farmers, it brings loyal group of consumers, who, together, share the risk of food production for a long duration so that farmers can primarily focus on food production. Consumers get a weekly share of harvest and the knowledge about where their food is grown and under what conditions, giving them a feeling of consuming healthy and being responsible for the health. This idea of buying from local started due to the context of 'capitalisation of food' where, intensifying food production led to environmental degradation, increased injustice, oligarchical decision making structures (Shiva, 2000). Over the time, it also showed people's need for a community and connection with the food they eat, while maintaining the biodiversity and supporting environment. Environmental minded people enjoy visiting the farms with their children and meeting other like minded people.

CSA in working-

In Netherlands, the CSAs are developed with a bottoms up approach, with specific solutions for specific communities and there is no central governing organisation for CSAs. Although, in 2014, the first 'Food Otherwise' conference was held at Wageningen University of Research which focused on local food networks, agro-ecology, fair trade policies. The duration of contracts made for CSA depend on each CSA and can vary from months to years. Once a membership is created, members are entitled for a weekly food produce harvested at the CSA. The mode of delivery can be different for different CSA, in come cases, the harvest is home delivered and in some cases, members have to visit the CSA farm to collect or sometimes pluck the harvest at the farm. Some CSA have designated pick up points, where weekly harvests are distributed to the members. Most of the times, members of CSA are from a local area, close to the CSA farm which makes it easier for CSAs to distribute the harvest. Some of the CSAs, due to the current trends related to waste management and circular economy, have already started collecting and using the organic waste of their members for agriculture related activities. For the purpose, every week, a van goes around the locality to collect the organic waste and then the waste is used for composting purpose. The basic of CSA is based on using organic methods to produce the food items, for better nutrition and less effect on environment.

'If there is one problem for which we (CSA) offer a solution, it is that consumers don't trust their food anymore. By starting a local initiative, it is possible to regain this trust' (Vijfeijknen, 2015). With CSA consumers will be able to know where their food is coming from, who is producing it, in what condition it is being produced. Knowing that the food is being produced at a local farm, knowing about the production methods and being able to contribute to the production will increase the trust factor in members.'

Meetings at CSA are dependent on the CSA community members. Sometimes, the meetings are annual whereas sometimes, they can be weekly. The involvement on community members in CSA also differs based on the CSA type. Sometimes farmers are responsible for the harvest, sometimes the responsibility is shared between consumers and farmers. Volunteers actually work on the farm on some days to help farmers with the harvest. As of now, Urgenci is the organisation that works as an umbrella organisation for CSA related activities and other agro-ecological initiatives in Netherlands and Europe.

CSA are 'not meant for everyone'. Some CSA think that urban people might not be willing to participate in such initiatives due to the countryside location of the farm and due to the less interested urban population. On the other hand, Vijfeijken showed multiple reasons to enrol in a CSA in figure 19.

Figure 19: CSA advantages- disadvantages

The methods that are used at a CSA farm are mostly organic, which means no use of conventioal fertilisers to improve yields of crops. Due to the traditional ways of farming, the yield of a CSA farm is lesser than the commercial farms. In other words, for the same amount of output, less land is used with conventional farming when compared with a CSA. Often, initiatives such as CSA are considered as a step backwards as the world is looking at ways to improve productivity of farms to feed the expected 9 billion people.

CSA delivers fresh food basket to consumers but the food basket is already chosen based on harvest leading to less choices for consumers. According to a survey carried out by a CSA in US, Harvie, the top 4 reasons for members to leave CSA are related to choices. As the basket depends on harvest, the members of community don't really have a choice to select other produce, leading to dissatisfaction and un-enrolment from the CSA (Huntley, 2018). 41% members of Harvie mentioned that they wanted more choices in a basket, with more variety. Almost 23% member told that the basket was insufficient, and wanted to decide more on the frequency or quantity. Some members have also mentioned that the product that was not favoured, rotted in the refrigerator and some members, even after getting the basket, shopped at a grocery store.

On the other hand, some members feel that less choices is also better as they do not have to choose from a variety of options. They feel that this way, they will start to respect food more than ever. The members will get familiar with the fact that it is possible to eat whatever they want at anytime they demand, and this way, they will generate new value for food.

Ideally, the communities in CSA are supposed to increase trust among the members and farmers, however, some members only desire fresh, organic, local food and so, they are a part of a CSA. Whereas some member of CSA are more interested in forming bonds with like minded people of CSA. A group coming together every week at a farm, or a collection point, will make them feel connected as a community and with the food production or producer, a story supermarkets cannot provide (Vijfeijknen, 2015).

As CSA are developed with bottoms up approach, governments are not really a big part of the movement. ZLTO wants farmers to have the control of the chain so that he gets the most out of the system. ZLTO also wants farmers to be independent and start to focus on circular models and decentralised operation (ZLTO, 2020). ZLTO also notices the disappearance of sense of community from CSA and considers CSA as a way to deliver not only food but other services also.

Looking at a bigger picture, currently, there are 90 CSAs operating in Netherlands and they are not connected to each other. As observed by Vijfeijknen, these CSA are based on different values. For example, one CSA focuses on using the farmland more sustainably whereas another CSA focuses on healthy food or community building or reasonable prices. In a way, every CSA is branded in a different way and has expertise in different sectors. It is noticed that the CSAs do not have a connection between them. The initiatives are started by dissatisfied consumers looking for a change without actors on a regime level. People feel the need of an actor on authoritarian level as the developments in CSA are quite new and there isn't any legislation as such to guide the development. At the same time, people feel that governments interfering with the development is inappropriate as the development has to be bottoms up.

How Pyropower fits in-

Pyropower develops solution that help societies to come together and solve common problems. The solutions are mostly based on biochar systems which entail energy generation, biochar, waste management and climate change action. CSA also are communities of people who want to access better food quality, who want to have a community of like minded people while supporting environmental practices. On one hand, the number of CSA is going to increase, with more and more people wanting to be a part of CSA leading to increase in demand of production and on the other hand, due to traditional ways of farming, yield is less. Biochar, being a traditional way of improving the yield, can be a solution to improving the yield over the time. CSAs are also looking at ways to innovate their models and currently looking at circular models to manage waste and complete the cycle at the farm only. Pyropower offers a solution to manage the waste by pyrolysis the dry waste to convert it into biochar, and the same biochar can be used in the farm to improve the yield. The members of community will also get the satisfaction for contributing to climate change and farmers will get another revenue source of carbon credits while generating their own energy for use at the farm. CSAs are specialised in different sectors and collaboration of CSAs can lead to rapid development of the CSAs, while, at the same time, development of a regime body to guide the development of all CSA thus supporting the movement. The vision in design process followed during the project, takes the direction of supporting agricultural communities by allowing people to exchange valuable resources to ensure optimum working of the community which fits perfectly for the case of community supported farming. Next parts will tell about how the service can be, if implemented with CSA and how the relative business models with technology can be if implemented at the CSA farms.

Conclusion- Blue ocean creation

The chapter focused on creating an uncontested place for Pyropower to enter into.

For the puropose, blue ocean strategy is used, through which, the necessary factors were identified. The ERRC framework helps with identification of these factors.

These factors were then used to identify the blue ocean, which came out to be Community Supported Agricultures.

The next chapters focus on CSAs to develop a strategy which will allow Pyropower to enter the market of CSAs.

Chapter 5

Construction

Construction

This chapter describes the construction phase of vision in design method, used to create a service design concept for Pyropower. With the use of strategic tools, the results such as revenue models, business models are also designed within the step. The chapter starts with domain definition, in which a boundary is formed to limit the scope of design. This step is followed by generation of context factors which are referred to as 'building blocks' in ViP book. Factors are the principles or trends, developments or states which can be found anywhere, in a book or in a video or a conversation. The next step is to cluster the the factors by connecting them together if they are related to each other and then structuring the context by looking at all the clusters from a higher level. The structuring leads to identification of future practices where a decision has to be taken to consider one practice to be followed for further design. The practice and designer's stand on it gives birth to the mission statement which guides the next design process. The next stage is to design the type of interaction that is needed for the product/service to work in the context after which, product qualities are to be defined. Product qualities give the exact characteristics the product/service should have which help with concept creation. Later on, value modelling blueprint is used to design the revenue models for service that is designed as well as for the near future business plan. The revenue model visualises the value exchange within business whereas business model canvas helps to clarify the activities and propositions in the business plans. The next sections describe the construction phase followed to reach results.

5.1 Future context creation

5.1.1 Domain definition

Based on the data collected in previous chapter of collect, it is clear that agriculture is best suited for biochar produced by Pyropower. And from the understanding of previous business models which show creation and involvement of communities for implementation of biochar systems, a domain is defined which combines the agricultural sector and communities. Accordingly, the domain defined is the agricultural communities in Europe by 2025. This domain connects Pyropower with its previous

projects, as well as will give Pyropower a specific direction within agricultural sector to follow and implement the biochar system The figure 20 shows domain Pyropower is active in.

This forms the basis for factors collection and clustering which will lead to formation of a context in future in which a design will be implemented.

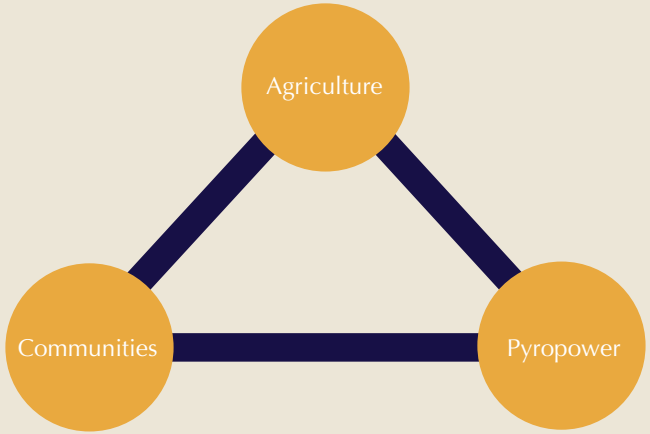


Figure 20: Domains Pyropower is active in

5.1.2 Context factors

Context factors are considered as a building blocks for ViP process. The context factors are bits of informations from future which are seemingly disconnected from each other. These context factors can be thoughts, research, principles, laws, facts, opinions etc. which are collected from different sectors related to agriculture. These context factors can be classified into 4 types- principles, states, trends and developments (Figure 21). The list of context factors and their descriptions can be found in appendix. Principles

	Economic	Social	Technological	Demographic	Ecology	Political	Psychology	Evolutionary	Biological	Culture	Agriculture
Developments (D)	7	6	4	2	-	6	2	-	-	6	1
Trends (T)	4	4	7	7	1	2	2	1	-	2	2
States (S)	1	2	4	2	-	1	-	-	-	3	5
Principles (P)	8	8	-	-	1	-	3	2	3	4	-

Figure 21: Factor collection overview

and states remain constant over the time whereas trends and developments are more dynamic in nature.

The diagram shows overview of context factors collected for the clustering phase. The factors were collected through literature research in the domain of agricultural communities and some factors were collected from thesis research on the repository of TU Delft. The factors then were clustered

based on their connections with each other and by looking at different combinations of context factors. To reduce the bias factor while clustering, some of the members of Pyropower team were asked to participate in the exercise. A couple of other people were also asked to participate in the exercise as much as they can. The duration of the exercise depended on the comfort of the participant. As the number of factors is around 125, after a time, participants felt fatigued to cluster the context factors. So, participants were asked to cluster the context factors until they feel uncomfortable. The total exercise took place on an online platform of Mural. Not all the participants were able to cluster all context factors but they showed a different perspective while clustering. Accordingly, 8 clusters were formed which show the possible context in future. The 8 clusters-

- Society on the edge
- The 'cape of good hope'
- Bridging the gap
- Good riddance
- Strategic exploitation
- Enlightened older generation
- Small utopian cities of future
- Meaningful desires

Each of the cluster shows a part of the future in the domain of agricultural communities. The subsequent section describes the clusters.

Workshop facilitation information

Total number of participants- 3

Roles of the 3 participants

1- Masters student, professional with 2 years of experience

2- Pyropower ex-team member, looking at business development

3- Pyropower COO

Total duration of each study

1- More than 2 hours

2- Fatigue induced- less than 1 hour

3- In personal time, over a period of 2 days

The clusters can be found in Appendix 7

Society on the edge

- People's search for happiness continues and people will get more aware about the overall mental health. They will keep on looking for experiences that are meaningful for them and satisfy them as individuals. They look into their past experiences, which made them happy and try to find similar experiences in the present. Apart from that, people enjoy comparing themselves to other people to get a sense of betterment and feel happy about it. Also, being able to choose what they want correlates directly with the happiness of a person.

- But on the other hand, restricting the value offered to them or not having the choice causes emotional chaos. The same thing happens when people are unaware of the output of the action. It all relates to the future where social media is just a click away and people easily take such bad or good experiences to the social media to share it with everyone. People know what they want and when it is not provided, they express their feelings on social media. They want to be heard, they want to share their experience with everyone, either good or bad and get acknowledged by the other people.

- In the current world, they have lost trust on news media and institutions and as social platforms are right there, they make use of the opportunity to find out the truth themselves. They do not want to be left out of any action and want to contribute to the improvement of society in any way possible. Social media being the easiest way to do it, they take it quickly to the social media, from where, it can be a downhill or uphill really quickly. They have reached the tipping point and the small nudge either way will decide the fate of an entity.

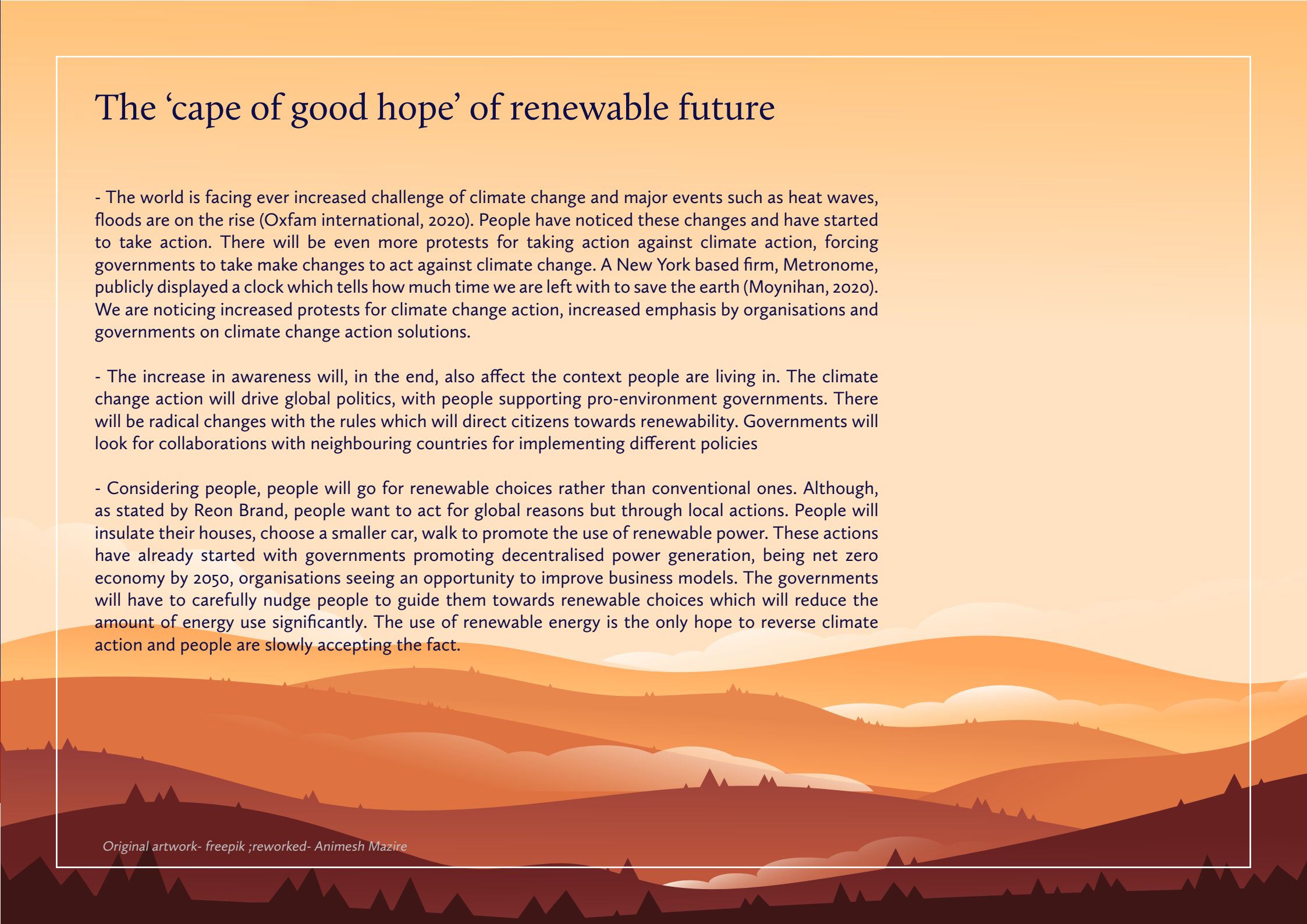
Original artwork- Vecteezy ;reworked- Animesh Mazire

The ‘cape of good hope’ of renewable future

- The world is facing ever increased challenge of climate change and major events such as heat waves, floods are on the rise (Oxfam international, 2020). People have noticed these changes and have started to take action. There will be even more protests for taking action against climate action, forcing governments to take make changes to act against climate change. A New York based firm, Metronome, publicly displayed a clock which tells how much time we are left with to save the earth (Moynihan, 2020). We are noticing increased protests for climate change action, increased emphasis by organisations and governments on climate change action solutions.

- The increase in awareness will, in the end, also affect the context people are living in. The climate change action will drive global politics, with people supporting pro-environment governments. There will be radical changes with the rules which will direct citizens towards renewability. Governments will look for collaborations with neighbouring countries for implementing different policies

- Considering people, people will go for renewable choices rather than conventional ones. Although, as stated by Reon Brand, people want to act for global reasons but through local actions. People will insulate their houses, choose a smaller car, walk to promote the use of renewable power. These actions have already started with governments promoting decentralised power generation, being net zero economy by 2050, organisations seeing an opportunity to improve business models. The governments will have to carefully nudge people to guide them towards renewable choices which will reduce the amount of energy use significantly. The use of renewable energy is the only hope to reverse climate action and people are slowly accepting the fact.



Original artwork- freepik ;reworked- Animesh Mazire

Bridging the gap of technology and humans

- People want a problem free life, and they think that with the use of technology anything is possible and so, they do not have to compromise on the things that matter to them. They want personalised solution to their problems and with the use of AI it is possible to achieve the same. The use of AI also reduces the time needed for innovation and with the changing context, people will see chaining services relatively quickly than ever. The use of AI demands personal information to be shared and so, the security of artificial intelligence systems will be a big threat. People will ask for transparent and traceable technologies which can be provided with blockchain.

- Organisations will provide special attention to make the technologies people centric and smart so that they can have the 'human touch' to them. Organisations are trying to reduce the tension users and technology, to make it appeal more friendly and emotionally to increase the reach of technology.

- People want technology to be used for humanitarian purposes rather than just adding to the earlier versions of it. They want the field of science and technology to be used to improve the welfare of society along with the individuals. Technology is a means to achieve a goal, and companies are trying to bring the technology more closer so as to close the gap between users and technology.

Original artwork- freepik ;reworked- Animesh Mazire

Good Riddance

- Europe has the ambition of recycling 55% of organic waste by 2025 and 65% of municipal waste by the end of 2030 (European commission, 2019). And one of the ways to achieve this is through the implementation of circular systems which keep the resources in use as long as possible to extract maximum value from it. Recently, Netherlands created a policy- Extended Producer Responsibility (EPR) which talks about the waste to be a responsibility of the producer and so, should pay for management of the same. So, companies are looking at ways to reduce the waste, through redesigning of products or package-less products etc. As an ambition, Netherlands has decided to reduce the use of primary raw materials by 50% by the end of 2030 and become a completely circular nation by the end of 2050.

- The basic principle behind circular economy is to consider waste as a food to the biological order of earth. This way, waste is considered as a resource rather than valueless entity. Thus disposal of waste, now, can create value stream for a company, bringing a positive feeling to the management of waste.

- Although implementing such circular models needs to revolutionise the business models. The current business models, that are resource dependent, contradict the notion of circular economy and so, there is a need of revolutionising business models. Some organisations are already trying to shift their business models to circular by introducing product as a service models or just with service models. Some organisations are taking help of other companies that work on the principle of circular economy. Collaborative efforts are needed to successfully implement a circular system as the actors are more interdependent, which also leads to sharing the risks of circular models.

Original artwork- freepik ;reworked- Animesh Mazire

Strategic exploitation of agriculture

- Considering agricultural sector, people are trying to increase the production of food through multiple ways. Europe has already reached optimum capacity of food production and so, will have to look at other ways to intensify the production. The farmers are using ways such as vertical farming, genetic farming and other artificial methods of food production while also implementing high tech technology to regulate parameters and produce quick harvest.

- On the other hand, there are farmers which follow traditional way of farming and traditional ways of increasing productivity of farms such as using organic fertilisers, or circulation of plantation. These farmers mostly supply their harvest to the local market.

- The population of Europe will decrease in future but Netherlands is looking at ways to increase production of food to supply the global need of food and on the other hand, there are initiatives that focus on traditional farming methods to supply to the local market. So, people want to exploit the opportunity of food production but at the same time, also want to consume natural food locally. On one side, agriculture becomes a business opportunity to meet the global demand and on the other hand, it becomes a means of better health for population. On one hand, it is about using technology to increase the production of the food and on the other hand, it is about reducing environmental impact while keeping the method of production traditional.

Original artwork- freepik ;reworked- Animesh Mazire

Enlightened older generation

- The average age of European population will increase in the future, along with the per capita income of people. This means that people will be able to spend more on things that matter to them. This older generation is richer and can spend more money as they also are motivated by greed. But on the other hand, they are also aware of the value it will generate in their lives. They will buy a product/service only if it creates a real value for them.

- 'value barrier plays significant role in ethical consumption and consumer acceptance of a product' (Kushwah, 2019)

- It is expected that there will be a rise of moral populist tendency which will also affect the consumption patterns of older generation. The older generation is even willing to pay more if the proposition appeals to them on a moral level.

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Meaningful desires

- Consumer will be looking for products that create meaningful interactions, with surrounding or with themselves. They will be attracted towards products and propositions that are altruistic, the propositions that are solely based on providing rather than receiving.

- Brands have identified the need of consumers and so, they will try to develop authentic products that appeal to consumers on an emotional basis. The brands know that stories affect people and so, the companies will try to sell stories instead of products. For the purpose, companies will try to make use of science to create authenticity, they will create and maintain a constant touch with their consumers through social platforms and will make sure that the story is propagated across.

- The brands, through the emotional appeal and storytelling through branding, will try to create dedicated communities of loyal people, who believe in the brand and will stay with the brand for long time. But the problem they will face is of shorter attention span of humans and more filtering power. This means that, people will be able to multitask more but at the same time, the attention span of humans will be relatively less, which means, if brands have to appeal then that appeal has to work in the shorter attention span of humans to create the attraction needed.

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Small utopian cities

- In future, the number of mega-cities will remain the same whereas number of medium sized cities will increase. More number of small communities will be formed with the development of rural areas and economies. The like minded people and activists will come together to form long term relationships with each others' families.

- The small communities will practice self governance and will demand for policies and rules specific to their community. The national governments will be fragmented, meaning rise of inexperienced parties to parliament. So there will be a need of mediator which helps communities and governments to come to a common ground while, at the same time, inexperienced governments will be open to experimentation. Accordingly, peer to peer platforms will be developed which help communities to connect with government as well as with other community members.

- The people from such small community will support the community in every possible way, starting from consumption to supporting local businesses. They will trust the interpersonal interactions to know about their society.

- These small cities or communities will try to build an ideal city, which is self sufficient, self governing and dedicated to people of the community.

Original artwork- Vecteezy ;reworked- Animesh Mazire

5.1.3 The community model

The understanding of future context through context factors has led to the clusters which describe different contexts in the future. These clusters are the relationships between context factors which, when looked at from a distance, show the driving forces for future. In this section, a framework is explained which can be used to design for the future. The practices that generate from the model can show how people will behave in futuristic context.

Looking at the clusters from a distance, it becomes clear that there is a goal and people are trying to reach that goal using various ways and there is a facilitator to connect the ways to the goal. Accordingly, the clusters 'small utopian city', 'the cape of good hope' and 'good riddance' can be seen as the ambition for people whereas the cluster of 'bridging the gap' forms the facilitator to connect ambition with ways. In this case, the ways to reach the ambition are 'meaningful desires', 'society on the edge', 'strategic exploitation', and 'enlightened older generation'.

The clusters placed in one group should not be considered as the same but should be considered as a different perspective of the driving force. In this case, the driving forces are 'ambition', 'people's push' and 'facilitator'. To create a better visual understanding, ambition can be considered as an island where everyone wants to live. The utopian island is surrounded by other 4 islands and an identical bridge connects the utopian islands with the 4 outer islands. Here, the utopian island becomes the ambition of every citizen. The bridge every citizen takes to reach the utopian island is the same but the starting point for every citizen can be different (any of the 4 islands). Now, divide the utopian island also into 3 islands and then, there will be 12 different combinations of outer islands connected to inner utopian islands. These 12 different combinations become the practices citizens will follow to reach their ambition.

Same goes with the case described with ambition, people's push and facilitator. When combined together, they form 12 different practices that one can follow to reach the ambition. These 12 different practices are mentioned in the appendix. A designer now has to take a stand, he has to select a practice he wants to focus on and that practice becomes the basis of his design. The selection of the practice is completely dependent on the designers view, where he has to envision the change, envision the encouragement or support he intends to develop with the design. Although, there is a chance that, knowing the company's vision and operating sector can affect the selection of practice, the designer has to follow his intuition to select the practice. The ViP method is based on exploring the possibilities in future and is not a method to find solutions to existing problems. The generation of practices makes the exploration into future possible where each practice can show multiple opportunities and can lead us to different designs.

Accordingly, to design with the model, the designer has to select one cluster each from 'ambition' and 'people's push' whereas the facilitator 'bridging the gap' remains constant in each practice. The combination of these clusters form the practice the designer is looking for. For the case of Pyropower, the practice of 'getting your hands dirty!' is selected to explore further.

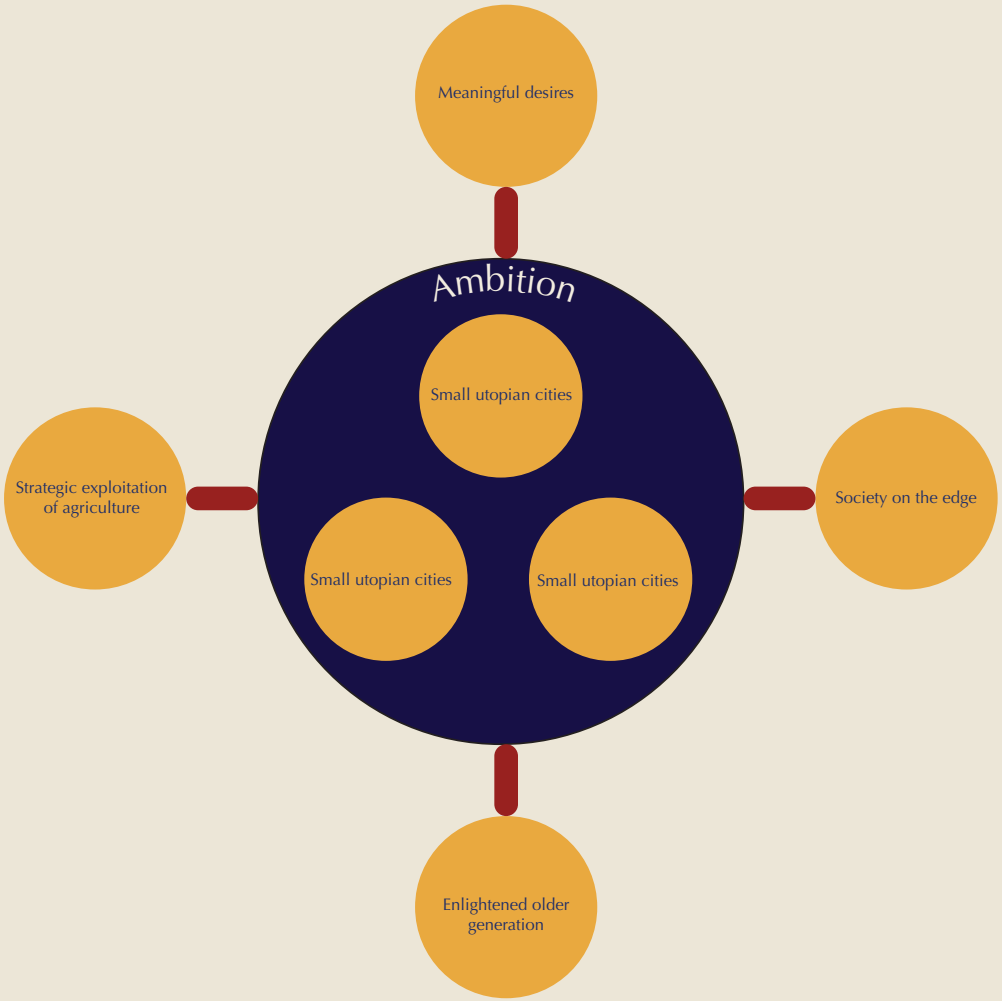

Figure 22: Community model

5.1.4 Getting your hands dirty!

The practice is a combination of clusters-a small utopian city : bridging the gap : societies on the edge. People in future have the ambition of building their own small community and they want to actively participate in building this community. These people want to make sure that the community thrives on its own, is a just, supportive community. The community is quick to respond to changes, through virtual media or reality. They will be searching for happiness and well-being through the community and will create long term bond with the community by introducing their children also. People in the community will be quick to take decisions between themselves and will adhere to the decision taken. The community makes use of science and technology to achieve the goals set by the community. The selection of practice takes us into the next step of designing with ViP which is the definition of mission statement.

5.1.5 The mission statement

After deciding the practice to work on, the step is to define what one wants to achieve with the practice chosen. The statement tells what the designer has envisioned to design for the practice he has chosen. It shows us whether the designer wants to oppose the practice or support the practice, basically tells about the position the designer takes in the future context. It shows the effect designer wants to have on the people and serves as a guiding statement for next ViP steps.

With the practice chosen, 'getting your hands dirty!' I want to support people who want to build their community through collective collaboration and support they need by exchanges of resources, tools and the like.
Accordingly, a mission statement for the project was created. Through the statement vision, people from communities are encouraged to make the exchanges happen which will lead to development of their community as well as the other community, which makes a mutual beneficiary system. Individuals as well as total communities are encouraged to make exchanges with other community's individual or the community leading to a profitable trade for both the entities while making sure that the community is working effectively.

I want socially aware people to be recognised as a valuable resource to the agricultural community and enable the exchange of this valuable resource to ensure overall development and innovative culture within the collaborative agricultural community by allowing participants of the community to take action and fulfil their psychological desires.

5.2 Interaction vision

To understand more about how the mission statement will deliver value to people and community, an analogy is used, the analogy which describes the interaction that is expected with the design that will be developed. Accordingly, an analogy of neurons in the brain is selected to describe the future interaction expected.

To make the interaction clear, let us consider an example of the Neurons in the brain. Neurons are the key players inside the brain. They use signals to transfer information inside brain, between different areas and to the nervous system. The Neuron sends stimuli so that human being can react to the environment. So, a Neuron is triggered by the context which sends a suitable electrical signals to another Neuron which takes an action to rectify the situation and the context sends feedback.

Dolphins are another interesting source for interaction. They like to live in a group, they help each other when in trouble or with getting food when the other dolphin is sick. They want to explore new things and get bored with mundane tasks (Corona, 2020). They have a friendly nature and on multiple occasions have been reported to help out humans also. Their behaviour is not completely understood by researchers, but the interaction they have with the context defines the sole characteristics and motives behind the action.

Similarly in case of CSA, the members can be signified by Neurons, where members will work together to achieve the optimum efficiency of working. The members are triggered by their inner beliefs or by the context to work for the goal of fulfilling their psychological needs. The members share their resources with others which can be signified by the signals that are sent by Neurons to one another to finish a task. Members of a community are also fuelled by certain beliefs that they want to fulfil and are ready to take the voluntary action. The members want to explore new things just like dolphins and want to believe in good for everyone, and are expected to help out the others without any expectations but to fulfil their desires. In this case, although it is relatively easier to understand the motives behind actions, the interaction and results from it form an important part of the mission.

The interaction and practice of 'getting the hands dirty' also directs towards a possible user group in future. The practice of 'getting the hands dirty' talks about people who are inspired to take action within their scope of reach, people who take the initiative to improve their surroundings or the community they are a part of and will make sure that their voice is heard, through a convenient medium. These users are open to discovering, promoting and participating in the activities they feel will lead to fulfilment of their life. These are the users who are on a quest to find and provide a virtuous meaning to the actions they take and expect the same from others too.

People who are inspired to take action are the people who know about their psychological needs and will take action to fulfil the needs. They have certain beliefs which they want to hold on to and they will look for opportunities that follow the values they believe in, within their surroundings to make contributions to. This way, they improve the state of their community while taking efforts to fulfil the needs.

People who take the initiative are the people who are not afraid to take on new challenges which also lead to the improvement of the community while allowing people to enjoy new experience. These people are not afraid to share their experiences on social media also, making them the marketeers of such events. These people will also express the positive as well as negative views on social media to raise concerns or support or provide feedback to the activities they participate in. The people will be connected to the local social circles and will influence the local circles through sharing their experiences.

The value offered

The earlier process discusses what the future context is like but does not talk about how Pyropower can contribute in such context. In this section, how Pyropower fits in, is discussed by looking at proposed value exchanges through the interaction.

The mission statement-
I want socially aware people to be recognised as a valuable resource to the agricultural community and enable the exchange of this valuable resource to ensure overall development and innovative culture within the collaborative agricultural community by allowing participants of the community to take action and fulfil their psychological desires.

Through the design, members of an agricultural community should be empowered to make use of their skills and aspirations for improving the community as well as help them fulfil the psychological needs. The exchange should in the end, lead to solving the problems faced by the agricultural community.

The members of the future have the ambition to take action to build a better community and surroundings. They have specific skills and capabilities which they want to use for improving the community they are a part of. They also focus on their psychological need of being happy by being moral in the actions they take. The design intended should help people with the interaction they want to have with the context. Pyropower should enable people, or an already motivated community, to make the contributions as per their need, which will lead to building a better community for themselves.

Community Supported Agriculture (CSA) is one such community which is a group of motivated people, coming together to contribute to building a better community. The motives behind joining a CSA is not only the fresh produce but also a feeling of being connected to the nature and the community, where volunteers work at the farm and take part in activities to build better bonds among the like-minded participants. The mission statement is used to define a vision for CSAs. The mission statement becomes,
I want CSA participants to be recognised as a valuable resource to the CSA community and enable the exchange of this valuable resource to ensure optimum working of the CSA community by allowing participants of CSA to take action and fulfil their psychological desires.

This way, the participants in the CSAs will be asked to contribute to the CSAs in ways they are willing to, which will lead to better working of the CSAs while fulfilling the desires of the participants of the CSAs. Pyropower will thus provide a tool to enable people to explore, act and improve the communities they have worked with and in return, Pyropower will gain the loyalty of the participants in CSA as well as growth in the European market.

In future, participants in the CSA or more specifically, volunteers who want to work at the community, will be a valuable resource CSAs should consider and with this tool proposed, Pyropower will offer an exchange of this resource with communities so that all the communities get the benefit of the resource while the participants in CSA will get to fulfil their psychological desires by taking action in the way they want.

The mission statement takes a stand in future which is about exchanging the resources to build a better community. To achieve the mission, the type of interaction needed is shown through the analogy of Neurons in the brain and dolphins. Looking at the interaction and future context, types of people in the future context and their qualities were identified who become the possible customer group for the concept to be designed. The mission statement was then looked at through the lens of CSAs. The value that will be shared between CSA communities and CSA participants and Pyropower is shown through a value map. The interaction proposed, value mapped and

mission statement leads us to know what qualities the designed concept should have and the development of the concept. In the next chapter, the qualities that the concept should have are discussed along with the design of the concept.

5.3 The new service

5.3.1 Defining product qualities

The previous part discusses about the future context, mission statement and the type of interaction intended with the concept to be designed which guides the design of the concept and helps to understand what qualities the design should have. This chapter discusses those qualities as well as the design of the concept based on the mission statement for CSAs and the implementation of the concept in the future context. The design is explained with a basic structure of the service envisioned, a wireframe prototype of the service and relationships needed to make the service possible.

CSA groups are considered as the community to be benefited with the design in the case, where exchange of community participants and their skills is a valuable resource for CSA community centres or farms. The volunteers take part in the work at farm as they have the need to fulfil their desire of reconnecting with nature or knowing their food source or it can be anything other. The volunteers want to be active in the community to fulfil these desires. The CSA community thus provides a way for volunteers to join and act to fulfil these desires. In a CSA, the need of the CSA farm can be different whereas the need of the volunteer can be different which leads to mismatch between them, where no ones needs are satiated. So, the design should allow such exchange among communities where skills/needs/talents of an individual CSA participant are matched with needs of the CSA farm/community centre, to enable the value exchange and interaction. The design should inculcate the culture of innovation within communities and support people with propositions to make use of the design for improving the communities.

Here the aim is to enable the exchange and learn from the interaction between CSAs and volunteers. For the design to be effective, it should have certain qualities associate with it, which will help with deciding the design characteristics. Based on the mission statement, interaction vision, 5 values were thought about, which are essential in the concept of the platform. Accordingly, the platform should be inspiring to nudge volunteers towards exploration. The platform should be interconnecting, to allow volunteers to connect with other CSA communities, other CSA members. The platform should be reformative, to create a loop of research-design-implement-feedback to create a culture of innovation within the communities. The platform has to monitor the activities and collect the data so as to form a collection of rich insights and the platform should provide a feeling of satisfaction to the volunteers using the platform, which is the need of volunteers.

These values are essential to the platform as these values will lead to accomplishment of the mission statement in the end. Based on the mission statement, interaction vision, the case of CSAs and qualities of the proposed platform, a concept is created which shows the design of the proposed interaction and how it leads to mission statement. The concept is explained in the next section.

5.3.2 The concept

The platform is inspired from the future that people want to fulfil their psychological needs and the psychological need of future will be of building their own community and playing an active part in the community by exchanging resources. The experience of exchanging in communities will bring the members closer within community as well as, will help to connect with other communities also. The connections and exchanges of resources will lead to the overall development of small agricultural communities. The platform is a digital platform which can be accessed by volunteers as well as all the CSA participants and CSA farmers and administrations to facilitate exchange behaviour within and among CSAs. It is a platform where CSA administrations/farmers can put up their requests/needs for resources/skills which will be explored by members and volunteers from all CSA communities and the need will be fulfilled by the member capable and interested in doing it. The interaction is monitored by Pyropower and feedback is collected from the volunteers and communities about the experience. This data then can be analysed to get insights from the data which can be used to create new propositions. The data is then made available to other parties which have a membership of the platform to help them create the new propositions.
The future context of getting the hands dirty talks about a community which thrives on its own, which is just and supportive. The community will be searching for happiness through activities and experiences that enrich them. The platform becomes the facilitator for helping people achieve the ambition of an ideal community. The primary objective of the platform is to facilitate the culture of sharing within and among communities leading to optimum use of resources and efficient working of communities. The platform also performs secondary tasks related to monitoring the data, promoting activities and support to communities. The platform is owned by Pyropower and CSAs have to partner with Pyropower to be a part of it. The members of those CSAs will get access to the platform and can start exploring. The platform is offered as a service to participants of a CSA.

Figure 23 : New service explaination

For more clarification, the service is divided into 4 main elements as shown in figure __- service working, organisation, stakeholders and embodiment. Each element talks about a certain specifications related to the service platform. The business model and revenue model related to platform is developed in the next section.

5.3.2.1 Service working

The service is offered by Pyropower, on a digital platform (a cloud based service) to CSAs that have partnered with Pyropower and to the participants of these CSAs and third parties. CSA are community supported agricultures, which consists of farmers and participant who collaborate to neutralised each others problems. 4 major stakeholders in this case can be identified with CSAs which are CSA farmers, CSA volunteers, CSA administration and CSA uninterested. The CSA uninterested are the people who are a part of CSA but do not participate in CSA activities unlike volunteers. The third parties in this case are the stakeholders which are not a part of CSA but want to work in the field of CSA. These third parties can be researchers researching about CSAs, new start-ups developing propositions for CSAs, freelancers who want to organise activities at CSAs or the parties whose business concerns CSA. The service offered is accessed by using a digital platform and internet. The memberships are provided to CSA participants free of cost whereas annual/monthly fee is collected from CSA administration for the memberships. The third parties have to pay to Pyropower to access the platform and for memberships on their own. The access provided to CSA participants is from 'member login', access provided to CSA administration is through 'CSA login' and for 3rd parties, access is stated as 'other login'. The different accesses lead to different experience and features which are explained in the prototype. The service can be divided into 4 parts-

a. Exchange of resources
b. Monitoring interaction
c. Analysing interaction
d. Insights

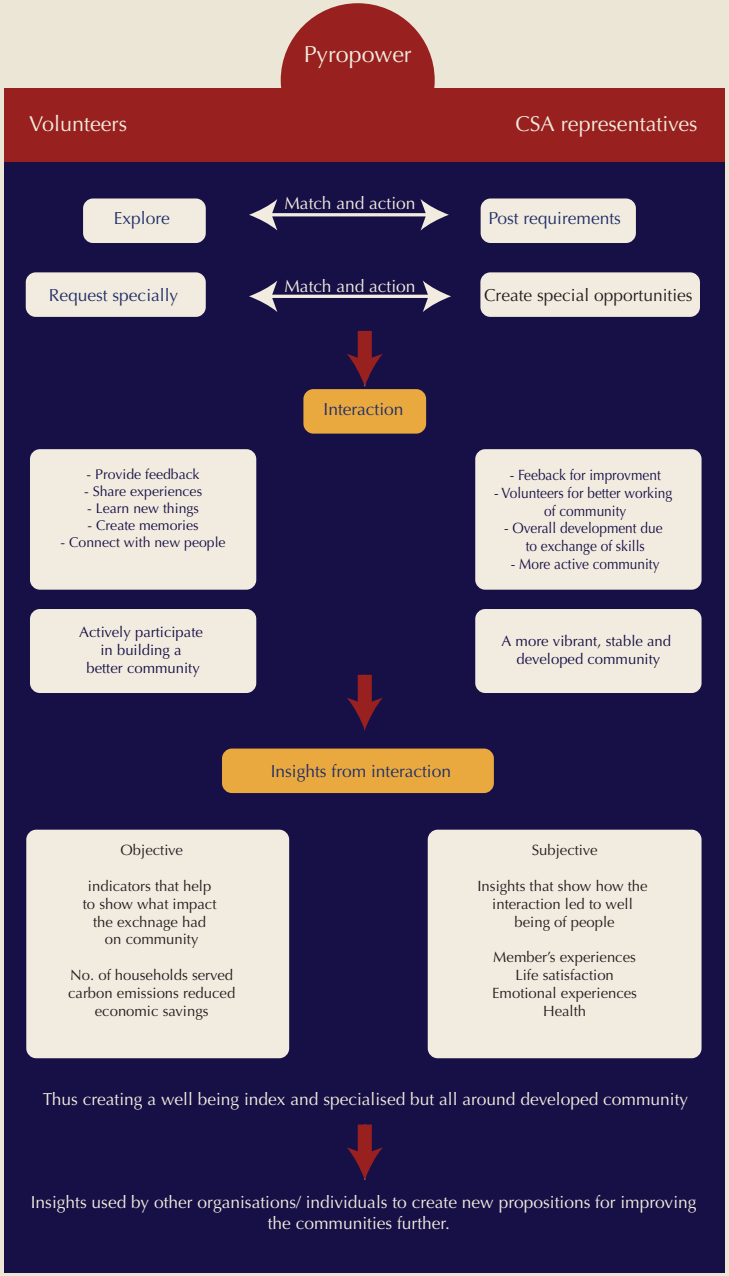

Figure 24 : New service- idea

Exchange of resources (volunteers)-

The action that is needed to make the platform successful is the exchange of resources. Resources in this case are the skills, talents, manpower or volunteers which is to be exchanged between CSAs. For the purpose, volunteers can create a profile with their desired/acquired skills or talents on the platform and mention the availability. The CSA administration, through their profile on platform, have to mention their required needs/talents and suitable dates. The algorithm will match these skills and dates and show the results to volunteer and CSA administration, from where, the activity can be scheduled. The CSA administration can also post their requirements on the platform where all the members of the platform will be able to see the requirements and if interested, will respond to it. Similarly, individual CSA participants can also make requests to specific CSA administration for the specific need he wants from that CSA. Pyropower monitors the exchange of volunteers among communities and promotes the exchange through various ways such as nudging volunteers towards newer experiences, sharing similar experiences of others and the like. The 3rd party organisations such as researchers or freelancers can make use of platform to plan, request and conduct an activity for volunteers at a CSA farm or community centre which benefits the platform members as well as the CSA. The CSA uninterested type members of CSA are nudged towards participating in activities through platform, by sharing positive experiences and positive impact generated by the activities.

Monitoring interaction

Pyropower is interested in promoting the exchange as well as knowing about the experiences the volunteers have and CSA administration has due to the exchange of volunteers. These interactions are captured through feedback from the volunteers and CSA administration. The volunteers are asked to share their experience with peers, they are nudged towards learning new things and provide feedback and suggestions about the activities they experienced at the CSA farm or community centre. This feedback is then shared with CSA administration as well as stored with platform data base for further use. The feedback is the first step of building a better community by actively participating in it.

Analysing interaction

Pyropower, with the help of data scientists, IT professionals analyses the data collected from the interaction that happened between CSA administrations and volunteers. This data is analysed to get insights from the data. The analysed data has to be shared with concerning parties as well as with the consent, with 3rd parties for developing better solutions. The data can be an objective data or subjective data but the analysed data is an objective result . Objective data shows the impact that can be measured such as economic impact due to activities, or climate change impact of a community. The other type of data is the subjective data, such as stories, videos, graphic content, audios etc. which need to be analysed which are bigger source of data. This analysed data is made available to CSA community members and on the CSA community homepage on the platform. The data is made available to 3rd parties upon request, consent from CSA and concerning platform members and fee for accessing it.

Insights

The insights gathered from the data collected can be based on the past data and by using the past data a profile can be created for the CSA administration as well as CSA participants. The objective insights from the data collected can talk about the performance of CSA and a basic inclination of a CSA (such as inclined towards genetic farming, towards finance innovation etc.) which can be helpful for members (volunteers), 3rd parties as well as other CSAs. In other words, over the time, a specialised CSAs are formed who can share their specialisation with one another so as to grow the culture of CSA. The volunteers will get to know which CSA focuses on which activities and will be able to decide on which activities to follow at which CSA. The 3rd party members of the platform will get to know about the CSAs more, and their efforts will be more channelised with the specialised CSAs. These specialisation will make the speculation for future for different CSAs easier and credible which leads to better and more convincing propositions.

5.3.2.2 Organisation

This part describes the structure of Pyropower to successfully run the platform. The platform is owned by Pyropower and internal team of company is responsible for the efficient working of it. Pyropower till now, has worked on physical products such as kiln or cookstove, but the platform is a digital service which is a new sector for Pyropower, completely different from the kiln or cookstove. The reason behind keeping Pyropower as the owner of the platform lies in the previous projects of Pyropower. As mentioned by one of the founders that Pyropower in future should work on biochar systems and empowering communities. In the past projects, the solutions proposed are related to communities coming together to solve a bigger problem. That is why, Pyropower supports motivated communities which want to solve their problems and Pyropower provides a means to these communities using which they can solve the problem. In other words, Pyropower is meant for people and not for the technology. Although biochar systems are significant part of Pyropower, the company is meant for people rather than technology. Pyropower wants to explore the markets where biochar systems are useful as well as they are related to people. With the case of CSA, biochar system can be implemented as well as there is chance to contribute to the CSAs with platform and help them to grow the movement, which will in the end also benefit Pyropower with biochar systems. The decision can also be supported with blue ocean strategy, where one of the principles of six path framework is looking across complementary products and services that can focus on functional-emotional orientation of the industry. In this case, the complementary service with biochar system is the platform which rethinks the value creation within the CSAs.

The platform team will be led by one of the founders of the start-up, whereas the other founders look at the biochar systems business. The internal structure proposed needs various teams to work on different things related to the platform. The teams needed are administration team, design and engineering team and communication and promotion team. Administration team looks at the overview of platform, initial customer support, legal support and managerial tasks among the teams. Admin team handles the finance related operations as well as 3rd party related operations for Pyropower. Data engineering related tasks are outsourced to an IT consultancy firm, so that Pyropower need not build expertise in the field of computer science. The outsourced work team handles the data collected, insights generation whereas for innovation with data for the platform the Pyropower team and IT consultancy team has to collaborate to generate insights. Engineering and design team looks at developing new propositions, research, maintenance and user experience for the platform. The design and data department look for ways to improve the exchange of volunteers/ resources through the platform. Communication and promotion team looks at ways to promote the platform more and to promote the exchanges of volunteers to keep the platform running.

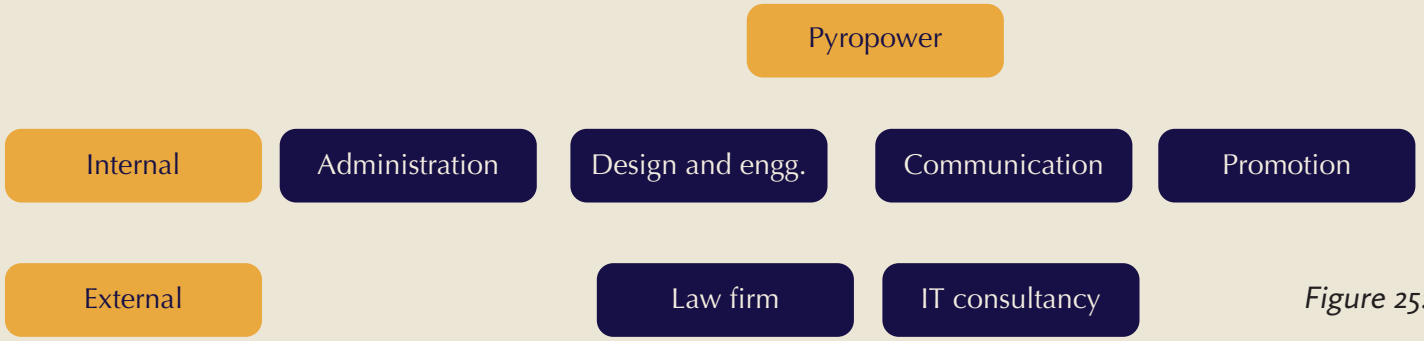

Figure 25: Platform Organisation

5.3.2.3 Stakeholders

The earlier parts discuss about the organisation and basic structure of the service which also give a little idea about the stakeholders involved in the service. This part focuses on the stakeholders that are a part of the platform. The value exchange between the stakeholder is captured in a revenue model in the next chapter whereas this part focuses only on understanding the stakeholders. Figure 26 shows a stakeholder grouping. The stakeholders are divided into 2 parts- internal stakeholder and external stakeholders. Internal stakeholders are the ones those are a part of Pyropower and external stakeholders are the ones that are benefited/affected by Pyropower's business.

As seen from the propositions, CSAs and CSA participants are the ones that are customers for the project, which become high priority stakeholders. The 3rd party organisations affect the business considering the immediate effect they have on innovation culture in the platform, so they also become an important stakeholder. The cloud service is offered by an organisation such as Microsoft Azure, which directly affects the platform, but at the same time, there are other service providers whose service can easily availed. Legal support is needed to handle the contracts and complaints and there are many companies that are offering the service. On the third level, the exchange of volunteers leads to new people in new communities which can make the local authority a 3rd level stakeholder. The government is also a stakeholder as Pyropower has to abide by the rules of data policy and business policy of the government of the Netherlands. The researchers, reporters, newspapers that work on CSA become a 3rd level stakeholder as they can have impact on the platform positively or negatively. Banking organisations also become a 2nd level stakeholder as they have to take care of the finance related operations of platform.

Considering internal stakeholders, the other team of Pyropower, working on biochar systems is an important stakeholder as the biochar systems business will directly affect the platform too. The internal teams of Pyropower related to platform and mentioned in organisation section are also a direct stakeholder in the project as they affect the development of the platform. The diagram below shows the organisation of stakeholders in a visual way. The value exchange that happens between the stakeholders is explained in

Figure 26 : Involved stakeholder

5.3.2.4 Embodiment

The previous sections discussed the organisation, stakeholder and basic structure of the platform which gives an idea of how the platform will function. In this section, a figma prototype is explored to know more about the platform and features on the platform. This section takes a point of view of a CSA volunteer, and how the journey of the volunteer on this platform can be is discussed through visuals and some description. The information used for creating the platform is taken from an existing CSA, Pluk! for representation purposes only.

The platform is a digital service provided by Pyropower and can be accessed through a website. The website gives a basic overview of what the platform is, the vision behind platform and contributing companies, contact information and participation information. The platform asks volunteer to login with the credentials he/she/they received from the CSA administration. The login window also has other login options for CSA administration and 3rd parties.

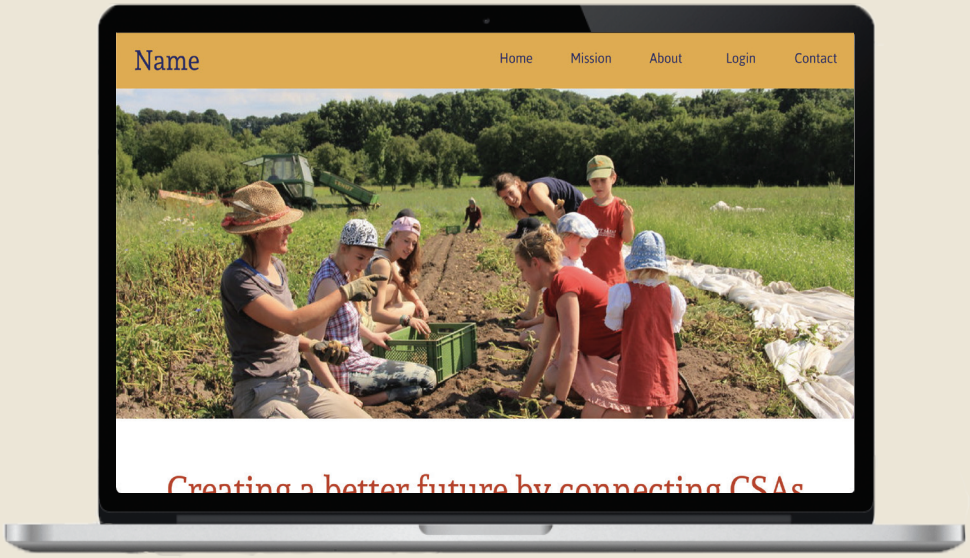

Figure 27: CSA platform

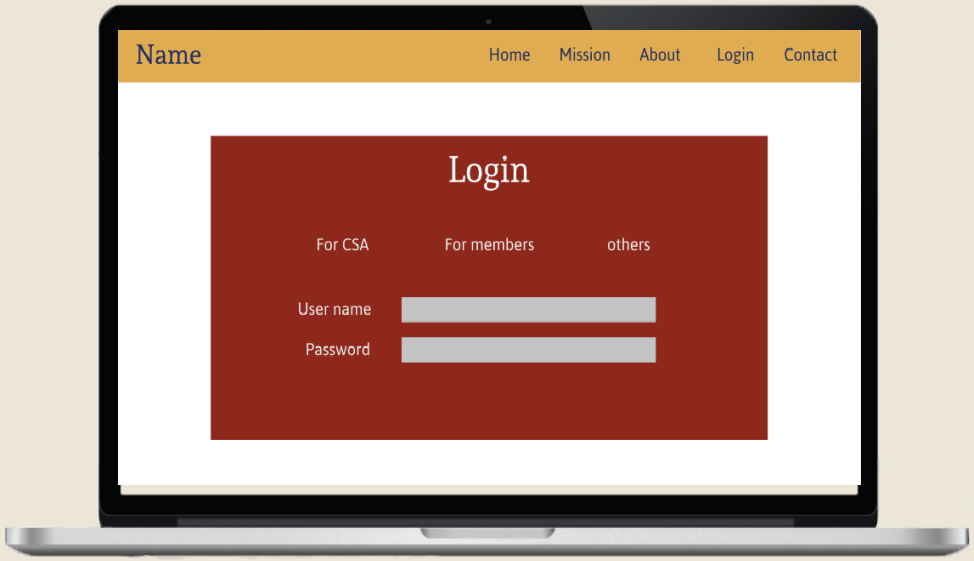

Figure 28: CSA platform Login

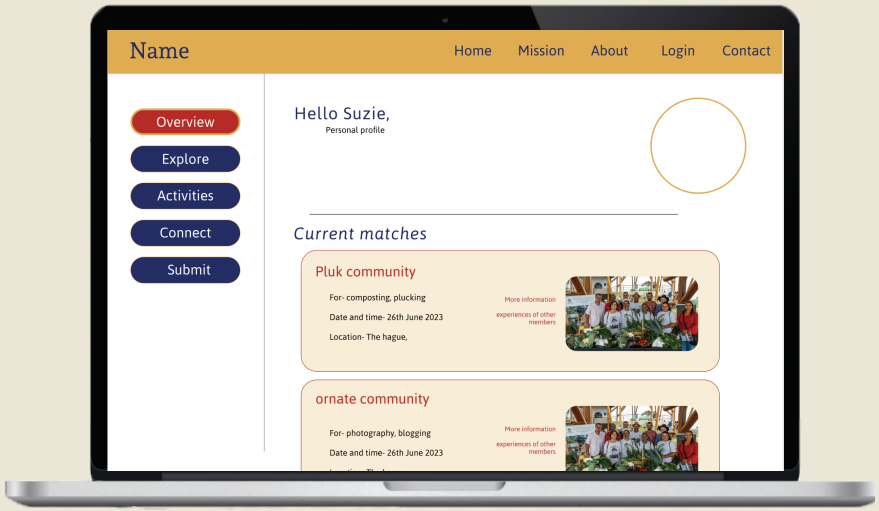

Figure 29: CSA platform user profile

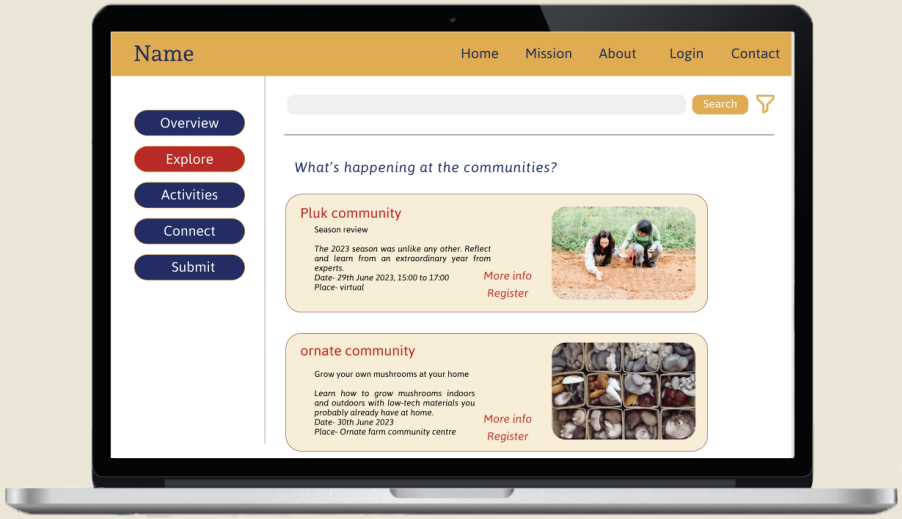

Figure 30: CSA platform exploring other communities

After logging into the system, the home page shows overview of profile, activities, past activities, matches for upcoming activities and experience you shared of past activities, and availability for coming weeks to participate in the activities of CSAs. On this page, the volunteer can mention the preference or skill set and availability so that the algorithm will match the skillset with requirements from CSAs. Figure __ and __ show basic idea of these pages.

The activities tab gives information about all the activities a volunteer has performed, the experiences he shared, upcoming activities and the impact those activities, the ones volunteer performed has generated is mentioned in the activities tab. The connect tab is about increasing connections with other volunteers, CSAs based on same interests or look at requests from CSAs for working with them. The submit tab is for providing feedback for the activity the volunteer has performed at a CSA. Here the volunteer can submit the data he collected (like pictures at CSA farm) or can share the experience with others. Using the submit and connect tabs, participants can connect with each other and submit feedback to CSAs. Figure shows activities page envisioned.

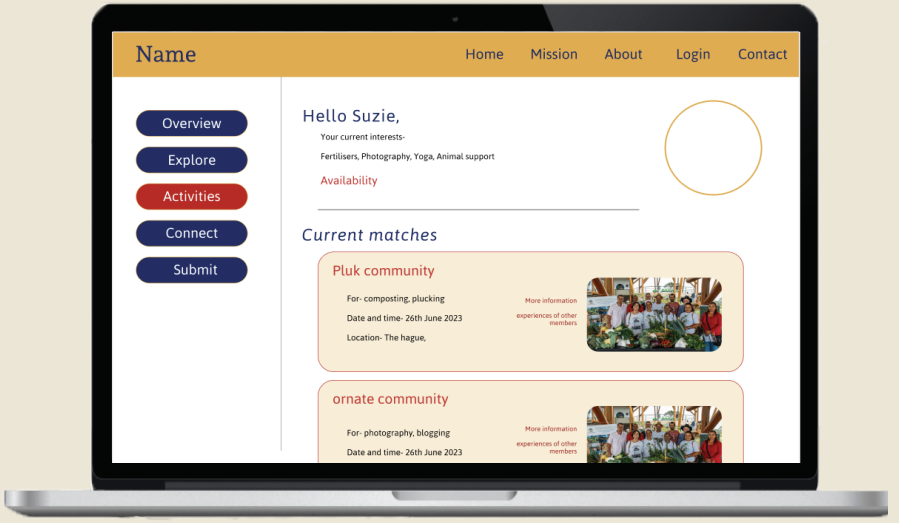

Figure 31: CSA platform exploring activities

Looking at community pages

The links on home page of profile, takes the volunteer to community page overview where the volunteer can learn about the community, their working style, the activities they conduct and pictures from the CSA.

The activities page show the upcoming activities at the farm as well as, the volunteer will be able to request for special activity or request to conduct an activity. Here the volunteer can look at the past activities to get an overview of what the CSA focuses on. The contact page is meant for getting in touch with the CSA.

Figure 32: CSA community home page

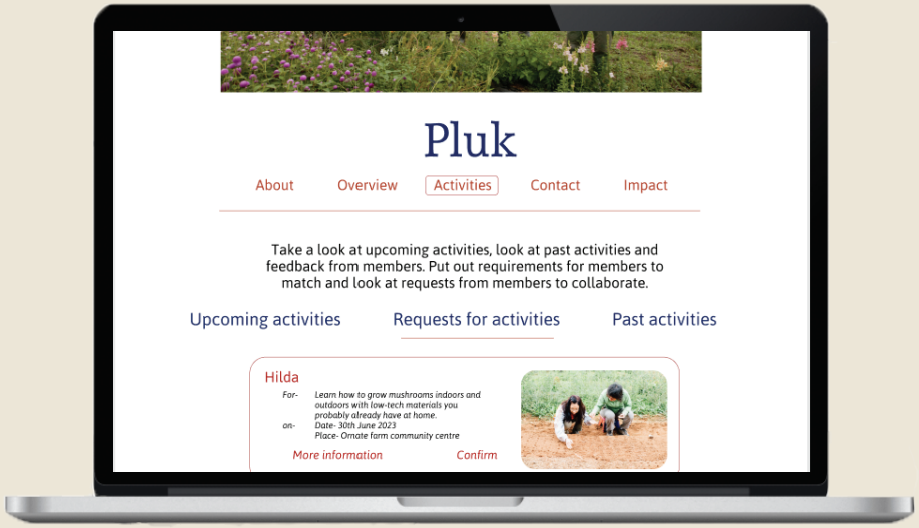

Figure 33: CSA Activities page

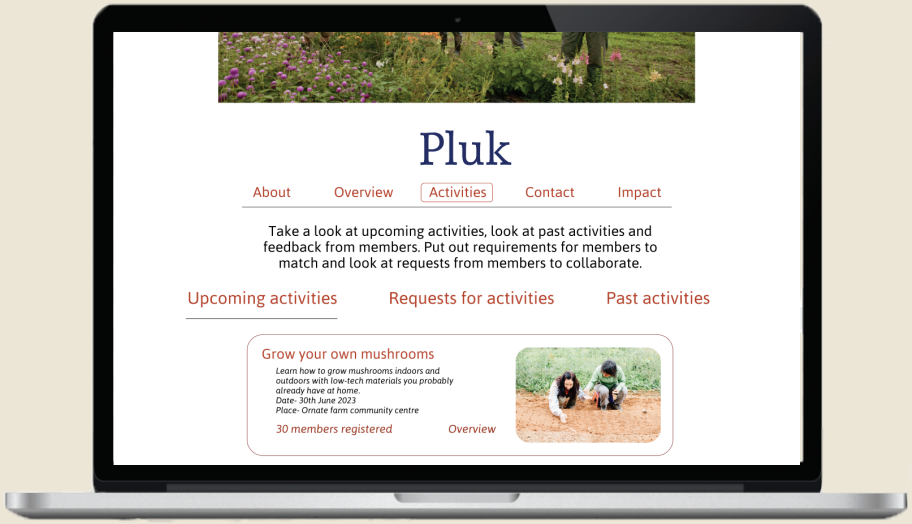

Figure 34: CSA community page

The impact page shows impact the exchange of volunteers has had by community on volunteers as well as by volunteers on community. The impact can be related to economy or environment or well-being of people or yield of the farm or operational efficiency or new skills learned etc. the impact page forms the specialisation for the CSA, where based on past data, an inclination of the CSA can be determined, making it a specialist in one or more areas. Volunteers can look at this page to match the expectations and decide whether to connect or not. This tab will show experiences, stories of volunteers who attended the CSA activity so that prospective volunteer will be able to decide. Adjacent figure __ visualises the impact page and some of the important parameters for checking the impact.

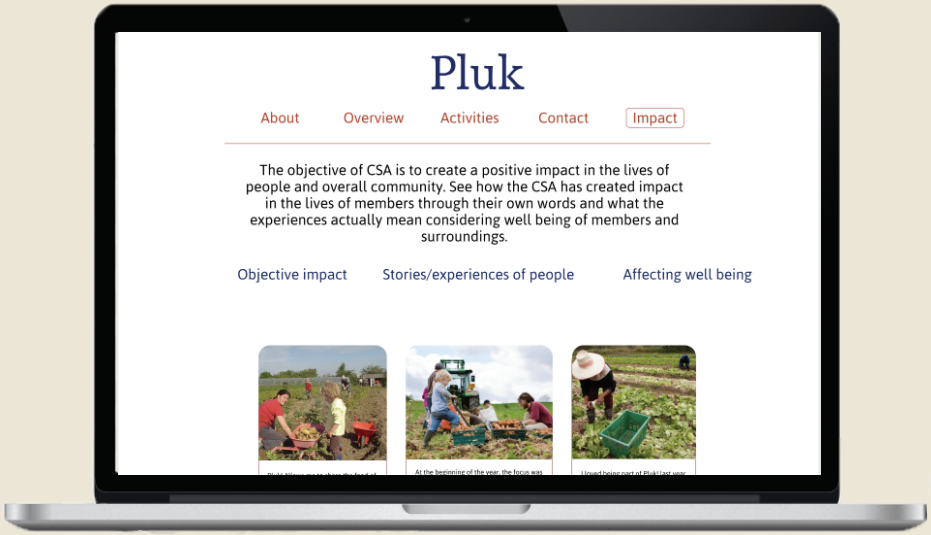

Figure 35: CSA impact page

The 3rd party organisations will also get access to the platform where they can post their requirements and look at the data analysis carried by the Pyropower. Through the login, the 3rd parties such as freelancers, new start-ups will be able to plan activities at a community centre of a CSA. 3rd parties in this case are individuals, initiatives, researchers who can benefit from the insights gathered from CSAs as well as those parties that can add value to CSAs. Initiatives can add value by proposing new solutions, individuals can add more value by organising activities at CSAs and research groups will generate new knowledge from those insights provided. To make it more specific, initiatives such as start-ups in the field of agro-innovation, start-ups in the field of social sciences, innovators in the field of humanities can be the possible interested parties to avail the service of the platform. The adjacent figure __ shows an example of a profile page for a 3rd party member of the CSA platform.

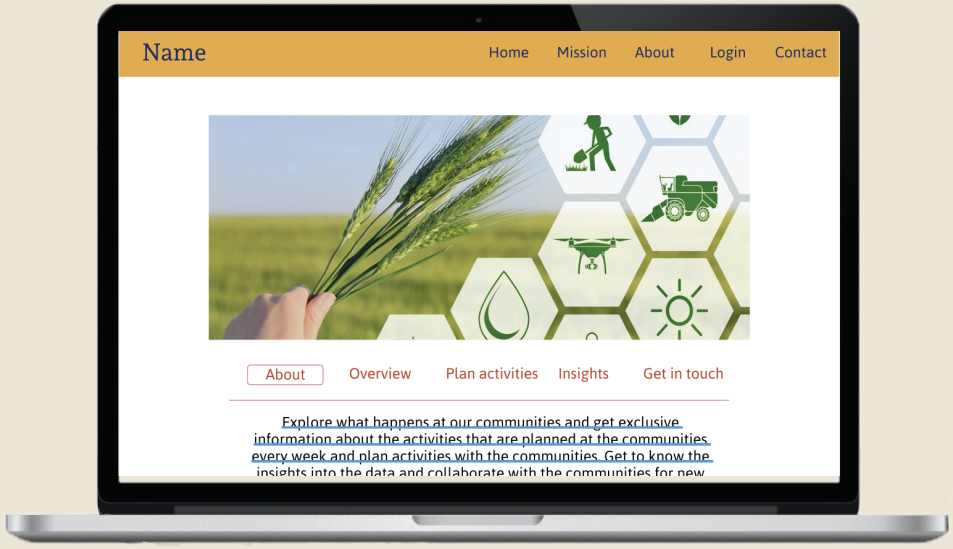

Figure 36: 3rd party page

5.3.3 Value modelling blueprint

The value modelling blueprint is a systematic way of understanding the canvas of proposed business and navigating the complexities while addressing conflicting values. The model helps to visualise the values that can be created and captured in a design project. This leads to a better understanding of needed collaborations, important relationships and tensions, opportunities in a design project. In case of Pyropower, the ViP model discusses about the future and how Pyropower can act to create values considering community as a direction for development. The value modelling blueprint is thus used to understand and develop a business model considering the biochar producing kiln as a direction for development. Through the model, it is possible to understand the collaborations needed, values created for different stakeholders, important activities and risks taken and in the end, develop a revenue model. The model is developed for 2 cases. In first case, only biochar is sold to the CSAs where the biochar
is produced from waste coffee grounds using the kiln, at the unwaste facility. In the second case, the kiln itself is leased to the CSAs and biochar produced through the kiln is owned by the CSAs.

Using the model-
The model has 8 sections to be designed, starting from horizontal sections left to right, which constitute of values for others and values for yourself (in this case, Pyropower). After designing the sections, the vertical section are designed which discuss the professional expertise required and risks involved. Afterwards, the partners needed, important activities and revenue model are discussed. The section of collaboration agreements is discussed briefly in the partners section only.

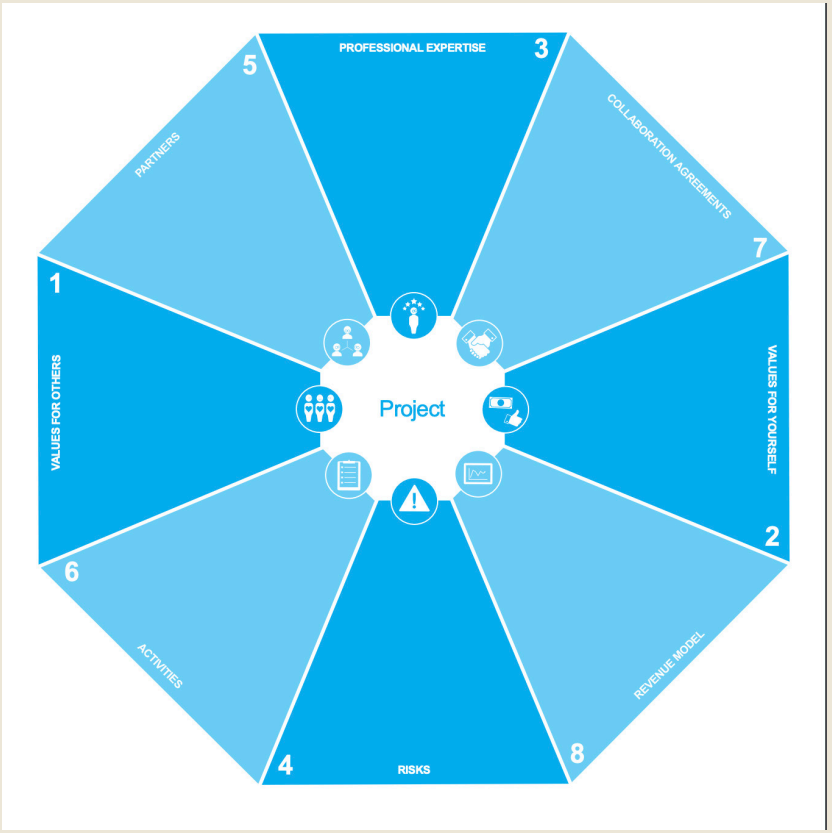

Figure 37 Value modelling blueprint

5.3.3.1 Case 1- where biochar is sold to CSAs

In this case, the biochar system that is implemented has different clients. For waste management and energy purposes, the client is unwaste whereas, for biochar produced through kiln, the direct consumer are the farmers in the CSA, where members of CSA are the indirect consumers, who pay for the biochar. The carbon credits are sold by Pyropower to companies willing to buy them, through Puro.earth. As explained in the earlier chapters, the business model considering waste management and energy production is developed for this case, whereas, the business model considering biochar is not developed. So, for this case, the business models considering waste management, energy generation and carbon credits is considered to be the same, with unwaste and Puro.earth whereas the value model focusses on biochar business model.

Values for users-

For the direct consumers of biochar, which in this case are farmers who are a part of CSA, the biochar helps with increasing productivity of the soil. CSAs are known to follow the traditional, organic way of farming which decreases its productivity and biochar provides a means for farmers to increase the yield while following the traditional way of farming. For members of the community, who will pay for the biochar collectively, the use of biochar adds to the satisfaction of supporting the climate change action while also increasing the produce at the farm. The biochar captures carbon from environment and helps the society with long term storage of carbon in the soil. For organic fertilisers, the biochar helps with retaining nutrients for longer duration than the usual duration thus reducing the nutrient loss in the surroundings. The cost of biochar, which is less than the market price of biochar makes the biochar suitable for agricultural sector. The high carbon content then other organic fertilisers makes it an attractive nutrient retainer for agricultural sector while also adding some nutrients to the soil.

Values for Pyropower

By selling the biochar to farmers of CSA, Pyropower gains financial returns. Pyropower will form a basis for strong relationship with CSA considering biochar. By introducing Pyropower to the members of the community, Pyropower will gain the following and consumer trust in European market which is still needed for the start-up.

Professional expertise needed

For the model to work, Pyropower needs to convince CSA to believe that biochar will increase the yield of the farms. For the purpose, systemic soil health checks need to be carried out for which, help needs to be taken from professionals in the industry. At the same time, biochar produced by Pyropower needs to be certified before selling the biochar to CSA farmers. Production of biochar is also dependent on the design of kiln which needs to be improved to produce a consistent quality of biochar. Thus a team of engineers will be needed to work on the design and develop a suitable kiln which can produce consistent quality of biochar.

Risks

Considering the market risk, Pyropower is entering a new market which is not yet introduced to the biochar and so, the competition is supposed to be low which is a relatively small risk for Pyropower considering the value proposition of lower priced biochar in a new market. Pyropower currently is focusing on subsidies to support the business

which will take care of investment for inventories and operational costs of the business for around a year during which, Pyropower needs to gain the trust of CSAs by showing the effectiveness of biochar in farms. As biochar needs time to show the effectiveness, it is possible to supply biochar to CSAs on credit, with even less initial costs to prove the effectiveness of biochar on field first.

Partners

Pyropower needs to have a transportation partner to transfer biochar from the Unwaste facility to the CSA farm. Pyropower also needs a partner to help out with the subsidy applications to avail the subsidy. A connection with soil health professionals is needed who will help with providing an unbiased decision on soil health after application of biochar. For best results from biochar, an organic fertiliser supplier is also needed so that biochar can be mixed with organic fertiliser and then applied to the soil. It is expected that the other partners from business models based on waste management and energy generation are in collaboration to keep the system working.

Revenue model

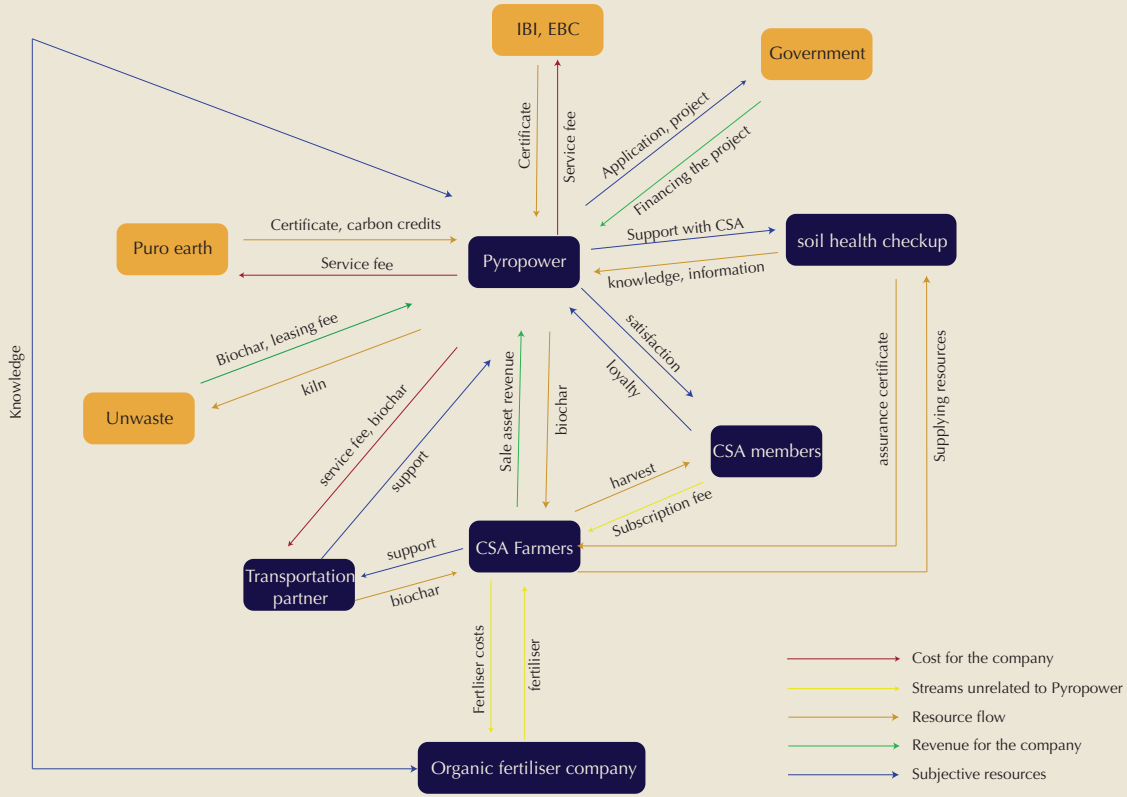

Figure 38: Revenue model- case 1

5.3.3.2 Case 2- where kiln is leased to CSA and platform is launched

In this case, the kiln which produces biochar itself is leased to the CSAs so that they can produce their own biochar and use it in the farm. The platform is also launched with CSAs as described in last chapter. The business model and value model in this context focuses only on CSAs. In this case, 3 components of biochar system- waste management, energy production, biochar are implemented at CSA and the carbon credits are owned by CSAs. Some of the CSAs are already planning to collect their own organic waste from the members and the waste is used for farming activities. A part of the waste collected can be used to produce biochar and energy which then will be used for farming purposes. The carbon credits owned by CSAs can be sold through Puro.earth or similar carbon trading company. The platform developed will be used by CSA members to fulfil their psychological needs as well as CSA farmers needs. The value model is used build a revenue model which shows value transfers in the system along with revenue streams. In this case, both, the platform and kiln are considered as offerings by Pyropower.

Value for others

a. The kiln provides a way for farmers at CSA to manage the waste generated at the farm as well as by the members of CSA community (if they are collecting the organic waste), as well as forms another way of generating energy which might be useful for farm activities such as drying or roasting or heating purposes. The biochar produced from the kiln can be used as a soil additive along with organic fertiliser produced at the farm or brought from an organic fertiliser supplier. The biochar in the end, leads to increase in harvest as well as supports climate change action. The carbon credits in this case, can be determined with more help from a professional service and are owned by the CSA which adds to the extra revenue stream for the CSA. The carbon credits also supports the CSA member's need to support the climate change action by actively participating in the movement.

b. The platform developed helps CSA members to fulfil their psychological needs of contributing to build a better community and society. The platform helps farmers with optimising as well as improving the working of their farms and their CSA group by allowing the exchange of interested volunteers among and within different CSAs. The platform allows other interested organisations to access the data and insights from the CSAs so that they can propose new propositions to the CSAs which will further help with building a better CSA community.

Value for Pyropower

a. By implementing the kiln at a CSA farm, Pyropower builds a sustainable revenue stream needed to run the business. As well as, Pyropower will be a service provider for the kiln maintenance and related operations. Pyropower will build a reputation of working for circular business models by implementing the kiln at CSA farms.

b. At the same time, the platform will help Pyropower to establish a brand in European market. The platform will create a base of valuable knowledge from CSAs which can be used by Pyropower to create additional revenue stream as well as to improve the platform and service itself. The platform will create financial gains for Pyropower from CSA organisations as they will pay for the membership of the platform.

c. Through the platform and kiln, Pyropower will be able to connect the European project to the other projects in Malawi and Indonesia as all of them are based on a common ground of empowering communities and biochar systems. Pyropower will be able to distinguish itself from other biochar related companies based on the values offered.

Professional expertise needed-

a. To implement the kiln and related components, and for maintenance of the kiln at the farm, a team of engineers is needed which looks at development and implementation of kiln at the farms. For biochar related operations, professional help from soil health scientists is needed to keep a check on soil productivity and effectiveness of biochar and organic fertilisers. Biochar quality also needs to be assessed more frequently as the biochar is produced from different waste sources leading to different types of biochar. For carbon credits application, a constant support is needed from carbon credit assessing organisation as the waste source is different in the case leading to different type of biochar and thus, varied carbon storage capacity.

b. To implement the platform successfully, Pyropower needs a team of IT professionals and designers who can build and run the platform as well as monitor the activities on the platform and find insights from the data collected. Pyropower needs an administration team which looks at complete administration related to CSAs and CSA members for kiln and platform. Pyropower needs a communications and marketing team which connects Pyropower with other organisations as well as promotes the use of platform. A legal support is needed to handle the contracts and regulations for Pyropower.

Risks

a. Pyropower is supplying kilns to CSA which will use the kiln to produce biochar which can have different and inconsistent quality as the waste that is used to produce biochar has different properties. Considering the lessened regulations of biochar in the current context, there is a possibility of even lesser regulations considering biochar, with more research in the field. Pyropower can take this risk of assuming that the CSA produced biochar is suitable for agricultural field, while also connecting CSAs to biochar regulating bodies and regular biochar checks. The risk of biochar being not suitable for farming, thus, has to be avoided.

b. Pyropower needs to ensure that the platform is being used to keep the business sustainable which means, the platform has to be valuable for members of CSA, and so, pilots are necessary to check the usefulness of platform before launching it on bigger scale. The platform initially has to be financed by Pyropower and to be tested with some CSAs. The finance for manufacturing the kiln and platform creation can come from sells of biochar to CSAs from stage 1.

Partners

a. For kiln manufacturing purposes, Pyropower needs a partner who can help with machining where Pyropower will provide the design of the kiln and the machining workshop will supply the final product. For biochar related queries, Pyropower needs a support from organisations like IBI (international Biochar Initiative) or EBC (European Biochar Certificate). For carbon credits related operations, Puro.earth can be consulted. For soil health related operations, an organisation like Soil Capital can be consulted and partnered with, which will provide support to farmers considering soil health checkups.

Activities

a. To realise the far fetched dream, Pyropower needs to start working on convincing CSAs about the advantages of biochar as of now. In the future, the focus should be on developing a kiln that suits the waste created at CSAs. Parallel to it, research/efforts are needed to check the quality of biochar produced from the waste at CSA and certifying such biochar and resulting carbon credits.
b. For platform to work, Pyropower needs more research in the field of CSAs, their activities and needs which will lead to development of the platform. Pyropower needs to market the platform to create more traffic and increase interest in the platform.

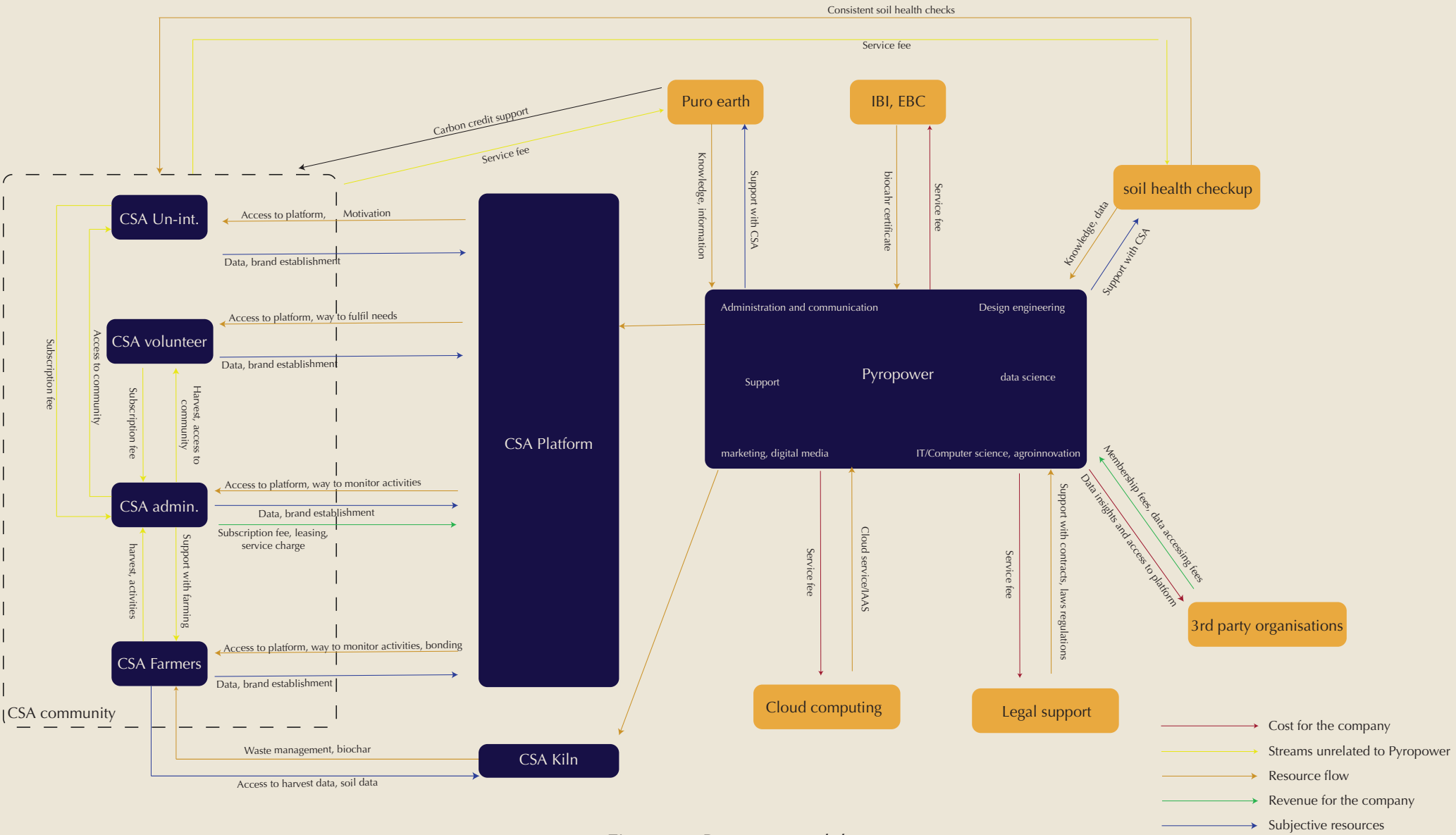

Figure 39: Revenue model- case 2

5.3.2 Business model

A business model describes the rationale of how a company creates, delivers and captures value in a project. The business model consists of 4 interlocking elements that tell about how the value is created and delivered in a project. The 4 elements are customer value proposition, profit formula, key resources and key activities (Johnson, 2008). A template developed by Alex Osterwalder is a comprehensive tool for understanding the different elements of a business model. The template-business model canvas is used in the project to understand the 4 elements of value creation and delivery.

The business model canvas defines a customer segment the company is targeting through customer value proposition or 'job to be done' and through what ways the job is done. For profit formula, the business model canvas describes key partners needed, the cost structure and revenue streams which are also discussed by revenue models. The business model canvas also entails the key activities, key resources and partners to successfully run the business and gain the profit intended.

In this project, the business model canvas is used to provide a structure to all business related activities. Just like the revenue streams, 2 business models are developed. The first model is about selling the biochar to the CSAs. In this case, the other business models related to waste management, energy production and climate change action are kept intact with collaborations from Unwaste and Puro.earth. In the second model, the focus shifts to CSAs and business model in this case tells about 5 different value propositions for CSAs, in the field of waste management, biochar, energy generation, climate change action and platform, and how these value propositions together will create a value for CSAs as well as Pyropower. The revenue models were taken as a basis for creating the business models.

5.3.2.1 Biochar is sold to CSAs

In this case, the biochar is produced from waste coffee grounds, at the Unwaste facility and the biochar is sold to CSAs for application in the CSA farms. The business models considering waste management application, energy production and climate change action remain the same as described in earlier chapter of deconstruction. The business model described here, focuses on biochar sales to CSAs. The figure shows business model canvas for the biochar application.

Customer segments-

a. The customers for Pyropower in this stage are the CSA farmers, who choose to use biochar as a soil additive to improve yield. At the same time, farmers alone cannot pay for the cost of biochar and also, as per the basic working of CSAs, the costs of farm operations are divided within the community. In such case, as the members are also contributing in the payment for biochar, the members also become an indirect customer to Pyropower.

b. The community supported agriculture groups (CSAs) follow a traditional way of farming in which, they use organic fertiliser and ways to produce the harvest. Comparing these methods with conventional farming, the productivity is lesser in the CSA farms. The farmers need to improve the productivity to cater to newer members and increase yield organically.

c. The participants in a CSA also have the need to support the environmental actions within their community apart from the usual need of fresh produce. It is their need to support the climate change action by being a part of CSA and reconnecting with nature by visiting the farm often.

Customer value proposition

Pyropower offers the farmers biochar, a solution which will improve the yield of the farm as well as is organic in nature. Biochar will keep the nutrients for more duration in the soil and thus, will increase the yield over the period of time. It is most suited when it is mixed with organic fertilisers. For community members, it a chance to support climate change action as biochar captures carbon from the environment and stores it in the soil for many years to come.

Key partners

a. The biochar needs to be transported from Unwaste facility to the farm for which, Pyropower needs to take help from a transportation company where transportation company will be paid for transporting the biochar from one place to the farmer at the CSA community.

b. One of the biggest problems Pyropower will face is the credibility of biochar that it increases the productivity of the soil. For the purpose. Pyropower needs to check the soil productivity and other properties over the time and monitor the improvement so that biochar becomes credible. So, a soil health checkup specialist company like Soil Capital has to be consulted.

c. The mixture of biochar and organic fertiliser is more impactful and so, as the CSAs already use the organic fertilisers, the organic fertiliser can be partnered with, to have more impact on soil health.

Key activities

a. As stated earlier, Pyropower needs to monitor the soil health until biochar becomes an established organic fertiliser. So, regular soil

Key partners

Key partners in this case are

transportation partner- who helps with transporting biochar from Unwaste facility to the farm.

Soil health check up specialists- a company like Soil capital, who will help with checking the soil health at CSA farms to show the enhanced productivity of soil at CSA farms.

Organic fertiliser company- as biochar is mixed with organic fertliser, a support from the fertliser company is needed.
IBI, EBC- for biochar certification

Key Activities

Soil check ups at the CSA farm

A sufficient supply of biochar

A long term connection with farmers and community
Connection with transportation partner and organic fertliser company
Application to EBC, IBI and subsidy

Key Resources

Biochar

Customer support, digital marketing

information of soil health

Certificates from EBC and membership of IBI

Partnership with CSA

Value Propositions

Pyropower offers farmers a biochar, a solution which is organic way of increasing productivity by retaining nutrients in the soil for longer durations than usual. Biochar when mixed with organic fertilisers are more effective, so a mix of biochar and organic fertiliser is needed. The CSAs already use organic fertlisers and with biochar they will get increased productivity for longer durations. The community members get a chance to support the environmental action by supporting CSA's decision of using biochar for soil improvement. The biochar is used for trapping carbon in the soil for longer duration which fulfils the community members ambition of supporting climate change action.

Customer Relationship

through personal touch with the CSA

Informative with the CSA members

Supportive with the farmers

Channels

Website of the company,

Social media- instagram, facebook, LinkedIn

Through transportation of biochar and support

Customer Segment

CSA farmers follow traditional way of farming which leads to less productivity than the conventional ways of farming.

The CSA community members join CSAs as along with the need of fresh produce, they also have the need to support environmetal actions in their community.

Cost Structure

Certification for biochar and testing at the farm

transportation of biochar

Salaries of employees

Costs of maintaining contact and digital marketing

Revenue Streams

Subsidy from government

Asset sale (biochar) to CSA community.

Figure 40: Business model- case 1

health checkups are one of the key activity for Pyropower. A sufficient supply of biochar to the CSA is needed to ensure sufficient carbon in the soil. The biochar is effective as a long term solution, so, Pyropower needs to maintain the connections with CSA for longer term, so that the effect of biochar is clearly visible. Maintaining the connections with organic fertiliser company and transportation company and working together is important to increase the effect of biochar on soil and transport the biochar. Getting the certificate from EBC and IBI is needed to use biochar in the farms.

Key resources

Biochar becomes the main resource for Pyropower as it drives the business. Pyropower, initially, has to look out to get on touch with CSAs and build a brand accordingly, and so, need a digital marketing team and a customer support team to maintain relationship with CSAs. The information from soil health checkups becomes an important resource as it will convince other people about the credibility of biochar. As mentioned earlier, Pyropower needs to maintain contact with CSA for longer durations, so, the connection become an important resource in the case.

Customer relationships

Pyropower needs to visit the farms regularly to maintain a touch with them and monitor progress. At the same time, needs to share the progress with other members and farmers to convince them about the effectiveness of biochar. The initial cost of biochar is distributed among members, still it can be a big amount, so Pyropower needs to stay with farmers as the biochar will show the effects in longer duration.

Channels

Channels used by Pyropower include the usual digital communication as well as direct contact with the farms. For marketing related activities, social media will be used to showcase the effect of biochar on soil.

Cost structure

a. Pyropower needs to pay for the certificate EBC (European Biochar Certificate) to deliver a quality biochar. The other important cost is the transportation cost of biochar from Unwaste to the farm. Pyropower needs to pay the employees working for them and they have to handle the digital and overall marketing costs.

Revenue streams

Pyropower aims to get a subsidy for the operations and investment in the project which will subside the costs of machineries needed and operational costs for some time. Pyropower intends to sale the biochar to CSA communities who will pay for the biochar. It is possible that the communities will not pay the full amount upfront, but over the time, the instalments, the amount will be paid to Pyropower.

5.3.2.2 Platform is launched and kiln is implemented at the CSA

In this case, the kiln is implemented at CSA and platform is launched to enable the exchange of volunteers among communities. The business model in this case, has been divided into 2 parts, one that is concerning the business related to kiln-biochar-waste management-climate change action and the other that is concerning the business related to platform. The 2 business models are described differently in the following sections.

A. Biochar system business model

The kiln is now implemented at the CSA to help farmers manage the waste and generate energy. The biochar that is generated from the kiln is used in the farm only and the carbon credits are claimed for the carbon captured from the kiln. The organic waste generated at the farm is used to prepare compost or biochar. The business model canvas shows the elements of business.

Customer segments

The CSA farmers have the need to improve yield of the farm, at the same time, they have started to manage their waste on their own. Some of the CSA now collect the organic waste of their members and organic waste at the farm to prepare compost from it. They have the need to manage the waste at the farm only and increase the productivity of the farm while earning money from it.

Customer value proposition

A. The farmers have the need of increase yield of the farms which is fulfilled by the biochar that is produced from the kiln, and mixed with the organic fertiliser.

B. The waste that is generated at the farm is used to generate biochar and energy from the kiln. The energy can be used for other farm activities such as roasting or drying purposes.

C. The biochar entraps carbon in it for long years. When applied to soil, the carbon is stored in the soil and so, can be used as a revenue stream to avail carbon credits.

Key partners

A. The soil health assessment needs to continue to monitor the effects of biochar on soil. So, a company working on soil health checkups should be partnered with. The certificates from EBC and membership of IBI is needed to keep the credibility of biochar produced. A carbon trading company should be connected with to allow CSAs to trade the carbon credits and monitor the carbon captured. The production of kiln should be outsourced, which shows the need of a production partner for Pyropower.

Key activities

A. Key activities for Pyropower include data collection of soil assessment and monitoring which affects the biochar credibility. The Pyropower needs to support farmers with a service for maintenance of the kiln and support during operation if needed. Pyropower needs to look at the design and development of the kiln to suit the farms requirements.

Key resources

A. The engineering team is needed which looks at the design and development of the kiln, and supports farmers with maintenance of the kiln and operations part. The data of soil assessment and biochar quality is needed to maintain and increase the credibility of biochar in the market. The kiln at the farm is another important resource as it basically forms one of the core of the business model. Certificates from EBC and membership of IBI is still needed to convince more people about biochar. The collaboration with CSA is an important resource as the CSA opens up a bigger market for Pyropower.
Customer relationship-
A. Pyropower has to supportive towards farmers regarding the usage of kiln for waste management and biochar production, and usage. Pyropower should monitor and provide support with some of the activities at the farm related to use of biochar and operations related to kiln.

Channels

The connection is through the digital contact and direct contact with the CSA farmers. Maintenance team supports farmers through visit to the farm or through digital media. The website of Pyropower or the platform is a main channel for CSA to visit and take action. Information distribution happens through informative media such as reports or newsletters or updates or emails with the farmers.

Cost structure

Pyropower has to pay for production cost of kiln and design of the kiln. Pyropower needs to be a part of IBI initiative and pay for EBC certificate. Pyropower also has to pay for salaries of employees.

Revenue streams

Pyropower gets paid for the kiln that the farmers are using, through a lease agreement. Pyropower also gets money from the servicing of kiln.

B. Platform business model

Platform enables volunteers to exchange their skills, talents with other communities as well to ensure overall development of all the communities while providing volunteers a way to fulfil their psychological desires, as described in the last chapter. The business model canvas focuses on platform business model.

Customer segments

Members of the CSA act as a volunteer to work at the farm, to fulfil their psychological desires, connect with nature or to learn new skills or connect with other people. They have the need to contribute to improve the community they are a part of. On the other hand, the CSA farmers have the need of getting volunteers to work at the farm and build a more vibrant community of members. The number of CSAs is going to increase in the future and it creates more opportunities for organisations other than Pyropower to contribute to these communities, if they are provided with valuable information from the CSAs.

Consumer value proposition

Pyropower has the platform which allows the exchange of volunteers among communities which leads to overall development of the communities and psychological fulfilment of the volunteers as described in the last chapter. Pyropower offers the insights from data collected and analysed to

Key partners

Soil health checkup

IBI, EBC

Puro.earth

Key Activities

Data collection of soil assessment and carbon captured

Maintainance and support with kiln

Design and development of kiln

Key Resources

Engineering team, support team

Data of soil assessment and waste management

The kiln at the farm

Certificates from EBC, IBI

CSA

Value Propositions

CSA farmers need an organic solution to increase the productivity of the farm, which is provided by biochar.

The waste that is generated at theCSA farm is collected and a part of it, which is dry, to be incinerated is pyrolysed to produce biochar. Thus providing a way to manage waste at the farm itself. The energy can be used for other farm related activities such as roasting or drying produce or heat generation.

The biochar is a rich source of carbon, which provides additional advantage of carbon entrapping and can be used as a revenue stream to avail carbon credits.

Customer Relationship

Informative and supportive for farmers

Service based for maintainance

Monitoring with CSAs

Channels

Through digital contact

Through direct contact

Through maintainance team

Through informative channels like reports

Customer Segment

CSA farmers follow traditional way of farming which leads to less productivity than the conventional ways of farming.

The CSA farmers are planning to collect their own organic waste from the members as well as they make use of existing organic waste from the farm to make compost or need a solution to manage the waste.

Cost Structure

Design and production cost

Certification and membership costs

Salaries of different teams

Revenue Streams

Leasing of the kiln

Maintainance charges

Figure 41: Business model- case 2 kiln

the 3rd party organisations such as start-ups or freelancers or enthusiasts who want to use the data for building more propositions for the community.

Key partners

Platform is based on a cloud service which uses internet as a service (IAAS) for operation. Pyropower needs legal support to make and follow contracts, regulations etc. Although CSA pay for the service and are a customer, they also are partners as they give the access to the CSA members. Banking organisations are needed to handle the finance system of the platform.

Key activities

Key activities for platform are administration and monitoring of the activities that happen through the platform. Data analysis has to be carried out on the data collected to make it a useful dimension which is another key activity for platform to be undertaken. Design and development of the platform needs to be carried to attract and ease of use. The platform has to be marketed so that more members use it regularly and avail the services of different communities in their vicinity.

Key resources

Engineering team, administration team, IT and computer science developers, designers are needed to ensure proper working of the platform. The platform itself is a big resource as it drives other revenue streams. Data collected is an important resource considering the potential it has with developing new propositions. Exchange of talents, skills for betterment of society is at the core of the platform, so this exchange is an important resource for platform to work.

Customer relationships

The digital platform should provide a feeling of personalisation through the service offered and suggestions provided. The relation has to be informative, where Pyropower has to share the related information gathered with the members. Pyropower has the monitoring role in this case. The relationship is bounded by contract too, which forms the boundaries of exchanges between Pyropower and CSA members.

Cost structure

Pyropower has to pay for the cloud service it will use to run the platform, as well as Pyropower has to pay for the costs of developing the platform. Pyropower has to arrange for the costs of legal contracts and fees and they have to pay for the marketing and communication.

Revenue streams

a. The CSAs will pay for the membership of the platform for them as well as for the participants of a CSA. The 3rd party organisations will have to pay for the membership of the platform, where 3rd party organisations can be freelancers or startups willing to work in the field of CSAs. The 3rd party organisations or any other entity will have to pay Pyropower in case they want the insights from the data collected through CSAs.

Key partners

Cloud services

Law company

CSAs

Banking organisation

Key Activities

Administration and monitoring

data analysis and support

Design and development of platform

Marketing, digital media

Key Resources

Engineerign team, administration team, IT team

Platform

Data collected from the platform and insights

Members exchange

Value Propositions

Pyropower enables the exchange of these volunteers through a digital platform leading to exchange of skills, talents among the communities which leads to the overall development of the community and a better surroundings for everyone.

Pyropower offers the 3rd parties insights from the data they have collected which can be used to develop new propositions as well as access to the platform which they can use for sharing the knowledge, conduct experiments or propose new solutions.

Customer Relationship

Personalised,

informative,

suggestive,

Monitoring,

Channels

Digital

Contracts

Updates,

Scheduled meetings

Customer Segment

Members of a CSA community often act as volunteers to work at a farm and learn new things, to connect with the farming and other activities. They have the need of contributing to the community to build a better community and surroundings.

The 3rd party organisations have huge opportunity to contribute to these communities, if they have the insights.

CSA farmers need volunteers to work at the farm on various things, they want to create a more vibrant community.

Cost Structure

Cost of the platform, cloud services

Cost of development of the platform

Cost of legal contracts and formalities

Cost of digital marketing and communications

Revenue Streams

Membership fees from CSAs

Membership fees from 3rd parties

Data accessing fees from 3rd party organisations

Figure 42: Business model- case 2 Platform

Conclusion- Construction

The chapter focused on development of revenue model and business model for Pyropower. The revenue model and business models were further divided into 2 cases, one in which only biochar was considered as a proposition and second, in which biochar systems along with platform were considered as a proposition. The first case answers the problem of short term business modelling for Pyropower whereas the second case, with biochar system and platform answers the question of long term business development and vision for Pyropower. As described the 2 cases differ on timeline. Case one (biochar sells to CSA and Unwaste for kiln) can be implemented relatively sooner than the second case (platform and biochar system). The next chapter describes the implementation of the phases for Pyropower.

Chapter 6

Feasibility and Implementation

Feasibility and Implementation

The section focuses on questions related to the fit between Pyropower and CSAs. The chapter will discuss feasibility for the business related to kiln as well as for platform. The chapter will also discuss why Pyropower should also consider the development of a platform for CSAs as well as what are the capabilities needed to do so. The feasibility is explained using technological factors, economical factor, organisational capabilities and procurement/ materials needed factor. The assumptions and risks in some cases are mentioned in the relative segments. A strategic roadmap is devised which can act as a guide for coming 4 years.

6.1 Pyropower and CSA

Pyropower as a start-up needs an approachable and new market, where it is possible to implement biochar produced with technology considering the existing business model. The most suitable market in the case of Pyropower is one which needs high volume of biochar, of medium quality. Which willed to sustainable environment and climate change action. Pyropower needs a long term commotion as well as continuous/sustainable revenue stream to perform the operations. The market should also support Pyropower's ambition of supporting decentralised and environment friendly energy generation and waste management.

CSA supports solutions that allow them to contribute to climate change action. One of the objective of following the CSA movement is to support the traditional way of farming which is less harmful for the environment. CSA farmers need a solution which will improve the yield of their farms in an organic way. CSA farmers already know about the importance of using organic fertilisers which makes the use of biochar in the context easier.

Considering biochar systems, Pyropower can fulfil the needs of CSA and CSAs can support Pyropower with the business they want to establish in European context. At the same time, CSAs are relatively new market which can be significantly benefited from biochar. With this case, Pyropower gets to introduce biochar to this new market at a cost suitable for farmers and community while working towards their goal.

6.2 Why Pyropower should pursue the idea of platform

Pyropower as of now, focuses on biochar systems and biochar production methods whereas the concept developed through the thesis clearly shows a shift towards digital platform. For Pyropower, this means building new capabilities, entering a new domain, taking new risks. Still, Pyropower should enter this new domain considering the positive impact it creates for Pyropower as well as the CSA communities. The blue ocean strategy tells about the extra services which appeal on functional-emotional level. With Pyropower, when biochar system is about functional benefits, the platform takes more emotional perspective which help Pyropower for overall development.

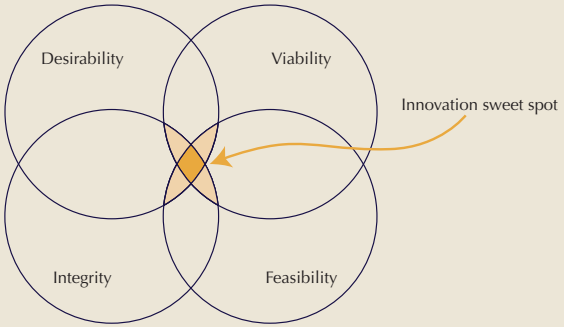

Figure 43: Innovation sweet spot

Platform adds to the revenue generation for Pyropower
The revenue model proposed is quite complex with multiple revenue streams for Pyropower, where each stream is important to generate revenue for Pyropower. In the scenario, the platform adds a completely new revenue stream to generate revenue for Pyropower.

Platform helps with brand establishment
Pyropower is trying to establish the brand in European market, and it becomes the best opportunity to shape the brand right from the start, through sharing the story and appealing based on emotions. CSAs provides the necessary audience, an audience which already is environmentally aware, and so, will be more empathetic towards the story of Pyropower. The CSA volunteers, which connect with the story of Pyropower will become loyal to the brand as well as will become the ambassadors for the brand. The CSAs thus provide the initial connection with the people Pyropower needs to create a strong brand in the market. Pyropower will be able to connect on a deeper level with the customers which will create strong bond as well as will guide Pyropower with future branding activities.

Platform as a means to connect the project to their mission
Previous projects of Pyropower show the significant involvement of people in the projects Pyropower undertakes. Pyropower wants to help the communities in need, and do not want to just provide the technology, but want to make sure that the necessary positive impact is created. Right from the start, Pyropower wants to come across as a company which focuses on people more rather than just technology and is ready to take the extra step needed if needed. With the European context, the biochar system is more divided where different solutions impact different parts of the society. The platform provides a way to Pyropower to create an impact altogether and helps to come across as a people's company.

Platform as a means to be future centric
The intersection of desirability, feasibility and viability is considered as the sweet spot for innovation traditionally. As proposed by board of innovation, a business design and innovation strategy firm, the innovation sweet spot lacks on one aspect which should be included in the design, which is integrity (impact). This new integration is about providing beyond customer centric solutions, which are based on moral principles and is socially responsible, which considers the effect of solution on community as well as environment (Fecheyr, 2020). The platform will help Pyropower to incorporate the 4 layer of innovation sweet spot through activities that will be performed on the platform. More work in this direction is still needed to capture the 4 dimension of innovation sweet spot. The figure on next page shows the addition of 4th innovation dimension and innovation sweet spot.

6.3 Feasibility study

Feasibility studies help to understand whether the solution/intervention is suitable to be studied further or not. The study answers the basic questions of if the ideas can be shaped to be realistic ans sustainable (Bowen, 2009). In case of Pyropower, the feasibility study was conducted to speculate the possible revenue, to know about needed capabilities and overall possible working of the system. Accordingly, the working of the system is explained through technical feasibility, cost feasibility, procurement feasibility and organisation feasibility. In each part, kiln and platform are discussed. The economical feasibility part is discussed for kiln and platform as of now, is not considered in it. The platform is relatively far fetched and Pyropower needs to have an assurance that the business model related to kiln and biochar works perfectly, which is explored in the cost analysis.

6.3.1 Technical Feasibility

Technical feasibility looks at the technology related aspects needed to fulfil the project. It includes labour related aspects, location, transportation, material related information.

Kiln related business-

In the case of Pyropower, the business model focuses on sells of biochar produced through kiln. So, initially, Pyropower will need one kiln to start with. Even if the kiln is sold to CSAs to produce their own biochar, the number of those will be relatively lower. This all directs towards outsourcing the design of kiln to a manufacturer rather than producing the kiln in house. There are manufacturers such as Audacious BV which work on sheet metal processing and fabrication which can help with the manufacturing of the kiln, if design is provided. The kiln developed should be capable of monitoring and recording temperatures and other pyrolysis parameters. Pyropower will also need a device to check the biochar quality to ensure a quality product. The developed kiln should be capable of exchanging heat energy to dry the coffee grounds. As well as. Pyropower will need a soil checking instrument, along with a connection to the soil health assessment company to monitor the soil health. This soil checking instrument can be provided by Agrocares, a company that develops portable soil nutrient checking instruments.

Platform-

For platform, Pyropower needs a IAAS (Infrastructure As A service) provider, which will rent a part of their data centre to Pyropower, from where, the platform will be hosted. The IAAS provider should be selected so as to match the mission of Pyropower as well. Pyropower is a company which works towards environmental sustainability and IAAS provider should also believe in the same. Accordingly, windows Azure can be a suitable option as the provider currently has carbon neutral impact on environment, with 60% of their carbon credits coming from renewable energy and the company has the aim of reaching 100% renewable energy by 2025. At the same time, Pyropower will need suitable machines/computers to operate, design, monitor the data on the platform and perform data science operations.

6.3.2 Organisational feasibility

Organisational feasibility looks at the capabilities in terms of management expertise, organisational competence needed by Pyropower to fulfil the business models.

Kiln related business-

The kiln related business largely depends on 2 parts- design of the kiln and agriculture related competence. Pyropower consists of 2 teams, the Delft based team looks at the design of the kiln. This team consists of process engineer, mechanical engineer, designer to help with the design of the kiln. The team based in Wageningen University focuses on agriculture related side of the business. The team consists of circular economy engineers, who can handle the agriculture related tasks in Pyropower. A financial expert works with Pyropower to help the startup with finance related activities. The design related activities and collaborations between the teams is handled by me. A legal support is needed to handle the IP related activities and legal activities.

Platform-

For platform related activities, Pyropower needs newer expertise in the field of information technology and data science and security. The field is completely new to Pyropower and so, will have to recruit new members over the time, to help with the development of platform. An administration team and management team has to be created which look at overall development of the company and projects. A marketing and design team is needed to promote the activities on the platform. A legal support is needed to deal with data privacy and contracts with customers.

6.3.3 Operational feasibility

Operational feasibility looks at how the input materials to the process will be collected to ensure performance of activities within Pyropower.

Kiln-

The kiln needs a source of coffee grounds to produce biochar which is provided by De Graaf, a waste management company in the Netherlands. The output coffee grounds are provided to Unwaste for their business. Considering working of the kiln, workforce of Pyropower needs to be trained so that the biochar can be produced at the facility. The action of biochar on soil will be slow, where Pyropower and farmer has to be patient to realise the effect of biochar. The instrument brought from Agrocares will help with intermittent, regular checks of soil health and the service of De Graaf will help with the transportation of biochar.

Platform-

For platform, the input for operating the platform is data which will be collected from users of the platform. Apart from that, the engineers and designers from Pyropower, will look at the performance of platform and insights creation from the data collected.

6.3.4 Economical feasibility

This part looks at if it is possible to realise the project considering financial aspect. The kiln model is a combination of multiple revenue streams which together form the revenue streams. This kiln model is considered for addressing economic feasibility as it is the near future business model. For this, multiple assumptions are made to perform the analysis. It is assumed that Pyropower supplies biochar to 10 CSAs for the pilot part.

As of now, there are more than 90 CSAs in Netherlands, of which, Pyropower has to convince 10 CSAs to use biochar as a pilot for Pyropower. From the report of Urgenci on CSAs, it is found that average size of a CSA farm is 1.25 hectares (Urgenci, 2016). Assuming these CSAs use organic fertilisers, Pyropower will have to mix biochar with this organic fertiliser. Now, the amount of organic fertiliser needed is found from organic fertiliser company Benefert, which suggests that around 1 ton of organic fertiliser is needed for 1 hectare of land (Benefert, 2020). The biochar is mixed with organic fertiliser in the proportion of 30-50% by weight.

Quantity of organic fertiliser used for 12.5 hectares= 12.5 tonnes
Considering 50% biochar is mixed with organic fertiliser= 6.25 tonnes of biochar needed for 10 CSAs.

In Netherlands, the yield season is from March to September in which, seeds are planted twice in one year (National Gardening Association, 2020).

In that case, biochar is applied in the CSA farm twice a year, which makes the requirement of biochar 12.5 tonnes a year.

Around 6.5 tonnes of biochar is needed per 3 months during the harvest period, which says that, around 6.5 tonnes of coffee grounds are to be converted to biochar every 3 months. Now, by pyrolysis those 13 tonnes of coffee grounds in one year, the amount of coffee grounds roasted for Unwaste will be around 13 tonnes or lesser. The cost of those dried coffee grounds is taken as 2 Euros per kg. The biochar in this case is assumed to be sold at 400 Euros per ton. The cost of carbon credits is taken as 30 Euros per ton of CO_2 removed. In this case, the carbon removed will be around 40% of 13 tonnes which comes to 6 carbon credits equivalent to 180 Euros. Accordingly, a sales revenue model is shown below for the year 2022, assuming that it will take an year for Pyropower to setup all the activities in between.

For the year of 2023, it is assumed that Pyropower got in touch with another 10 CSAs so that the sales of biochar are doubled and respective sales revenue model is shown below.

Year		Sold products best case	Sold products worst case	Sales price Excl. VAT	Sales price Incl. 21% VAT	Sales revenue best case	Sales revenue Worst case	Sales revenues (best case+worst case)/2
Biochar	2022	13	13.00	400	484.00	5200.00	5200.00	5200.00
Dried coffee grounds	2022	13,000	13,000	2.00	2.42	26,000.00	16,000.00	21,000.00
Carbon credits	2022	5.00	5.00	30.00	36.30	150.00	150.00	150.00

Figure : Sales revenue predictions

The information about costs needed for manufacturing the kiln is obtained from a subsidy application made by Pyropower to the government and discussion with one of the founders and is taken to be 30,000 euros and for IP related activities, 5000 euros. The agrocares instrument is available at 3000 euros (agrocares, 2020). The leasing cost of a 500 m2 warehouse near semi urban area is 27500 euros annually, considering cost of 1 m2 is 55 euros annually. Cost of IBI membership is 411 euros per year (IBI, 2020) and cost of getting a EBC certificate for biochar for one year is 1700 euros (Wilson,2014). For permits, B.V. registration, notary fee, book keeping around 1850 euros are needed (gov.nl, 2020) For salary consideration, 12 Pyropower members are considered, working 4 hours a week for the period of 2022 in which the focus is on conducting the pilot successfully. This salary calculations leads to 7800 euros in total (assumption). The transportation costs for biochar is found from Panteia which comes to around 15 euros/tonne.km. Assuming the biochar is transferred 30 km, for each trip, 360 euros are needed. And in 1 year, considering 6 trips, 2160 euros are needed (Panteia, 2020). The table shows costs incurred for year 2022. Pyropower should apply for subsidy to finance the business. The DHI subsidy scheme offered by Netherlands government seems suitable in the case, as the subsidy is for ideas that want to demonstrate that a sustainable business can be built through it. The costs for marketing is considered to be 2000 euros. For the next year, it is considered that members provide at least a day per week to work on Pyropower activities. The respective costs model is shown in the table.

Capital needs planning

Investments		
Machines / technical equipment	30,000.00	Outsourced design to Audacious sheet metal BV
Agrocares scanner	3,000.00	Agrocares
Other		
Sum investments	33,000.00	
Start-up costs		
Permits- B. V. registration	50.00	Retrieved from https://business.gov.nl/starting-
Notary fees	800.00	Retrieved from https://business.gov.nl/starting-
accounting/ bookkeeping	1,000.00	Retrieved from https://business.gov.nl/starting-
Sum start-up costs	1,850.00	
Launching costs (before product launch and first revenues)		
Personnel salary	7,800.00	Cost of 12 personal working 4 hr. Per week
Lease	27,500.00	Statista, one square meter= 55 euros per year,
Transportation	2,160.00	Panteia, research to progress, April 2020
Sum launching costs	37,460.00	
Capital needed	72,310.00	

Funding

Other	1,00,000.00	DEI subsidy
Sum funding	1,00,000.00	

Figure 44: Capital needs planning

Income statement		
Sales revenues	26,590.00	44,600.00
./. Variable costs		
Gross profit	26,590.00	44,600.00
Personnel costs (incl. non-wage costs)	7,800.00	15,600.00
Marketing	2,000.00	2,000.00
EBC certificate	1,700.00	1,700.00
Sum costs	11,500.00	19,300.00
Profit / loss (before interest, depreciation, taxes)	15,090.00	25,300.00
Interest	0.00	0.00
Depreciation	0.00	0.00
Operating profit / loss (before taxes)	15,090.00	25,300.00

Considering the profit, in first year, around 15,090 Euros can be earned and if the same model is continued, considering 33,000 as a fixed cost, the break-even comes to around 2 to 2.5 years and if the sales of biochar is increased, as the sales revenue also increases, the break-even reduces.
Break-even= fixed cost/ gross profit = 33000/15090

Figure 45: Income statement

B. Economical feasibility for platform

Assuming Pyropower has 20 CSAs willing to buy the membership of the platform and each CSA consists of 60 members, Pyropower will have around 1200 members for the platform.

Assuming that Pyropower asks for 100 Euros per year per membership of the platform, total revenue generated will be 120,000 Euros.

Now, for each member, a total space given on cloud is assumed to be 8gb which is easily sufficient for an year. For, 1200 people, total space needed on cloud will be 9600 gb or 9.6 Tb and assuming 10 Tb space needed for CSAs and back-end operations.

Total space needed on cloud- 20 Tb

Support needed to realise the project- Assuming
Legal support- 15,000 Euros per year (yearly contract with the law firm)
AI, computer science freelancer- 10,000 Euros (Project based contract)
Working prototype- 10,000 Euros (check appendix for basic quotation)
Administration, office activities~ 10,000 Euros (3 days a week)
Cost of hosting- (check appendix for basic quotation)
Upfront costs- 2000 Euros
Monthly costs- 770 Euros~ 10,000 Euros per year (Microsoft Azure)

Total costs incurred- 55,000 Euros, excluding salaries of Pyropower people

Total surplus amount- 65,000 Euros for first year.

In these calculations, the memberships of other CSA interested organisations is not considered, which will increase the revenue.

6.4 Strategic roadmap

This part discusses the 3 horizons put forth to achieve the final goal of establishing the Pyropower business in European market. The business is divided into 2 parts, one that is related to biochar systems and the other that is related to empowering motivated communities. The earlier chapters discussed the fragmented outputs of the envisioned place for Pyropower in future and in this chapter, the pieces are connected to form 3 horizons Pyropower can look forward to and work towards to achieve the final goal.

Horizon 1

New market for biochar

Horizon 1 represents near future, where it is easy to increase cash flow, where business is readily available. Usually this horizon focuses on increasing performance of existing business models to increase profits and cash flow (McKinsey Quarterly, 2009). In case of Pyropower, there is a business model for waste management, climate change action and energy generation but there isn't an existing business model for sells of biochar due to multiple reasons related to biochar. In that case, the challenge for Pyropower in first horizon is to build a business for biochar in the European market. The advantage for Pyropower in this horizon is the low cost of biochar and relatively higher percentage of carbon than organic fertilisers while also supplying nutrients. For Pyropower, the first horizon is achieved in year 2022.

Market-

Pyropower will use its current contacts to build a business with Unwaste where biochar will be produced. Considering the biochar systems, waste management and energy production business models will be implemented with Unwaste and carbon credits are claimed for the biochar that is produced.

Biochar business model is to be implemented with CSAs (Community Supported Agricultures) where CSAs will get the biochar and Pyropower will get the fees for biochar, in instalments. Usually, the frost free zone of Netherlands starts from 10th March and ends on 23rd September which is also the harvesting season of Netherlands. Pyropower can aim for the harvesting season of 2021, by which, Pyropower needs to get in touch with some CSAs and convince them about the use of biochar, and start a pilot with the CSAs. With the current market scenarios around biochar, Pyropower needs to gain trust of CSAs by showing them that biochar is effective for this season. The cost of biochar in the case, can be paid in instalments, so that the problem of huge initial investment costs are eliminated, while building a consistent touch with the CSAs. Pyropower needs an organic fertiliser company like Benefert, which will support Pyropower with organic fertiliser mixing and then the biochar will be applied to the farm. Pyropower needs a credible transportation partner who can transport the biochar from one place to other.

Pyropower needs to speed up the process of getting a certificate from EBC for the biochar that will be produced. A partnership with IBI will also open doors to many other biochar producing and supporting companies. For Pyropower, it is important to create trust and credibility among biochar users that it is an effective and organic way of increasing farm yield, for which purposes, the activities related to re-branding of biochar/changing the perception of biochar can also be started.

Technology-

The technology needed for this business model to work is the kiln technology which will be implemented at Unwaste facility. The design and engineering team has to work on the kiln so that the biochar quality produced from the kiln is consistent. After the design and testing of the kiln, Pyropower will have to apply for EBC (European Biochar Certificate) which will build credibility for biochar produced through the kiln. Buying a pyrolysis reactor from the market is not really recommended as the reactors increase the manufacturing cost of biochar thus, increasing the selling cost of biochar also. So, the design of a kiln that can produce consistent quality of biochar is needed for Pyropower.

Business model-

As described by the first case in revenue modelling chapter, the business models with Unwaste remain intact whereas business model with biochar and CSA are to be developed as shown in the business modelling section figure 40.

Horizon 2

New market for Kiln and established biochar, scouting for platform

The 2nd horizon for Pyropower, is achieved in year 2024, is the one where decision is taken whether to stick with the existing business model or to shift towards a completely different one with new value proposition in new market. For Pyropower, the 2nd horizon is about implementing the kiln on a pilot basis at CSA, to check the usability and increasing the sales of biochar to other CSAs also. In this stage, Pyropower needs to check if the idea of platform with CSA and implement the platform for a group of local CSAs.

Market-

In this stage, the business with Unwaste can continue, with biochar sales to other CSA organisations as well. By this horizon, in 2022, the other CSAs should be approached with the proposition of using biochar for increasing farm productivity. With the testimonials and test results, certificates, it should be relatively easier to convince CSA farmers about the effectiveness of biochar. Accordingly, more and more CSA farmers and communities should be approached to sell the biochar. The collaboration with organic fertiliser company should continue as the effect of biochar with organic fertiliser is higher and for longer duration.

Apart from that, Pyropower needs to understand the waste structure at CSA and accordingly develop a kiln which can convert the waste into biochar to be used at the CSA farm only. CSA farms are trying to manage the organic waste from farms at the farm only for which, kiln can be provided as

a solution to managing dry waste at a farm. Pyropower should start working towards platform in 2022 to introduce the platform in 2023 to some of the CSA as a pilot.

Technology-

The technology needed in this case is related to the improved design of a kiln, suitable for CSA farm's waste. The new technology should also produce similar quality biochar and the biochar should be EBC certified. Apart from that, the platform is introduced to some of the CSAs as a pilot. A cloud service supplier and a team which can support Pyropower with the operations related to platform is needed.

Horizon 3

Kiln, with new proposition of platform for CSAs.

The 3rd horizon is characterised by new value propositions in new market. This the desired future state. This horizon, for Pyropower is achieved in 2026, with the introduction of platform for CSA communities and the business model concerning kiln, with CSA and Unwaste can continue.

Market-
In this horizon, the focus will be on implementing the platform with CSAs as well as providing the kiln to other CSAs to manage the waste at the CSA farm only. After the 2nd horizon scouting for platform, a decision is to be taken whether to scale the platform to other CSAs as well. In 2024, In that case, new activities should be started, with team expansion to include more departments.

The platform is to be promoted among CSA communities to attract people to the platform. This horizon is the one in which people are looking for ways to fulfil their psychological needs and are willing to take action for achieving the same. In this horizon consumers are willing to help other communities also and they are looking for ways to do so. In this horizon, the pilot is expanded to other communities as well while keeping the business model concerning kiln with Unwaste and CSAs intact.

Technology-
In this horizon, the kiln technology remains the same and platform technology is expanded to incorporate more CSAs.

Business model-
In this horizon, the business model concerning kiln with Unwaste and CSA farms is intact, with biochar supplied to new market which needs to be determined over the time. The business model concerning platform is implemented on a larger scale, incorporating more CSAs in the system. In this horizon, the all 3 business models and 2 revenue models should be operational, which are mentioned in the chapter of revenue and business modelling figure 42.

Business model-

For the second horizon, the business model with Unwaste can continue to produce more biochar to be sold to different CSAs. Along with the business model with Unwaste, the business model with CSA can be implemented, in which, the kiln is introduced to the CSA farms and CSA communities pay for the leasing cost of the kiln. This business model is represented in the 1st part of 2nd case in the business modelling section figure 41.

Conclusion- Implementation

The chapter focused on feasibility related criteria to make the project a reality. As seen, Pyropower has multiple reasons to opt for the CSA as a market for potential business opportunity. At the same time, over the time, Pyropower will be able to gain sufficient revenue to sustain in the market.

Chapter 7

Evaluation and Reflection

Evaluation and Reflection

The project was carried out for Pyropower, with the aim of developing an innovation strategy to establish Pyropower in European market. The previous chapter contain the design of the innovation strategy whereas this chapter is about Pyropower's reaction and external stakeholder's reaction on the strategy developed. The evaluation and validation part will lead to discussion and reflection part in next chapter. The evaluation and validation part focuses on Pyropower's and other's views on the design whereas discussion and reflection is more personal. The aim of the evaluation phase is to check whether the concept fits Pyropower's need for near and far future and if it suits the founders' expectation of Pyropower as a brand and builds the basic understanding of the brand through Pyropower's eyes. The external perspective helps with understanding market and concept match.

7.1 Evaluation

For evaluation purposes, the concepts are explained to Pyropower's members and an external expert in the field of agro-innovation. With the external expert, due to time constraints, only the outputs related to service design were discussed. A powerpoint presentation was used to explain the details of the concept to the expert and the format was informal, as such, the expert could ask questions anytime, in between presentation as well, while keeping up the related conversation. For evaluation with Pyropower, the project is explained in 2 parts. The first part is related to near future plans for Pyropower, which is presented in one of the weekly meetings of Pyropower to every member of Pyropower, to introduce the near future business plans to the members. At the same time, the near future plans are discussed in detail, with founders of Pyropower, financial officer of Pyropower and COO of Pyropower. For the first part, the plans are discussed using a power point presentation, revenue and business models. During the weekly presentation, the setting was more formal, with questions answer session after presentation whereas during the other discussions, the setting was more informal with discussion on topics along with the presentation. The second part focused on designs that are related to far future plan of Pyropower. The second part is discussed with founders of Pyropower and financial officer of Pyropower. For discussing the second part, a powerpoint presentation was used along with the Figma prototype, revenue model and business model. The results of the interaction are described in the chapter.

Near future part of the project-

The near future part is presented in a weekly virtual meeting to Pyropower members and later on, was discussed individually with some members in a virtual meeting. In these meetings, the idea of introducing biochar to CSAs is put forward, along with the discussion on blue ocean strategy, vision, business and revenue model. This section documents the evaluation related to these parts.

The blue ERRC framework suggests that the cost of biochar should be reduced, while looking at ways to reduce high initial investment, is well considered. Still, at the same time, the high quality of biochar produced from technology is also expected, which asks for technological improvement to produce the high quality biochar.

The organisation vision developed after the SWOT analysis and blue ocean strategy, as per the views of the Pyropower members, could be short. The 'carbon negative solutions to bring people together to build a better place' is a bit long, although the meaning suits Pyropower's mission, in which 'bring people together to build a better place' could be changed to a smaller sentence.

The initial part of project, related to near future business model and introduction of biochar in European market, was well received, with one of the founder quoting 'if biochar is to be introduced in Netherlands, then CSA is the way'. At the same time, it also showed the initial biochar quantity needed, which formed boundaries for business modelling.

The major questions in the near future part were related to business model related to business model related to coffee business. In other words, the doubts were related to business models related to waste management solution and energy related business model. As per the views understood, the business model for near future, considering waste management and energy use, were complex, and not yet fully developed. A suitable and sustainable market for energy produced through biochar systems is to be determined, as energy plays large role for feasibility, if we have to reduce the costs of biochar produced. As of now, energy is used for drying coffee grounds, for which more research is needed.

The addition of organic fertiliser company and soil health checkup company is a positive addition to the business model, where the interaction and exchange between Pyropower and organic fertiliser company has to be developed more, with the mutual collaboration for mixing biochar with organic fertliser. The members also suggested to consider Agrocare as a possible solution for soil checkups for their portable solutions.

Far future part of project-

The far future part is presented to founders of Pyropower, and external agro innovation expert in virtual meetings. A powerpoint presentation is used for discussion with external stakeholder in which, the service model only is discussed due to time constraints. With founders, a powerpoint presentation is used to describe the service model as well as the figma prototype is used to easily visualise the idea. The revenue model as well as business model is used to explain the stakeholders and the value exchange among stakeholders. This section documents the feedback received from founders and external stakeholders.

The overall idea of developing a platform which leads to exchange of volunteers within community and psychological well being is well received as after discussing the initial idea, newer ideas, building on the initial idea started flowing in the discussion. The ideas that built up on the initial idea were related to addition of more features and stakeholders within the platform to add more revenue streams and value streams through platform.

The founders suggested to consider other individuals, those are not a part of CSA communities, to be a member of the platform. This will increase the size of the community and there will be more activities, and at the same time, it will help CSAs with efficient operations. Other suggestion was about clustering CSAs at the start only. The CSAs can be clustered at the start based on the activities they want to organise and the image they want to build, for example, a CSA interested in composting is grouped with other CSA wanting to have similar specialisation etc. A similar example of such platform is a platform named 'Workaway' which also focuses on exchange of workforce and volunteers all around the world.

The other topic for discussion was about the membership fees, which are paid by CSA members at the start. The founders are of the view that the CSA communities should not pay for the membership of the platform, instead, the revenue should be generated from advertisements related to biochar, selling memberships to other parties and other streams. One founder mentioned about the premium membership of the platform, which suggests different membership plans for different entities.

Considering the plan with leasing the waste management solution to farmers, the founders think that few farmers from CSA community will buy such a waste management solution and so, the biochar business model, with CSA being a biochar customer, is still valid in coming years. At the same time, it also makes clear the position of Pyropower founders intend to have. In a way, Pyropower wants to focus on biochar business more and less on technology side of producing biochar. As of now, Pyropower has contacts of companies who want to ship and sell biochar in European market and so, Pyropower thinks that the solution of platform for selling biochar as well as build a CSA community is suitable in this case. So, Pyropower envisions this as a biochar selling shop as well, along with the CSA community platform.

The part related to finances for the platform is less developed as of now, for the costs of memberships were assumed to be 50 euros or 100 euros, which need more consideration, which will be addressed in the future. The detailing of the business plan is needed, with more thoughts on memberships, costs, marketing as well as connection needed for realising the project. Also, more discussions are needed to understand the position of platform related to Pyropower, if the platform is a part of Pyropower or is it a side business of Pyropower needs to be decided.

The founders could see the idea to be connected to Pyropower as a brand and could see the impact it will create for Pyropower in the long run. As said by one of the founders, his favourite quote is people- planet- profit, which means that, Pyropower is about people first, then planet and in the last, profit. So, this need of connection with people justifies that the platform can be a part of Pyropower.

The expert consulted, understood the concept and identified another similar

concept, which has a similar direction that this project is proposing. The dutch company, Herenboeren is also trying to build 'schools' to teach people about organic farming and CSAs. Herenboeren trains farmers and carries out research, while also focussing on knowledge exchange, inspiration and soil management. This can be the start of the movement for CSAs and over the time, it can evolve into small communities taking care of themselves, where the platform will play significant role. At the same time, it also shows that Pyropower can have a potential competitor in this field as well.

7.2 Discussion and Reflection

This section focuses on the designer role within the project and shares limitations, recommendations and a personal reflection on the project.

7.2.1 Role of designer

"The scope and influence of design is expanding rapidly these days. Organizations are increasingly adopting a design approach to define and implement their innovation strategies, using design to leverage organizational transformations, and even embracing design principles as the overarching philosophy that guides their entire organization." (Calabretta et al., 2016)
This report is a result of the design intervention aimed at providing Pyropower a way to introduce and establish their business in European market and build a sustainable business, while still keeping a touch with the other projects in other continents. To achieve the same, my role within the project was multifaceted. Along with using the strategic tools and methods to support the process of development, a shifting mindset was needed which can be emphasised by the timeline. I, in this project, had to switch between a more pragmatic mindset and a visionary mindset. On one hand, to deal with the immediate requirements, to introduce Pyropower as soon as possible, a more pragmatic mindset was required, which looks at the current conditions and position Pyropower has and builds up on it, to make it as quick as possible. On the other hand, a more visionary approach and mindset is needed, which looks forward in the future, and envisions Pyropower's business in that setting, while still being connected to Pyropower's beliefs. At the same time, I had to change between multiple roles such as researcher, facilitator, creator and advisor to create the impact that is needed. These shifting between roles was made easy with the use of tools that are used for design.

7.2.2 'Future proofing' for Pyropower

Future proofing for Pyropower in this case, is achieved through the use of different strategic methods. Blue ocean strategy, which creates an unprecedented market space is used for immediate action plan for Pyropower whereas the method of vision in design guides the overall process of the project. The vision in design process helps to extract the essence of an entity and put that essence in the future setting, while considering the individual designer's creativity. In case of Pyropower, understanding the essence was important as the setting was completely changing from 3rd world countries to a developed world. ViP process allows to connect the mission of Pyropower to both the worlds. The vision in design process gives output in terms of a specific product/service concept and thus, has to be coupled with tools from strategic design to make sure that the outputs that are achieved are useful for management people as well as other members, thus are strategic. The use of blue ocean strategy in the project was to ensure a distinctive and workable position in the European market. The ERRC framework used in the report helps with locating the position that Pyropower should aim to attain in near future, and also leads to a central vision which Pyropower has to adhere to in its projects. Pyropower is envisioned as a responsible business that is future oriented, and aware of its impact on others. Initially, the project started with the possible intersection of people-technology-business and later on, another domain of social impact was added to it, to make it people-technology-business-social impact.

7.2.3 Reflexivity and the designer

The ViP process collects factors that are relevant to the future to build the future. In the end, it comes to the designer to build the future, which allows for the personal touch to the future setting the designer envisions, and thus, is highly creative. The factors collected for future creation can be combined in multiple ways to create different future settings. In case of this project as well, the designer had to create the possible future settings. Ideally, the process of creating the futures should be kept unaffected and independent from the project undertaken, but at the same time, the future is affected by designer's usual beliefs, his values. In this project, it was taken care that the project does not affect the creation of future setting, as well as other perspectives were also considered, by inviting other individuals to create the future settings. But, in the end, the futures settings that were created, were, to some extent biased, to match the designer's expected world. This bias can be noticed in the future settings created, where the clusters seem to be on the optimistic side, believing in the goodness of people. For example, 'older and richer generation' when matched with 'individuals are greedy' leads to a more capitalistic nature. Although this weight was considered while creating the future setting, the other weights/ factors led to the setting 'enlightened older generation'.

7.2.4 The perception of biochar

Biochar is considered as a soil conditioner due to its nutrient content and ability to supply those nutrients to plants over the duration of time. Through the research conducted, it was understood that biochar alone, when compared with other organic conditioners or fertilisers, can be inferior to some grades or organic fertilisers as the organic fertilisers are treated and have better nutrient content. As claimed by organic fertiliser companies, the organic fertiliser is supplied to crop for 90-120 days after which, the farmer has to again treat the land with organic fertiliser. In such a case, biochar adds value by reducing wastage of nutrients and retaining the nutrient content for more duration in the soil, which leads to long term betterment of the soil. So, should the biochar be considered as a solution which allows the nutrients to be supplied for even longer duration? A possible direction to be explored which will cause biochar to be considered as a nutrient retainer and a sustainable, long term solution to improving the yield of soil.

7.2.5 The use of future settings for developing other value propositions

The clustering exercise carried out in the project leads to creation of 8 clusters which are the possible future settings, which when combined, give 12 future practices, of which, one practice is selected for developing the next proposition. Similarly, the other 11 practices will also lead to development of newer propositions within the domain of communities in agriculture. These practices are neutral in nature, and not specific for the context of Pyropower. It is possible for any other designer or enthusiast to use the practices or the future settings to develop newer propositions and can be a direction to explore new things for Pyropower as well.

7.3 Conclusion

The project looked at the development of an innovation strategy for Pyropower to establish the business in European market. This was achieved by using the design methods and tools of strategic design.

The vision in design process guides overall process of design and addition of blue ocean strategy make sure that the position is distinctive and targeted market is unattained. A due consideration was given to make Pyropower a future oriented, responsible business by keeping people and planet before business. The project is divided into 2 parts- one that addresses near future and other that addresses far future.

The research carried out helped to understand the problems related to biochar introduction in European market as well as Pyropower's beliefs and values they believe in. As found through the research, as of now, biochar is suitable for agricultural sector, but it faces the problems of high initial investment and trust issues related to productivity of biochar, and, biochar already faces competition from other types of fertilisers. From the Pyropower perspective, there already are existing competitors in European market, which develop solutions that produce biochar as well as sell biochar. Accordingly, following the principles of blue ocean strategy, a new market was selected to introduce to, this market was CSA.

The selection of CSA is also supported by the domain definition created during deconstruction phase. The domain Pyropower is active in is related to communities in agriculture and thus, CSAs form a perfect fit for Pyropower to support. The domain definition is followed by creation of a future setting, future practices and a design of a service that focuses on exchange of volunteers among CSAs which leads to psychological wellbeing of volunteers and efficient working of CSAs.

The design of the service is supported with the design of business model and revenue model to realise the concept in European market. The strategic roadmap in the project shows a timeline Pyropower can consider for its progress till 2025 and implementation of the designs in the report.

The project was about establishing Pyropower in European market and build a sustainable business. So, the strategy also shows a direction for Pyropower as a brand and justifies the selection of CSAs as a match for Pyropower's initial activities in the European market.

The overall project and report will serve as a guide for Pyropower for coming years for developing the business in European market with a focus on CSAs as a customer and for building a successful brand out of it.

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