STRATEGIC AND FINANCIAL ANALYSIS OF MALT BY-PRODUCT VALORISATION

COMPARISON OF TEXTURIZED VEGETABLE PROTEIN WITH CURRENT CATTLE FEED PRODUCTION

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The in-company project marks the end of a Vlerick year full of new learnings and experiences. It is the moment where gained knowledge can be turned into practice. This can be done in the environment of a company, so you get a feeling of how it is to be part of the real work-life. We are grateful for this experience, which has been made joyful due to the help of several people.

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Executive summary

Being the masters of malt is the goal of the biggest malting company in the world, Boortmalt. Boortmalt is located in the port of Antwerp where barley is imported by barge and train. After the conversion of barley into malt by a four-stage process, the malt is exported by truck or ship. The malt can be used for different applications: for whiskey or beer production or for the production of malt flour for baking applications.

The malting process generates different by-products being the broken and small barley grains, husks and the rootlets. In the light of circular economy, more and more waste streams are being valorised. Today, Boortmalt mixes all these by-products to produce pellets for cattle feed.

The rootlets contain 30% of protein, and with the rising demand for plant-based products as sustainable alternatives for meat, Boortmalt wants to understand if the rootlets can be processed into a more high-end product for human consumption. After a first market scouting by ShakeUp Factory, a consultancy company, an idea was to valorise the rootlets into texturized vegetable protein (TVP). TVP can be used in different vegan or vegetarian applications, as texturization gives plant proteins a meat-like structure. As such, the goal of this in-company project was to answer the following research question: “What creates more value for Boortmalt: using the malt rootlets in the pellet production for cattle feed, or to use these to produce texturized vegetable protein?”

TVP is only one of the possibilities for the valorisation of rootlets, and other by-products should then also be further processed into new applications. This means that other markets, in which the different by-products can also find their application, should be investigated as well. This in-company project includes therefore a guideline on how to do an in-depth market research. By way of illustration, the market research has been applied on the pellet market and the market for TVP to be used in meat alternatives.

Practically, market research has been tackled by answering different questions using specific frameworks. A first aspect that has been investigated was the market attractiveness, which can be assessed by using the five forces of Porter. To understand what factors shape a market and which the minimum criteria are for a company to play in that market, the key success factors analysis has been done. For a company, it is then also interesting to understand where – compared with competitors – it has competitive advantages, parity or competitive disadvantages. This is analysed by performing a VRIO analysis as this shows a company where to give attention to, or in which resources or capabilities to invest in. Macro events however might change the market shape and outlook in the future. PESTEL investigates potential political, economic, social, technological, environmental and legal factors that might influence the market, and your business, in the future. As such, a company can anticipate on these events and maybe even adjust its strategy.

To complete these frameworks, mainly secondary resources have been consulted on search engines such as Google, Google Scholar but also in databases such as Bel-first, MarketLine and Euromonitor International. Besides, a customer interview which is a primary resource, was conducted for the pellet part to understand Boortmalt’s competitive advantages. Next, also internal information from Boortmalt and its employees has been received.

The market research data has also been supplemented with a financial profitability assessment for both markets. The profit and loss statement (P&L) for the pellet production process aimed to understand how profitable this business actually is. Therefore, cost and revenue information has been

gathered via Gert Van Laer, projects and asset care manager of Boortmalt Europe. He provided us with all cost information such as electricity, power, labour cost, depreciation, etc. related to every machine of the pellet production process.

To draft a P&L for the TVP production process, some general numbers were received from a Swiss start-up, with which Boortmalt is considering to partner up for the TVP production. The numbers gave an overview of the profitability when Boortmalt would outsource this process to a third party.

The results of the market research for pellets showed that the market is not very attractive. Also the future outlook shows that the need for cattle and pig feed will decrease. This trend is fuelled by legal regulations such as the nitrogen decree in Belgium, that aims to scale back the amount of livestock. More specifically, the market for cattle feed in Europe even decreased with -0.16 % between 2020 and 2021. However, Boortmalt delivers pellets as ingredient to compound feed producers, and several reasons contribute to the expectation that Boortmalt might keep its position in the market longer compared to competitors. First, as a customer says, Boortmalt provides pellets that are sustainable as the ingredients are coming from waste streams. Second, Boortmalt is known for its accurate filling and buyer orders, which is a competitive advantage. Third, if Boortmalt would not be able to deliver the promised amount of pellets, the company will always communicate this well in advance. These are seen as advantages, and should keep Boortmalt in a good position for the future. Besides this market research, the profit and loss statement also showed that the pellets have an operating margin of 91,8%. This high margin is mainly due to the low costs related with the production of pellets. The low costs are among others due to the absence of any depreciation costs for the machines. That these machines are so old and the fact that there are rising trends in plant-based products for human consumption, were the main reasons for Boortmalt to start discovering new applications for the valorisation of its rootlets.

One such a potential application is the production of texturized vegetable protein. TVP is now mainly used for the production of plant-based meat alternatives. The demand of these meat alternatives is booming since recent years due to consumer awareness about health, animal welfare and sustainability. The meat industry is under pressure due to its extensive land, water and energy use but also because of the enormous contribution to global greenhouse gas (GHG) emissions. The market for TVP production is attractive, and competition is not really fierce yet. TVP today is mainly made from soy, wheat and pea. Still, there are some technical barriers to overcome and no company has found the ideal recipe for TVP production yet. Boortmalt fulfils all minimum requirements to play in that market. Competitive advantages are the fact that Boortmalt has direct access to lots of protein, and that the company is as such supplier independent. There are two other factors that could give Boortmalt interesting competitive advantages. First, plant-based meat alternatives today try to imitate the meat taste. Boortmalt however would produce TVP with a malty taste, which would result in malty tasting meat alternatives. If customers would like that, which first should be investigated by product testing, then this could be a first point of differentiation. Moreover, the rootlets are quite bitter which is also a barrier for the meat alternative producers, as only a small fraction of bitter TVP can be added without influencing the burger taste too much. Second, studies at the University of Eastern Finland have shown the presence of phytochemicals in malt rootlets from barley. Phytochemicals are said to be healthy. This has not yet been confirmed for Boortmalt's rootlets, but if that would be true, Boortmalt could use this together with the malt taste in marketing campaigns to distinguish itself from the competition. Besides, confirming this would also answer to the health halo challenge. This challenge is born from the fact that meat alternative burger producers claim that its products are healthier than meat, while there is no evidence for this.

The trend for plant-based foods will keep increasing in the coming years and will be supported by legal actions such as the nitrogen decree that will limit the meat availability. Moreover, the idea of implementing meat taxes is rising and more and more European advisory bodies that give feedback and recommendations regarding plant-based diets are founded.

The first financial calculations for TVP production shows profit potential, and the margin would be 69,5% on TVP. However, these calculations are based on the scenario where Boortmalt would outsource the TVP production. The long-term goal is to invest in an own production facility, where it also expected that the product margin for TVP will increase due to scale of economies, just as is currently the case with pellets which have an operating margin of 91,8%. The general conclusion for Boortmalt is to go into the production of TVP due to the attractive market outlook and the new plant-based food trend. Diving into the TVP market would diversify Boortmalt's business and enable the company to create more strategic value by expanding its product portfolio in the food market. Boortmalt has already a potential partner for it, a Swiss start-up, of which they can use the experience and knowledge needed to dive into this new market. Products for human consumption can create more value than animal feed, however the pellets are still very profitable at this moment. That is why the pellets can be used as back-up or as cash cow while Boortmalt is in the transition phase of scaling-up the TVP production.

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List with abbreviations

Abbreviation	Meaning
BFA	Belgian Feed Association
B2B	Business to business
B2C	Business to consumer
GDP	Gross dominant product
GNP	Gross national product
GHG	Greenhouse gases
GMO	Genetically modified organism
IFRS	International Financial Reporting Standards
KSF	Key success factor
kWh	Kilowatt hour
NPS	Non-starch polysaccharides
PAS	Programmatische Aanpak Stikstof[1]
P&L	Profit and Loss statement
TVP	Texturized vegetal protein

[1] Translation in English: Programmatic approach to nitrogen

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Part I – Boortmalt

1. The company

1.1. History

In 1924, the family Thirionet founded the malting company Boortmalt. The production facility was built in 1927 near the Leuven – Dijle canal in Boortmeerbeek, Flanders. At that time the company produced 3 700 tonnes of malt each year (Boortmalt, 2022a).

In 1986 Boortmalt acquired the Sobelgra silo in Antwerp (Flanders Investment & Trade, 2018). Two years later, the company moved its production facility to Antwerp because of the strategic location, which is advantageous for the logistics. In Antwerp, Boortmalt can easily transport malt to the rest of the world by ships, in bulk containers, or by trucks in 25 and 50 kg bags. The raw material, barley, comes in either by train (from France) or by barge.

Another important event is the acquisition of Boortmalt by the French grain cooperative Epis Centre in 2004. Now Epis Centre has merged with Agralys to the cooperative Axéréal which is the largest grain collector in France and also one of the largest in Europe. Over the years, Axéréal invested a lot to increase the capacity of the production facility in Antwerp and to equip it with an innovation centre. Boortmalt Antwerp is the largest malting site in the world with a yearly production capacity of 470 000 tonnes (Flanders Investment & Trade, 2018). Since the acquisition, Boortmalt grew exponentially and opened new production facilities all around the world (Flanders Investment & Trade, 2018). After the acquisition of Cargill malt in 2019, Boortmalt became the largest malt producer in the world with a production capacity of three million tonnes each year. Besides the production of malt for beer, Boortmalt also produces malt flour for baking applications. This is a side business as 99,5% of the malt is used for beer while only 0,5% of the malt is converted to malt flour (Boortmalt, 2022a).

2. Malting as Boortmalt's core activity

2.1. Vision, mission, sustainability

Boortmalt wants to be the masters of malt. In order to be the best malting company in the world, Boortmalt has a strong focus on quality and continuous improvement. The company's mission is to create an exceptional ingredient for brewers and distillers by doing each day better than yesterday (Boortmalt, 2021b).

Malt is made from barley which needs water and energy to grow. Because of the dependency on natural resources, Boortmalt is aware of its responsibility and is committed to run its business in a sustainable way. Therefore, Boortmalt does not only want to be masters of malt, it also wants to be masters of sustainable barley and sustainable malt. As such, Boortmalt has four core objectives to boost its sustainability level: sustainable farming, energy use & emission reduction, health & safety and water conservation (Boortmalt, 2021b).

To achieve sustainable malt, Boortmalt focuses on the core objectives energy use & emission reduction and water conservation by reducing energy and looking for alternative energy sources as well as reducing water consumption. In Antwerp specifically, the energy consumption will be reduced when Boortmalt will implement a heat recovery technology that converts process waste heat into valuable heat which can be reused (Boortmalt, 2021b).

The ambition of Boortmalt also extends to the raw material, barley. Boortmalt invests in sustainable farming by supporting local sourcing programming to teach farmers how to cultivate their land in a

sustainable way that is also beneficial for local communities. Boortmalt wants to help farmers in sharing their best practices and promotes them to use regenerative techniques (Boortmalt, 2021b).

2.2. From barley to malt

Boortmalt provides breweries with one of the four main ingredients of beer being malted barley. The malting process is needed to modify the grain to make fermentable sugars and amino acids available for fermentation. To understand the malting process, it is important to understand the structure of barley (Figure 1).

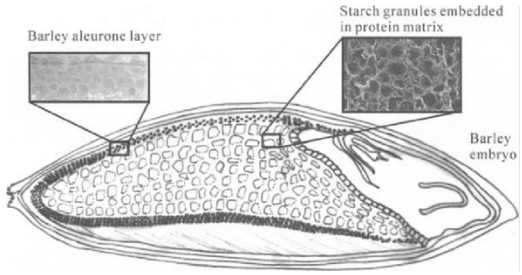


Figure 1: Structure of barley grain (Fox, 2010).

Covered by the husk, the barley grain's two most important components are the embryo and the starchy endosperm. The embryo is a living organism from which a new plant can grow through respiration, the process where sugars and oxygen are transformed to water, carbon dioxide and energy. The starchy endosperm constitutes 58 to 65% of the grain. Starch is the major carbon and energy source that can be used by the embryo for its growing process, and is present in both small and large granules. This starch is embedded in a protein matrix which keeps the granules in a fixed position within the barley. Besides proteins (8,5-13%) and starch, the chemical composition of barley also includes water (13-15%), lipids (2-3,5%), minerals and vitamins (2-3%), non-starch polysaccharides (NSP) like cellulose (5%), hemicellulose and gums (10-12%) as well as polyphenols (0,1-0,3%) and small amounts of oligo- and monosaccharides like sucrose, maltose, glucose, fructose, raffinose, etc.

After the barley arrived via train or barge at the company site, the dormant barley is stored in silos until the malting process begins. Important is that the moisture content of the grains does not excess a value of 12-13% in order to control potential microbial growth. Other important parameters to control are the oxygen supply so the embryo is kept alive, as well as the temperature, which should be lower or equal to 15 degrees to prevent yield losses through respiration. After the storage, the first step is to mechanically clean the barley to remove stones, other foreign grains as well as smaller grains. Selecting grains by size is the next step and is important to facilitate uniform water uptake and germination later in the malting process.

At this stage, the malting process can begin and barley will be converted to malt by three steps: steeping, germination and kilning (Figure 2A).

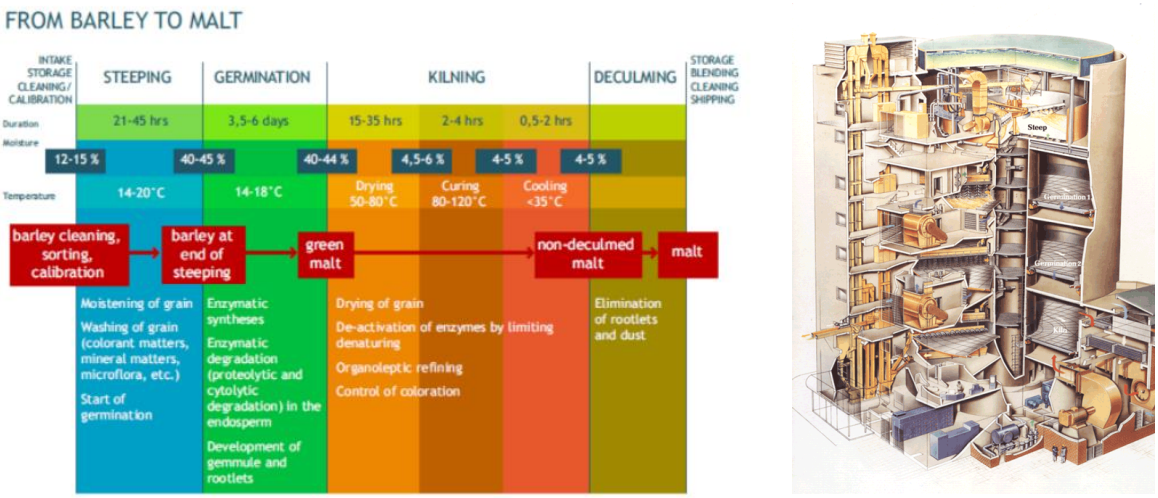


Figure 2: (A) Detailed overview of different steps in the malting process and corresponding parameters: steeping, germination and kilning (B) Malting tower comprising infrastructure for the steeping, germination and kilning processes (Malteurop, 2022).

The goal of steeping is to extract dirt, eliminate germination inhibitors and facilitate moisture uptake by the barley and to increase the moisture level to 15-45%. Practically, this is done by immersing the grain in water having a temperature of 14-20 degrees. The water used for this should be conform drinking water regulations and the amount used is about two to ten cubic meters for every ton of barley. Air is simultaneously blown into the water to provide oxygen to ensure the embryo's survival. This process is performed in cylindroconical vessels, where after the steeping is finished, all grains are collected in the middle of the tank to be transported to the germination box in the malting tower (Figure 2B).

During germination, two processes occur: proteolysis and cytolysis. Proteolysis is the degradation of the proteins that make up the matrix in which the starch granules are embedded. After the proteolysis, cytolysis can start and enzymes break down endosperm cell walls to make starch available. These enzymes are produced due to a hormone, called gibberellic acid, in the aleurone layer of barley. This step is very important as it creates the possibility to break down the starch into fermentable sugars during brewing. Besides, the germination results in the activation of β-amylases as well as the production of α-amylases, limit dextrinases and other starch conversion enzymes. These enzymes are responsible for converting starch into smaller sugars which can be used for the growth and respiration of the embryo. The consequence of this is that the embryo grows and the rootlet starts to grow. Respiration and the early conversion of starch in this phase means extraction losses, so this process should be limited to a loss of maximum 5-10%. As respiration releases heat due to its exothermic character, temperature control is needed. Also, the carbon dioxide and water that are produced should be removed. After three to five days, when the germination is finished, the barley is now called green malt.

Next, the green malt is dried to lower the moisture content from approximately 40% to 12%. At the same time, the heat is stepwise increased to 70 degrees to stop the germination process and thus also the endosperm modification. The grain is now at the bottom of the malting tower where the kilning will start. The moisture content will be lowered to less than five percent by air and heat (>80°C), which will also ensure microbial stability. At this stage, the malt will get its flavour and colour, mainly due to Maillard reactions. During Maillard reactions, reducing sugars and amino acids react with heat as

catalyser to form colour forming components such as melanoidins, reductones, furfural, dicarbonyl, aromatic heterocyclic compounds as well as flavour compounds such as Strecker aldehydes. The heat will also cause all present enzymes to be inactivated. At the end of the kilning process, the malt is deculmed to remove the rootlets that were formed during germination. Lastly, the malt is cooled by blowing in fresh air (temperature of 35-40°C) to obtain an even moisture distribution within the grain before the malt is stored (Boortmalt, 2022b; de Clippeleer, 2021c).

2.3. The usage of malt for beer production

The malted barley is said to be the soul of beer, and is next to hops, water and yeast needed for the beer production. To make the malt extractable, the grains are milled to flour with a disk or hammer mill (de Clippeleer, 2021d). Next, warm water with a temperature rising from 45-65°C to 78°C degrees is added to reactivate the enzymes that convert the starch into fermentable sugars for the yeast. After extraction, lautering is performed to separate the solid material from the liquid extract, called wort. Then, this wort is boiled and hops are added. Hops are plants that not only contain antioxidants essential for beer conservation, but also contain iso-α-acids to add a bitter taste, essential oils as aroma and polyphenols that determine the mouthfeel of beer. Again, a filtration step is needed to clarify the wort by removing the hop components. The wort is cooled and then, the fermentation can start (de Clippeleer, 2021e).

Depending on the type of fermentation, a lager yeast such as *Saccharomyces Pastorianus*, or an ale yeast, such as *Saccharomyces Cerevisiae* is added to the wort. The difference between lager and ale fermentation is that when the fermentation ends, a lager yeast sediments at the bottom of the vessel while an ale yeast starts to flocculate. In general, the yeast will use the extracted malt sugars (glucose, sucrose, maltose and maltotriose) in absence of oxygen to produce alcohol, carbon dioxide and other aromatic substances. After filtering out the yeast, the typical Belgian beer is born and is ready to be packaged (de Clippeleer, 2021b, 2021a).

2.4. Boortmalt's innovation centre

"Boortmalt masters of malt is not about claiming first place, it's about offering the best malt to passionate and demanding customers." This sentence refers to its innovation centre, where Boortmalt likes to improve the quality and taste of its malt according to the expectations of industrial and midsized brewers, distillers and food companies. To bring innovation alive, Boortmalt has two innovation centres of which one is located in Belgium and the other one in Argentina.

In Antwerp, the innovation centre is a separate lab with micromaltings for pilot testing. Micromaltings are used to germinate new varieties of barley, but also legumes and other cereals. Besides, micromaltings are also used to create malt with new tastes through infusion of barley with herbs, spices or other materials that could potentially give a characteristic taste to the malt. These infusion pilot projects can process up to one ton of flavoured malt.

Infusion is a technique that gives rise to a much broader range of possible beer tastes. Infusion makes it possible that spices are added during the malting process, while traditionally wise, spices are added during the brewing process. To check the effect on the final beer, the company also has a little brewery to use the newly produced malt in brewing.

Besides, the innovation centre is also in the possession of a pilot evaporator to produce malt extracts, which can be used for the production of malt syrup. Research is also conducted on the health effects of malt extracts, and food applications in which this extract could be used.

Boortmalt supports open collaborations and internal ideation to come up with creative ideas. Partnerships are established with industrial companies, as well as craft breweries, research centres and universities. Besides, the company also supports breeders to experiment with newly bred barley lines (Boortmalt, 2022c).

Part II – Project scope

3. Overview of all by-products

Waste streams are linked with the production process of malt. Some of these waste streams could have economical value and are considered by-products of the malting process. Boortmalt considers four elements as by-products: rootlets, husks, small barley grains and broken malt grains (Cafiero, personal communication, 2022).

The rootlets are one of the most valuable by-products, as these contain around 30% of protein (see Appendix part IX.19). The protein content is an important nutritional value and determines the economic value. The rootlets are formed during the germination and detached from the malt by deculmination at the end of the kilning process. In total, the rootlets comprise about 2,6% of the total malt volume (Cafiero, personal communication, 2022).

The husk is the exterior of the grain and contains a lot of fibre. After the germination and kilning, the malt has become more fragile. Therefore, the husk is more susceptible to break down from the malt during transport. Another by-product is the small barley grains which are removed from the other barley grains in the beginning of the malting process. In order to have the same pace of germination, the grains need to have approximately the same size. As a consequence, the smaller grains are left out of the further malting process and are considered as by-products. The last by-product stream is the broken malt grains which are broken because of the transport on the production site. The husk, small barley grains and broken malt grains are called 'dusting' and represent around 2,5-3,0% of the total malt volume (Cafiero, personal communication, 2022).

4. Valorisation

4.1. Current pellet production for cattle feed

Currently, Boortmalt valorises all by-products into pellets for cattle feed. More specifically, pellets consist of 55-60% of rootlets, which are the main protein source, and 40-45% of dusting (Cafiero, personal communication, 2022). Dusting is the collective name of a mixture of small barley grains, broken malt grains and husks (fibre).

The process diagram of the pelletising process is visualised in Figure 3. To produce the pellets, all by-products are collected from the different parts of the malting production plant via mechanic transport systems. After mixing the rootlets with the dusting, 1,9 cubic metres water is added per ton of mixture. The amount of added water is a critical parameter in the pelletisation process. From an economic point of view, as water is a low-cost ingredient, it is interesting to add as much water as possible to produce pellets. However, adding too much water would prohibit pellet production, causing clogging in the presses. Moreover, it also results in microbial instability of the pellets. On the other hand, too few water would result in a dry powder that is not pelletisable.

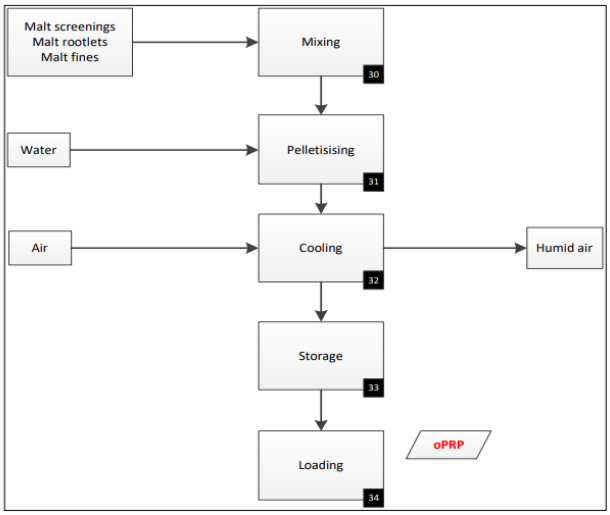


Figure 3: Overview of pelletising process.

Next, the wet mixture is sent to the pelletising machine which is in fact a roll press. As this equipment produces heat due to mechanical action, humid air is generated and is removed. As such, the pellets are dry again, and are cooled before being stored in silos.

By mixing the rootlets with the dusting, the final protein content of the pellets is minimum 19% (Cafiero, personal communication, 2022). Based on information of Baert compound feed company, a protein content of at least 14% is needed for both calf as well as beef cattle feed (Mengvoeders Baert, 2022). As such, Boortmalt complies with this criterium and provides the pellets to compound feed producers such as Arvesta. Boortmalt acts in the B2B market, and clients are searched by a broker, Derigran.

The average selling price of the pellets is 150 euros per ton. Boortmalt's selling price follows the market price of pellet substitutes such as soy or sunflower meal, rapeseed or wheat (Pot, personal communication, 2022). This price can also fluctuate depending on global factors such as the current Ukrainian war. The war causes food prices to rise, resulting in higher selling prices of both Boortmalt's malt and valorised by-products (Ahmed, 2022).

4.2. Problem formulation

Boortmalt's core business is producing malt mainly for the alcoholic beverage industry. To secure the business by diversification, Boortmalt would like to process its by-products and use these to further enter the food market, whether it's food for human or animal consumption. The long-term goal, although not resolute yet, is to have 10% of the total current EBITDA coming from new commercial activities of by-product applications in the food market. Although Boortmalt has production sites in diverse countries, and the business diversification will be applied within the Boortmalt group, the focus of this project will be on the plant of Boortmalt Antwerp where Boortmalt's headquarters are located (Cafiero, personal communication, 2022).

The two main reasons for looking into new food market opportunities at this specific moment are to diversify the business portfolio with other food applications, and because the roll presses used for pellet production in Antwerp are old (Figure 4). Before Boortmalt decides to provide CAPEX for new pelletising equipment, Boortmalt wants to understand if there is no other, more financially and sustainable valuable option to valorise its by-products.

Figure 4: Roll presses of Boortmalt's pellet production.

Therefore, our company surpervisor, Gianluigi Cafiero, is responsible for investigating new ways to valorise by-products, and as such, to discover new potential markets to jump into. For this reason, the consultancy company Bundl has been contacted to conduct a first, general market scouting of all non-food applications such as fish feed, plant-based leather, bioplastics, industrial scale fertilizers, and nutritious pet food. In this market research, Bundl mainly focused on new upcoming trends for which Boortmalt's by-products could be used. For each trend, Bundl investigated both the market and revenue opportunity, however, no specific match between Boortmalt and a new market space has been made yet. In selecting a new market, Boortmalt values the criterium of sustainability. As is mentioned in the sustainability report, sustainability is at the core of Boortmalt's business strategy (Boortmalt, 2021b).

However, during this project, the focus will be to find a new application for the rootlets specifically because rootlets contain 30% of protein, which is a valuable factor. Boortmalt itself also believes that applications for human consumption will create more value compared to the production of non-food products, and will be therefore given priority. The external lab analysis has confirmed that the rootlets are food grade (see Appendix part IX.20). This means that the by-products can be used for human consumption and that is why market scouting in food applications has been started by another consultancy company, called Shakup Factory. The result of the first market scouting suggested Boortmalt to consider going into TVP production, with TVP standing for texturized vegetable protein. This can be used as an ingredient for plant-based meat burgers and similar finished products that serve as meat alternatives.

At this moment, Boortmalt is in contact with a Swiss start-up consisting of a food distribution owner, a serial entrepreneur with engineering capabilities in the agrotechnology and food industry as well as an owner of a food manufacturing company having a lot of experience with product and machine innovation for food technology, as well as for TVP specifically. The Swiss start-up not only produces TVP, but also uses this as an ingredient to produce different kinds of products including plant-based meat alternatives.

During this in-company project, the possibility for Boortmalt to dive into the TVP production has been further investigated. To do so, contact has been made with the Swiss start-up. This opportunity has been compared on different levels with the current rootlet valorisation, to understand if going into the TVP market would indeed create more value for Boortmalt or not. How this problem has been tackled

is explained in more detail in § 5. Research question, § 6. Research design from Part II – Project Scope as well as by Part III – Methodology.

5. Research question

In order to work out a methodology, it is important that a clear research question is defined based on the problem statement. Our main research question for our in-company project at Boortmalt is:

"*What creates more value for Boortmalt: using the malt rootlets in the pellet production for cattle feed, or to use these to produce texturized vegetable protein?*"

Value specifically refers to the economic value an application would create for Boortmalt, taking into account that there should be a strategic fit with the company. This research asks for a comparison, so the project can be divided in two parts: part I, the current pellet production to process rootlet by-products, and part II, a new production process that uses the rootlets to generate texturized vegetable protein. As such, answering this research question asks for several analyses to be made for each project part. Therefore, the research question can be divided in a hierarchy of sub questions for each part:

1) Project Part I – current pellet production specifically applied to Boortmalt Antwerp

    - Is the current cattle feed market economically attractive?
    - What is the future potential of this market? Is it a growing market and why (not)?
    - Who are current clients of Boortmalt's pellets sold in Antwerp that define the company's selling market, and why do they buy pellets from Boortmalt?
    - What products and companies can be considered as competitors? And what could (not) be the competitive advantage(s) of Boortmalt Antwerp?
    - Is the current pellet production profitable?

2) Project Part II – texturized vegetable protein

    - Is the plant-based meat alternative market economically attractive?
    - Who are the competitors of Boortmalt for the TVP market and on what aspects does Boortmalt have competitive advantage?
    - What is the future potential of the meat alternative market? Is it a growing market and why (not)?
    - Would the TVP production be profitable for Boortmalt?

3) Which market, the pellet or the texturized vegetable protein market, should Boortmalt choose to focus on based on market outlook, strategic fit and profitability?

6. Research design

Defining a hierarchy of research questions helps pointing out which methods should be used to finally answer the main research question. Figure 5 gives a schematic overview of all research methods and frameworks that will be used. All methods are collected from several courses that are part of the Masters in General Management curriculum: entrepreneurship, strategic management, corporate finance and strategic management accounting.

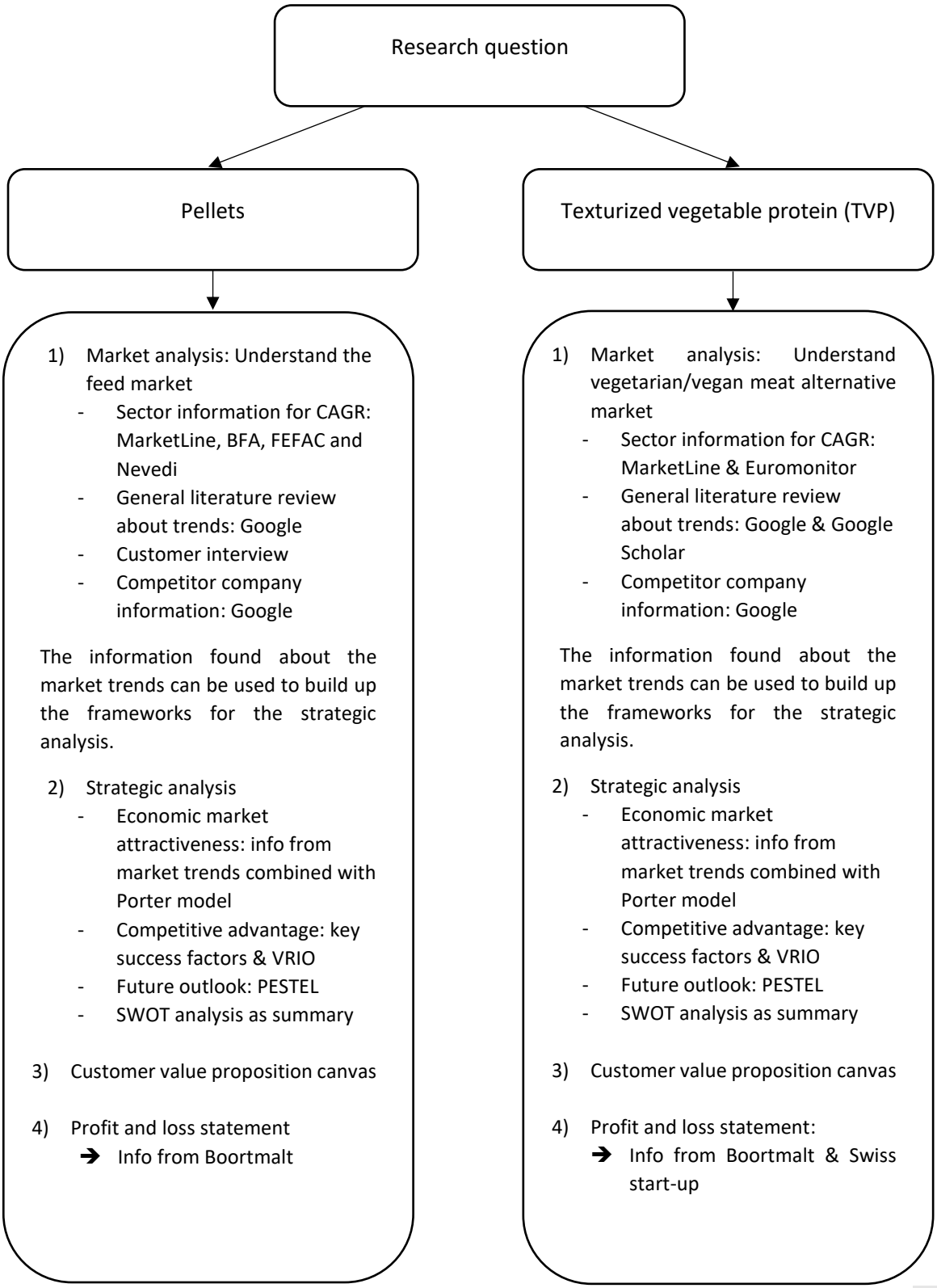


Figure 5: Overview of the research methods and frameworks used to analyse the market for pellets and TVP .

Part III – Methodology

The methodology is written out in detail to provide Boortmalt with a guideline on how to perform market research and a strategic analysis. Because of the limited time of this project, the scope was constrained. It therefore has been decided to investigate the market related to Boortmalt's pellets and texturized vegetable protein. In the future, Boortmalt could use this methodology to perform an analysis on the other markets where there is also a potential to use its by-products, like for example the pet food and fish food market.

7. Strategic analysis

Boortmalt wants to understand which application is most valuable to process the rootlets in: pellets for cattle feed or texturized vegetable protein for human consumption. In order to compare these two markets, the same analyses have been performed. First, the economic market attractiveness has been assessed for both markets. Practically, this has been done by applying the Porter framework. Then, it has been assessed if Boortmalt complies with all minimum criteria that are necessary to play in a particular market, by qualitatively investigating the key success factors. Then, Boortmalt's competitive advantages have been assessed in these markets. This has been studied by the VRIO analysis. Additionally, as it is important to understand the implications of macro-environmental events, a PESTEL analysis has been performed for Boortmalt as well. To summarize and link the output of all different frameworks, a SWOT analysis is made.

To visualise Boortmalt's position based on market attractiveness and competitive advantage, the business opportunity matrix can be used (Figure 6).

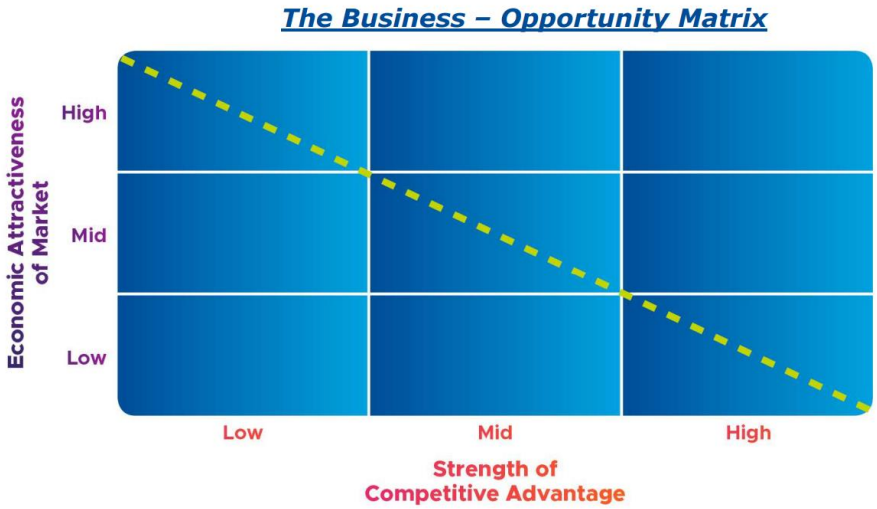


Figure 6: The business opportunity matrix (Peeters, 2022a).

7.1. Market attractiveness by Porter

The five forces model of Porter is a tool for understanding the competitive structure of an industry and the type of relations between the various participants in the market (Figure 7). This tool allows to identify the competitors and to help a company understand how competitors and changes within the industry can affect its profitability. The model of Porter examines five forces analysed from the perspective of current businesses that operate in a particular industry: customer bargaining power,

supplier bargaining power, the threat of substitute products, the threat of new entrants, and intra-industry competition (Magretta, 2011; Michaux, 2015).

Figure 7: Overview of Porter's five forces (Margretta,2011).

In order to assess the strength of each force in a more objective way, a basic scoring system can be applied per force. The system works as follows: per force, there are some guiding questions that need to be answered by assigning a number from one to five. After answering all the questions, the given scores must be added and be compared with the maximum score to define a conclusion. To come to the total score, the left questions should be answered by assigning a number. If the statement is true, then number 1 is given. If the statement is false, then a higher number is given, which also means that the statement at the right is more applicable. The interpretation of the score will be explained in more detail below per force (Peeters, 2022a).

The first force is called the customer bargaining power which is the amount of power customers have to negotiate the price or ask for better quality or additional services, and depends on different factors such as the volume customers buy, the availability of the products, etc. The guiding questions to decide on the strength of this force are shown in Table 1.

Table 1: Guiding questions to decide on the strength of the customer bargaining power (Peeters, 2022a).

Power of buyers (→ appropriation of profits)		
Strong buyer power		**Weak buyer power**
There are few buyers (purchasing large volumes)	1 – 2 – 3 – 4 - 5	There are many buyers of our products
Products in our industry are largely undifferentiated	1 – 2 – 3 – 4 - 5	Product differentiation is key in our industry
Buyers in the industry face no switching costs	1 – 2 – 3 – 4 - 5	Buyers in the industry face huge switching costs
Buyers in the industry are very price-sensitive	1 – 2 – 3 – 4 - 5	Buyers in the industry are not price-sensitive
Products have little effect on our buyers' costs and quality	1 – 2 – 3 – 4 - 5	Products have huge impact on buyers' costs and quality

When these five statements are answered, the sum of the numbers should be taken. In this case, the lower the score, the stronger the customer bargaining power and vice versa. Understanding the customer bargaining power is important to understand the effect on industry margins. A strong customer bargaining power results in a lower profitability either because customers will force the price to go down, or they ask for more value which means that costs for the company go up (Magretta, 2011).

Similar to customer bargaining power, the power of suppliers increases when suppliers can impose more requirements to the company in terms of cost or quality. The power of suppliers is significant when they have many customers from different industries, the transfer cost is high, etc. If suppliers have power, they will use it to negotiate higher prices or shorter payment terms, which both increase costs for the company. This also lowers industry's profitability, and as such, having a view on the supplier bargaining power might be important (Table 2) (Magretta, 2011).

Table 2: Guiding questions to decide on the strength of the supplier bargaining power (Peeters, 2022a).

Power of suppliers (→ appropriation of profits)		
Strong power of suppliers		**Weak power of suppliers**
There is consolidation among our key suppliers	1 – 2 – 3 – 4 - 5	There is no consolidation among our key suppliers
Our key suppliers serve many industries	1 – 2 – 3 – 4 - 5	We are very important customers for our key suppliers
We face huge switching costs when changing suppliers	1 – 2 – 3 – 4 - 5	We face no switching costs when changing suppliers
Our suppliers' products are very differentiated	1 – 2 – 3 – 4 - 5	Our suppliers' products are not differentiated at all
There are no substitutes for our suppliers' products	1 – 2 – 3 – 4 - 5	Many substitutes for our suppliers' products are available
Our suppliers threaten to enter our industry	1 – 2 – 3 – 4 - 5	Our suppliers have no intention to enter our industry

The same interpretation of the final score as with the customer bargaining power holds for supplier bargaining power.

Next, there is the threat of substitute products which is high when there are a lot of similar products available that could offer alternatives to the existing offer. A new product is said to be a threat as it has the same characteristics as existing products but with a better price-performance ratio, which not means having a lower price for the same product. Having a lot of similar products puts pressure on companies' profitability, as prices cannot be set too high without causing a decline in sales volume. In other words, a variety of substitute products puts a ceiling on the prices companies can ask for their products (Magretta, 2011). To evaluate if this threat is present in a particular market, the questions in Table 3 should be scored. Also here, the lower the total score, the stronger the threat.

Table 3: Guiding questions to decide on how strong the threat of substitute products is (Peeters, 2022a).

Threat of substitutes (→ a ceiling on prices)		
Strong threat of substitutes		**Weak threat of substitutes**
Attractive and cheap substitute products available	1 – 2 – 3 – 4 - 5	No attractive and cheap substitute products available
Our customers are able to switch to substitute products easily	1 – 2 – 3 – 4 - 5	Customers are not able to switch to substitute products

The fourth force is that of the new entrants, which is mainly studied by checking the entry barriers that might protect established companies in an existing market. When entering, new entrants can change the market by delivering greater value. The threat of new entrants is higher when new entrants have easy access to the market because of for example low capital requirements. The result of new entrants coming in is that industry prices go down, to avoid too many companies joining the market. Besides, companies have to try their best to keep delivering enough value to their customers by for instance

upgrading the product. This increases costs, and together with the decrease in price, industry profitability goes down if new entrants come in (Magretta, 2011). To evaluate the presence of this force, Table 4 can be used as guideline.

Table 4: Guiding questions to decide on potential entry barriers and their strength (Peeters, 2022a).

Barriers to entry (→ profit potential of our industry)		
Weak entry barriers		**Strong entry barriers**
Firms in our industry do not enjoy economies of scale	1 – 2 – 3 – 4 - 5	Firms in our industry enjoy economies of scale
There are no network economies in our industry	1 – 2 – 3 – 4 - 5	Established firms enjoy network economies
Switching costs for customers are low in our industry	1 – 2 – 3 – 4 - 5	Switching costs for customers are high in our industry
Easy to find enough capital to run the business	1 – 2 – 3 – 4 - 5	Difficult to find enough capital to run the business
Easy to match the quality levels of incumbents' products	1 – 2 – 3 – 4 - 5	Difficult to match the quality levels of incumbents' products
Easy to have access to distribution channels	1 – 2 – 3 – 4 - 5	Difficult to have access to distribution channels
Government policy favours newcomers in the industry	1 – 2 – 3 – 4 - 5	Government policy protects the existing players
Incumbents will not react when newcomers enter	1 – 2 – 3 – 4 - 5	Incumbents will strongly react on new entrants

Important here is that the interpretation is the opposite compared to the first three threats. The higher the end score, the stronger the entry barriers are. This means that new companies will have more difficulties to start a business in that particular market.

The last element of Porter's model is the intra-industry rivalry which is also influenced by the other forces of the model. The effect of rivalry on industry profitability is twofold: on the one hand, companies will compete at the level of prices with these mainly going down, while on the other hand, companies might invest to improve products, spend more on advertisement, R&D, etc. which increase costs. Both make the industry profitability go down (Magretta, 2011). Table 5 can be used to get a view on how fierce the competition is within a specific market environment. The score interpretation is again the same as the first three forces: the higher the score, the weaker the industry rivalry is.

Table 5: Guiding questions to decide on the intra-industry competition (Peeters, 2022a).

Rivalry in the market (→ distribution of profits)		
Strong rivalry		**Weak rivalry**
Competitors are numerous and/or are roughly equal in size	1 – 2 – 3 – 4 - 5	There are a few dominant players in the market
Industry growth is slow	1 – 2 – 3 – 4 - 5	Our industry grows fast
Exit barriers are high	1 – 2 – 3 – 4 - 5	Firms can easily leave the market
Rivals are highly committed to the business	1 – 2 – 3 – 4 - 5	Rivals are not committed to the business
Products are largely undifferentiated from the competition	1 – 2 – 3 – 4 - 5	Products are highly differentiated from the competition
Danger for excess capacity in the market	1 – 2 – 3 – 4 - 5	No danger for excess capacity in the market

Products in our industry are perishable	1 – 2 – 3 – 4 - 5	Products in our industry are not perishable

The model of Porter takes into account different economic factors that affect the profit of an industry. It focuses both on the vertical value chain as the competition within a market. Furthermore, it is a well-known and very easy model to understand. There are some disadvantages linked to the model of Porter. The model does not take into account that companies can also learn from competitors or from partnerships with competitors. The model gives information about the market structure and potential changes but because of its qualitative nature, it does not offer a tool to quantify these (Michaux, 2015). By using this scoring system, this limitation has been tackled partially.

7.2. Competitive analysis

TEST # 1:Does it meet the key success factors in the market?

The first step for a company is to understand if it is able to play in a market. This is investigated by comparing Boortmalt with the key success factors (KSFs) that shape the cattle feed or texturized vegetable protein market. It is thus needed to identify these KSFs per market. KSFs can be related to different domains, such as technology, manufacturing, distribution, marketing but also skills, etc. (Barney, 1993). Table 6 gives an overview of common types of KSFs including some examples.

Table 6: Overview of common types of key success factors (technology, manufacturing, distribution, marketing, skills and capabilities, others) together with examples to make the concept of key success factors more clear (Peeters, 2022a).

KSFs	Examples
Technology-related KSFs	• Expertise in a particular technology or in scientific research (important in pharmaceuticals, in most high-tech industries, Internet applications, etc.) • Proven ability to improve production processes (important in industries where advancing technology opens the way for higher manufacturing efficiency and lower production costs)
Manufacturing-related KSFs	• Ability to achieve scale economies and/or capture learning/experience curve effects (important in achieving low production costs) • Ability to manufacture or assemble products that are customized to buyer specifications
Distribution-related KSFs	• A strong network of wholesale distributors/dealers • Ability to secure favourable display space on retailer shelves
Marketing-related KSFs	• A well-known and well-respected brand name • Clever advertising
Skills and capability-related KSFs	• Product innovation capabilities • Supply chain management capabilities
Other types of KSFs	• Convenient locations • Patent protection

Once the key success factors that shape a particular market are identified, the next step is to score Boortmalt per KSF. This scoring can be done qualitatively by defining three categories: low, average or high. This gives a first indication if a company has the right resources and capabilities in order to keep

playing in a specific market. KSFs for which the company scores high can give a first indication of a company's potential competitive advantages (Peeters, 2022a).

TEST # 2:Does it have unique resources and capabilities?

However, to assess if a firm's resources and capabilities are indeed unique and thus result in a sustained competitive advantage, a second test should be performed, called the VRIO analysis. VRIO stands for the four characteristics that a firm's resource or capability should have in order to be unique: a resource or capability should be valuable, rare, costly to imitate and the organisation should be organised around it (Peeters, 2022a). Practically, a list of resources and capabilities should first be made for which the KSFs can be used (Jurevicius, 2021). The next step is to ask four questions per resource, related to what VRIO stands for. This principle is shown in Figure 8.

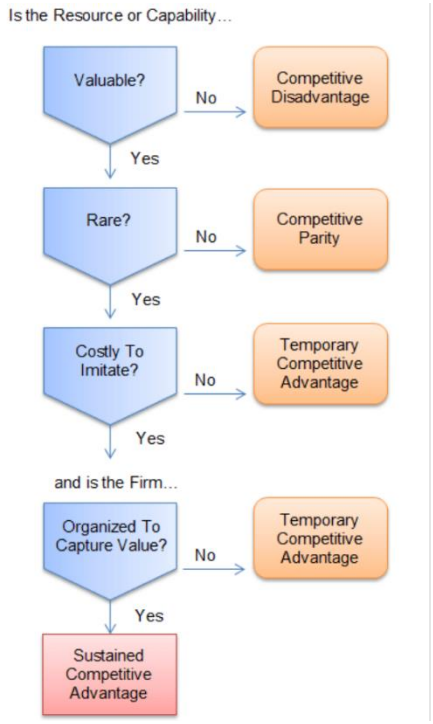


Figure 8: Decision tree that should be followed for every listed resource of capability in the VRIO analysis (Jurevicius, als 2021).

First, it needs to be checked if a resource or capability adds at least perceived customer value (Jurevicius, 2021). It also means that if a company would use these resources or capabilities, it should be able to use these in a strategic way to improve both efficiency as well as effectiveness. As such, there is chance that external opportunities can be seized or external threats neutralized (Grimm et al., 2021a).

Second, it should be checked if the resource or capability is rare. Something being rare means that the company is the only one with a specific resource or capability, and that no one or only a few others within the same industry can adopt or acquire that resource or capability. As such, benchmarking against other industry players is needed to answer this question.

The third question that needs to be asked is if the resource or capability can be easily duplicated or substituted. If not, it means that the resource or capability is costly to imitate. This is for instance the case when the company invented a technology itself, with this technology being protected by a patent.

Lastly, for every resource, an assessment should be made to see if the organisation captures the value from a specific resource or capability. Having valuable resources does not mean that value is created, unless a firm uses these in the right strategic way. A company should thus organise its activities around its most important and value-creating resources (Grimm et al., 2021a; Jurevicius, 2021).

Only these resources or capabilities where the four questions have been answered with a yes can be used by a company to create a sustained competitive advantage. A tip that can be given before conducting the VRIO analysis is that there is a greater chance to get competitive advantage from intangible resources such as trademarks, intellectual property, brand reputation, etc. than tangible assets, which can be more easily acquired by other companies too (Grimm et al., 2021a; Jurevicius, 2021). So it is therefore recommended to first look into these resources and capabilities to set up the list before asking the four VRIO questions.

VRIO is a commonly used strategic method to determine which factor within a company results in sustained competitive advantage (Knott, 2015a). Performing a VRIO analysis shows what a company's weaknesses and strengths are, and the tool helps analysing the value drivers of a company. As such, this analysis can also be used for making up the SWOT analysis (Grimm et al., 2021b). Moreover, by comparing each resource or capability with other players in the same industry, a company can get a clearer view on which capabilities are advantageous to play in that external environment. This information is critical for managers to know, not only for making the right strategic decisions, but also to determine investment priorities. Investing in resources that are not valuable will only result in a cost increase or revenue decrease. Another positive point of the VRIO analysis is that it makes companies look to their intangible assets as important resources, with intangible assets being hard to quantify (Grimm et al., 2021b; Lin et al., 2012).

Although VRIO might be the textbook method for strategic decision making, there are definitely some hurdles linked with the application of this framework. First, it seems that it is very hard for managers to identify resources and capabilities within a firm that potentially fulfil the VRIO criteria. However, this is the first step when conducting a VRIO analysis and will consequently also determine the outcome of it. It means that in general, companies should get more guidance or training for it. Second, and linked with the first obstacle, there exist capabilities or resources that are just embedded in the firm, and which are mostly not identified (Knott, 2015b). Third, the VRIO analysis can be influenced by biases that managers have, and as such, they will use 'obvious' resources and capabilities. Fourth, just as many other strategic frameworks, the VRIO analysis should be reassessed regularly as the value of resources or capabilities can change over time in line with changes in the market, certainly when times are turbulent or unpredictable, or when markets are rapid-changing (Lin et al., 2012).

7.3. Macro changes in the market by PESTEL

The environment in which companies operate changes continuously, and there are factors, so called systematic factors, that are beyond a firm's control. However, it is important to understand external factors that play into the environment so that a firm can analyse the implications, and proactively adjust its business or organisational strategy. As such, PESTEL is also an interesting strategic framework that can be applied for companies that want to launch a new product or business internationally (Peeters, 2022b; Shatskaya et al., 2016).

PESTEL is an acronym that summarizes the six most important macro-economic factors that should be analysed: political, economic, social, technological, environmental and legal factors (Peeters, 2022b; Shatskaya et al., 2016).

The political aspect looks at political factors such as governmental stability and leadership, bureaucracy, employment and operational laws, trade restrictions and taxes, and stability of neighbouring countries. For Boortmalt Antwerp, political factors of Belgium should be investigated, and by extension, factors that play in Europe. It is also important to look at priorities and future initiatives that are set by the government within Belgium and Europe, because these might determine how business is done in the future (Shatskaya et al., 2016).

Secondly, there are the economic factors such as inflation, taxes, credit policies, exchange rates, cost of living, globalisation but also indicators such as gross domestic product (GDP) and gross national product (GNP). The economic part of the PESTEL analysis is important for a company as it directly shows what aspects might determine a company's future profit. For example, current inflation, which is mainly due to the high energy prices, can determine a firm's pricing strategy, and thus potentially the future customer demand (Shatskaya et al., 2016; STATBEL, 2022).

Next, social factors are interesting to look at in order to understand who the customers actually are. Are they prosper, what is their general lifestyle, how well-educated are the people, what are their attitudes and beliefs and are these linked with religion, what about demographics and the employment rate, what is the general mindset of the customers in a specific country, etc. ? For this part of the framework, general info but also indices such as GDP per capita and the human development index can be studied (Shatskaya et al., 2016).

The technological aspect of PESTEL looks into aspects such as level of outsourcing, R&D levels in a country, production efficiency, quality and pricing, intellectual property, governmental activity and legislation, etc. Technology can evolve rapidly, and the situation within a specific country should be assessed. For companies, depending on the industry, it can be crucial to adopt new technologies or production methods quickly in order to stay competitive (Shatskaya et al., 2016).

The fifth aspect of the PESTEL framework deals with environmental factors. Sustainability and climate change are top of mind and are given more attention since recent years. Globalization means companies are active in different countries, so their environmental impact is spread across different areas in the world. Environmental factors deal with companies' infrastructure as well as with social and ecological implications of their activities. Moreover, it is also important to check weather conditions, as this might impact logistical activities or even adjustments to product specifications. Next, there are also legislations regarding disposal of materials or waste streams linked to process activities (Shatskaya et al., 2016).

In terms of legislation, it is important to check types of laws that might affect the business in a particular country. Legislation can relate to employment, competition, trading and taxation, marketing, etc. but also to health and safety. Legislation can, if complicated, define the way a company functions in a particular country, and thus might affect a firm's strategy as well (Shatskaya et al., 2016a).

It is clear that the PESTEL framework should be used to assess the macro-environment in which a company wants to play. It can be that some factors of the PESTEL analysis are less important for a

business to study, so it is common to choose the parameters that are expected to influence the business the most (Peeters, 2022b).

In general, PESTEL has many advantages such as the fact that it is a simple and straightforward framework for interpretation, and that it includes factors in cross-functional domains. Analysis of the macro-trends makes the company aware of potential threats and gives as such a chance to proactively think about concrete actions to minimize the effect of these threats on the functioning of the organisation, both on national and global level. On the other hand, it can open the way to potential new opportunities (Shatskaya et al., 2016).

Disadvantages include the qualitative character of PESTEL, so implications cannot be assessed in a quantitative way through statistical data. Most of the time, companies only make one employee responsible due to cost- and time restrictions, but this limits the effectiveness of applying PESTEL as discussion between people can be key to understand the most important threats. Related to this, the chance that the information is based on assumptions, and that the analysis is more subjective, is higher. Consequently, the quality of the resulting PESTEL analysis decreases which can impact the subsequent decisions. Another danger is called 'paralysis by analysis', which means that because of the wide availability of information, people get lost in details and lose focus. The goal of this analysis is to detect potential future issues, and to find solutions. Next, sometimes users tend to oversimplify the presented information which again can impact the quality of decisions made based on PESTEL (Shatskaya et al., 2016).

Further, it is important to note that PESTEL is only effective when the macro-environment is reassessed on a regular basis. Moreover, strategic decisions cannot be made based on PESTEL alone, it should be used in addition to other strategic frameworks such as SWOT. SWOT stands for strengths and weaknesses, which are linked to the company's internal assets and operations, and for opportunities and threats, which are in fact dictated by the outcome of PESTEL (Shatskaya et al., 2016).

7.4. A general overview by SWOT

The SWOT (strengths, weaknesses, opportunities, threats) matrix focuses on the relationship between a firm's internal strengths and weaknesses on the one hand and the external opportunities and threats on the other hand. A company should use its internal strengths to capture opportunities and overcome threats. Besides, a company should also be aware of its weaknesses and the hinder these could create in capturing opportunities or how these can worsen threats (Figure 9). A SWOT analysis brings the information of the five forces of Porter, the VRIO and PESTEL analysis together. The model of Porter has an external focus and explains which opportunities and threats are going on in the market. While the focus of Porter mainly is on the current situation, PESTEL provides insights in potential future threats and opportunities. The VRIO analysis has an internal focus and assesses which strengths and weaknesses of Boortmalt are compared to other players in the market (Barney, 1993; Shatskaya et al., 2016b).

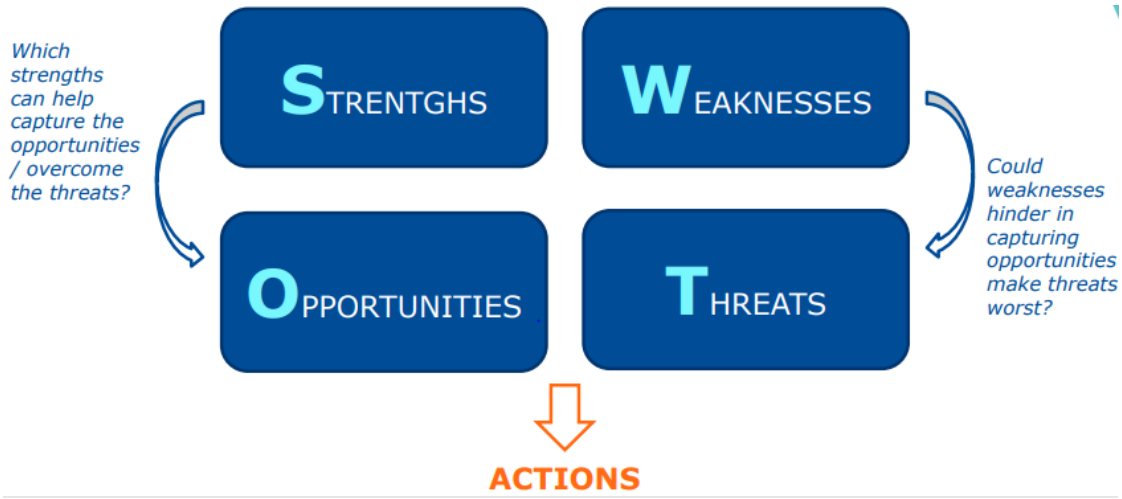


Figure 9: An overview of the different components of the SWOT analysis and how to use the information for conclusion-making (Peeters, 2022a).

8. Customer value proposition

The value proposition canvas is a framework that tries to understand what current customer pains are, and if Boortmalt in this case could solve these pains and/or potentially can create additional value for the customers or not. In general, the value proposition canvas consists of two segments: the customer segment and the value proposition segment.

The customer segment focuses on three elements being the customer job, the pains and the gains. The customer job describes why a customer uses a certain product or service. The pains are the negative aspects related to the customer job like for example undesired costs, negative emotions, etc. The gains are the benefits that the customer would like to experience or be surprised by during the customer job (Osterwalder et al., 2014).

The other part, the value proposition, consists again out of three elements that are linked with the three elements of the customer segments. The three elements are products and services, pain relievers and gain creators. In the products and services part, the company must explain the products or services that it wants to offer to their clients. The pain relievers describe how this product or service could relieve the negative emotions, unexpected costs and situations related to the customer job. The last segment, gain creators focuses on the surprising or pleasant effect the product or service could bring to the clients. If there is a good fit between the value proposition of the company and the needs of the customer, the company could create value for the customer (Osterwalder et al., 2014). This value proposition canvas is schematically shown in Figure 10.

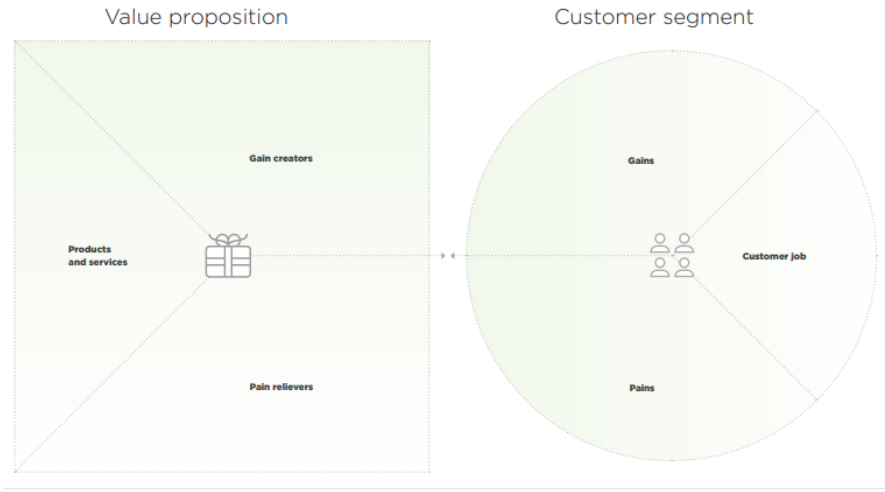


Figure 10: The value proposition canvas can be used to identify the pains and needs of customers and shows how a new product or service can create value by answering the needs.

The value proposition canvas is a tool that allows to organise information about what the customer wants in a simple way. With this tool, it is possible to effectively design value propositions and business models that target the most pressing job, pains and gains (Osterwalder et al., 2014).

The biggest disadvantage about the use of the value proposition canvas is that a lot of people misunderstand how to use it. There are also some common mistakes that are made when filling in the value proposition. One of the most common mistakes is that companies fill in the customer segment with their value proposition in mind. This results in a biased analysis of the customer segment. A common mistake at the value proposition side is that the company does an unrealistic attempt to address all the customer pains and gains. It is better to provide an excellent solution that addresses certain but not all customer pains and gains (Osterwalder et al., 2014).

9. Financial analysis

A profit and loss statement (P&L), also known as income statement, is useful for a company to understand its profitability. In general, a P&L consists of several parts as shown in Table 7.

Table 7: Structure of profit and loss statement.

Profit and loss statement label: Company name Business or company unit The currency Fiscal time period Unit in which numbers are shown
Revenues
- Cost of goods sold
=**Gross income**
- Other operating expenses
=**Operating income (EBIT)**
+ Financial revenues
-Financial expenses
= **Income before tax**
+Tax revenues
-Tax expenses
= Net income

Starting from the top, revenues are shown. These are calculated by multiplying sales volume with sales price. Next, there are the costs of goods which are costs that are directly linked with the production of the products or services that have been sold. Examples of costs of goods sold are the raw materials, packaging, labour of the people that have been assisting the production, etc. The difference between the revenues and those costs of goods sold is called the gross income (Stouthuysen, 2022; T. Harrison Jr. et al., 2018).

Next, a list of operating expenses is shown. Operating expenses include costs such as general and administrative expenses, electricity of the plant, insurance, rent of a plant, depreciation of a building or machines, etc. Deducting this total cost from the gross income results in the operating income, also known as EBIT (Stouthuysen, 2022). A financial parameter that is commonly used is the operating margin. It tells how much profit a company makes for every euro that has been sold. The operating margin is calculated by dividing the operating income (EBIT) by the sales revenues.

To go from EBIT to income before tax, financial revenues and financial expenses have to be added and deducted respectively. Financial revenues and expenses are linked with borrowing activities. To give an example: if a company borrows money from the bank, it has to pay interest. This interest is a financial expense (T. Harrison Jr. et al., 2018).

A company has to pay taxes beforehand, based on the expected income before tax. When the numbers of a company's fiscal year are published, and too much taxes were prepaid, the company will get the difference back from the government. This is then registered as tax revenues in the P&L. On the other hand, the taxes that a company needs to pay are registered as tax expenses (Stouthuysen, 2022).

The bottom-line of the income statement is the net income (T. Harrison Jr. et al., 2018).

A P&L is made for a fiscal year defined by the company, and that period can differ between companies. For Boortmalt, the fiscal year is defined from June to July. In line with this, the income statement only shows the revenues for that period. Revenues are registered when the company has fulfilled its obligation towards the client, i.e. delivered the product or service. In line with this, expenses should be matched with revenues within the same fiscal period. These rules are part of accrual accounting and follow the International Financial Reporting Standards (IFRS) (Stouthuysen, 2022).

An important note is that mostly, a P&L should be analysed in combination with other financial statements such as the cash flow statement and the balance sheet, as these statements are interlinked with each other. The goal of this ICP is to try to analyse the profitability of the current pellet production, and to compare it with the profitability when the rootlets would be used for TVP production.

Lastly, it is important to always label the P&L. This label should include the company name, if it is a business or company unit, the currency, the fiscal time period as well as in what units the numbers are given (Stouthuysen, 2022).

10.Methodology to project part I – pellets

In this part, the frameworks were applied to the pellet market. In order to understand the pellet market for animal feed consumption, primary and secondary resources were used.

Primary resources include an interview with a customer of Boortmalt and emails from the Belgian Feed Association (BFA). For the customer interview, five contact details of Boortmalt's pellets customers were given by Adjo Pot, an employee of Boortmalt working in the commercial by-products department. The five customers[2] were contacted but only one interview could be conducted the 19th of May with Louise Lecomte from Arvesta. It was our intention to do more interviews but the other customers did not have the time. The interview was conducted in order to gather more insights about the animal feed industry since there is not a lot of public information available. The list of the questions and answers can be found in Appendix part IX.18.

Secondary resources include news articles and reports found on Google, Euromonitor and MarketLine. How the articles and reports were selected, will be shared in the following paragraphs.

10.1. Market trends

For the analysis of the market attractiveness, a search on Google about animal feed has first been done. When '*diervoeders België*'[3] was used as keyword, one of the first results was the website of the Belgian Feed Association (BFA). On this website, information about the animal feed industry in Belgium could be found. One of the employees of the BFA, namely Eva Tyteca, has been contacted by mail. Her function is policy advisor for agro-economics. She answered us by email the compound annual growth rates of cow and pig feed from the past until 2023 in Belgium. She also shared a short opinion regarding market trends in the cattle feed industry. From the customer interview with Arvesta, it was clear that the pellets are only used for cow and pig feed so that is why there has been chosen to only ask these numbers and not of other animals.

In order to clarify what caused the big decline of pig feed in 2007, the key words 'pig decline 2007' were used in Google. This was not in Dutch because a general trend in the world or Europe was more probable. Then, a webpage of statistics of the European Commission about the pig farming sector was found after scrolling through a few results on Google.

As our company supervisor also asked to implement numbers of the Netherlands, '*Nederland veevoeder cijfers'*[4] were used as keywords in Google. Out of 68 300 results, the second popping up result from the organisation Nevedi was chosen.

[2] Leievoeders, Maalderij Roosens, Arvesta, Van den Avenne Ooigem and Mellaerts
[3] Translation in English: animal feed Belgium
[4] Translation in English: Netherlands cattle fodder figures

As the world level is also important, information about the growth rate of compound feed was found by entering the keywords 'Compound feed market annual growth rate' in Google. The first result was the source of Fortune Business Insights. On the level of Europe, the website of FEFAC, a European compound feed producers organisation, was very useful. FEFAC was mentioned in some documents during the literature research so therefore this website has been read.

The livestock evolution itself is also related to the need for cattle feed because when livestock would decrease, the need for cattle feed would also decline. Therefore, it was decided to also look into MarketLine where 'Europe meat livestock' was used as keywords. The most detailed and most useful report was the Europe meat & livestock report of October 2021, as this comprehends all meat industry trends in Europe.

10.2. Strategic analysis

10.2.1. Market attractiveness by Porter

For the information regarding buyer bargaining power, research has been performed about mergers and acquisitions. This has been done following the fact that if the size of the buyers increases, the power increases (Michaux, 2015). As a consequence, if there are a lot of acquisitions or mergers, then there might be a trend of a rising bargaining power of the buyers.

In Google, '*aantal veevoederbedrijven België*'[5] was used as keyword in order to know if there are a lot of big or rather small companies producing animal and cattle feed. The choice was made to read the article of Vilt because it was about the acquisition of a Belgian animal feed company. After that, another article about buyer power popped up when typing in Google '*hebben veevoederbedrijven grote koopkracht*'[6]. The article of Landbouwleven was chosen because this was a personal interview with the general manager of Arvesta, one of the biggest companies in the cattle feed industry in Belgium. A lot of inside information as well as his opinion could be found in this article.

To discuss the other forces of Porter, inside knowledge from Boortmalt was used, especially from conversations with Gianluigi Cafiero and Adjo Pot.

The information and figure used from FEFAC was found on their website under the tab 'statistics'. Underneath that webpage, a pdf was found about the years statistics in 2021.

10.2.2. Competitive analysis

The first step in the competitive analysis is to define the key success factors (KSFs) that shape the cattle feed industry. Firstly, this was done through the answers of the customer interview. It was asked what they find important when buying ingredients for compound feed production. In addition to this interview, there was an article of Pefindo on Google found by using the keywords 'Key success factors animal feed' and this was used to further complement the list of KSFs. Pefindo is a credit rating agency, so it uses their key success factors in order to determine the rating of companies in that sector.

For the information about the protein level of soy, an already used paper for the TVP part was consulted. It was looked up on Google with the key words 'soy protein level' and this article appeared as one of the first results. The article of Auzeral was found by the keywords 'Innovation cattle feed' on Google. This was originally used for the PESTEL framework regarding innovation, but also characteristics about soy could be found here.

[5] Translation in English: amount of cattle feed companies Belgium
[6] Translation in English: do cattle feed companies have big buyer power

The second step in the competitive analysis is to compare Boortmalt with other competitors. Almost all by-products from the food industry can be used in animal feed so the amount of competitors is very extensive. It was chosen to compare Boortmalt only with other malting companies and other producers of feed ingredients such as soy and fava beans. The biggest malt producing competitors in Europe are Malteurop and Groupe Soufflet, which were found in statistics of Firstkey, a consultant in the beer industry. A pdf with biggest malting companies was found through a search on Google with the keywords 'Largest malting companies'.

The results of the interview with Louise from Arvesta were also used to understand some advantages and disadvantages of the pellets from Boortmalt Antwerp compared to other competitors specifically.

Finally, additional information about Boortmalt was gather internally via personal communication with Adjo Pot and Gianluigi Cafiero.

10.2.3. Macro changes in the market by PESTEL

The focus of the PESTEL analysis is mainly on the legal and environmental aspects, which are intertwined with each other in this case. From watching the news, it was clear that nitrogen in the agricultural sector has become a big problem. That is why this topic has been further investigated as this could be a threat for the livestock and cattle feed industry. In Google '*varkens en koeien stikstof*'[7] was used as keywords and by this search, a news article of Het Nieuwsblad, which is a Flemish newspaper, was found which states that there is a proposal to reduce nitrogen and livestock.

In the article of Het Nieuwsblad, the Flemish government was mentioned. After that, the webpage of the Flemish government of the department 'Environment' has been read. On that webpage, it was chosen to click on '*Inspectie en handhaving*'[8], next '*Handhavers*[9]' and next '*Stikstofbeleid: PAS*'[10].

On the website of the Flemish government, it was found that the nitrogen rules are coming from the European Union. On the website of the European Commission, clicking on food, agriculture and fishery, resulted in the subpage 'Most important policy areas – common agricultural policy' showing the part 'in a nutshell', which has been read.

10.2.4. A general overview by SWOT

The SWOT analysis is a summarizing framework for which the information that was collected for all previous frameworks has been used.

10.3. Customer value proposition

The customer value proposition contains insights from the VRIO analysis, the Porter framework and the PESTEL analysis.

[7] Translation in English: pigs and cows nitrogen
[8] Translation in English: inspection and enforcement
[9] Translation in English: enforcers
[10] Translation in English: nitrogen policy: PAS

10.4. Financial analysis

With the P&L, Boortmalt can assess if its current application of the rootlets, namely the conversion to pellets for cattle feed, is a profitable business or not. In order to make the P&L, revenue and cost information of respectively selling and producing the pellets was needed.

The first step was to understand the production process of the pellets to have an overview of the potential costs. On the 21st of April, Christophe Lemmens, quality specialist of Boortmalt, guided us at the production facility in Antwerp. During this malting tour, the different machines related to the pellet production process were studied. Afterwards, Christophe provided us with a process diagram of this process (Figure 11).

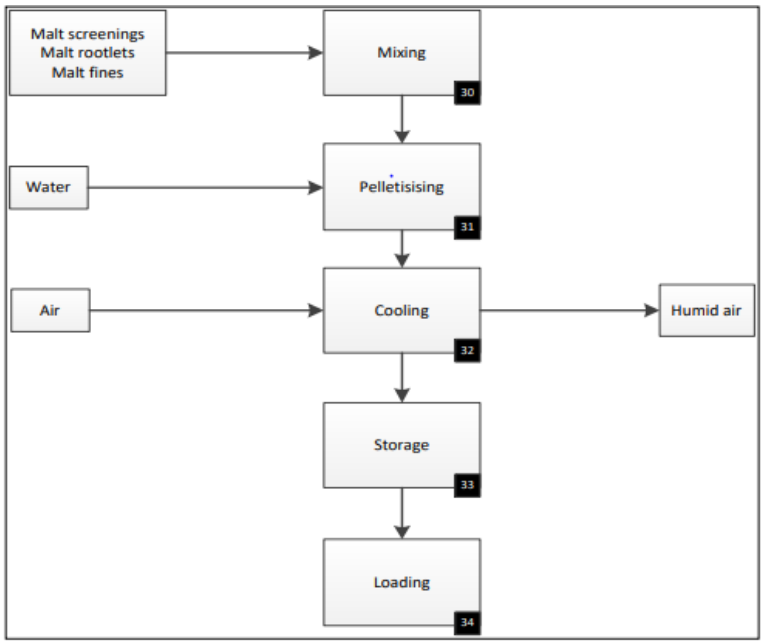


Figure 11: Process diagram of the pelletising process.

The complete questionnaire, all data received by Gert and the subsequent calculations made based on this information can be consulted in the Appendix part IX.18 and 20 respectively. Finally, on the 6th of May, a Teams meeting was set up with Gert Van Laer to go over all data together to make sure everything was clear.

Based on this diagram, revenue and cost streams have been identified and a question list was made to ask Boortmalt for concrete numbers. This list has been specifically sent to Gert van Laer, the projects and asset care manager of Boortmalt Europe. The question list was split in two parts: revenues and costs (see Appendix part IX.20).

Revenues were calculated based on volume sold and corresponding price for the fiscal year of June 2020 to July 2021, as this year was representative for the average situation. Our company supervisor, Gianluigi Cafiero, provided us with some information about the average volume that has been sold every month, and the average price expressed in euros per ton. Multiplying these two numbers resulted in the total revenues generated from sales activities. As current grain prices, and thus also pellet prices, are skyrocketing partially due to historical trends and partially due to the Ukrainian war, it is interesting to include some uncertainty in the revenue calculations. Therefore, sensitivity analysis has been done, for which data regarding the variability of the selling price was received via Gianluigi Cafiero.

To ask cost numbers in the questionnaire, costs have been divided per step in the pellet production process. The production process is continuous, and consists of five process steps: mixing, pelletising, cooling, storage and transport. The productive time for all machines per year was asked. Additionally, the electricity and water cost (if applicable), depreciation cost of the machine, labour and maintenance cost were asked for each step of the pellet production process along with the capacity of each machine. Besides these costs, the cost of the raw materials was considered as well. However, as the raw materials are rootlets which are a by-product, and if not valorised, considered as a waste stream, the cost of raw material is zero.

For electricity, information about required energy consumption in kilowatt hour per hour, the cost of electricity in euros per hour and the total productive time of the machine was gathered. To calculate the total electricity cost, these three numbers were multiplied.

During the pelletising step, water is added to the mixture of dusting and rootlets. This cost should thus also be taken into account in the P&L. To calculate this, the volume of water used per hour has been multiplied with the cost of water per volume and the yearly capacity of the pelletizers, expressed in hours per year. These numbers were also added as questions in the questionnaire that was sent to Gert.

The depreciation cost for the machines used in the pellet production process has been set to zero as the machines were already fully depreciated.

To calculate labour cost, the hourly wage of the employees and the time employees spend on performing manual actions or checking the machine was considered. Gert Van Laer provided us with this data per machine. The only machine that does not include labour is the mixing machine, as this one works fully automated. An important note has to be made regarding calculations for the labour cost: Gert gave hourly wages as employees' gross salary. However, for the wages of internal employees, this number should be multiplied by 1,5 to know the cost for Boortmalt. For all process steps, Boortmalt uses internal employees except for the final storage of the pellets, for which external truck drivers are responsible.

Maintenance cost per year and per machine always includes two aspects: the wage of an employee, which is calculated as explained above, and the material cost needed during maintenance. As this information is also internal, these numbers were also asked in the questionnaire.

The cost calculation for the last step in the process, which is the storage, was done differently as it does not involve electricity, maintenance or depreciation costs. The storage is the final step in the process where pellets are stored in three vertical silos. However, these silos have to be emptied every day to avoid ignition danger. If clients are not able to unload the silos on the same day as the pellets were produced, the pellets are transferred to another silo of 1000 tonnes to reduce the ignition risk. This requires an external firm to drive trucks back and forth from silo to silo. To calculate this cost, the number of needed trucks is multiplied with the time needed to load the truck and to transfer the pellets to the other silo, as well as with the total cost to operate the truck per hour, i.e. truck cost and employee wage of an external driver. The amount of trucks is calculated by dividing the yearly amount of pellets that have to be transferred by the capacity of one truck. All cost and volume information to make these calculations was again received via Gert.

Besides the questions related to the cost of each step, also some general questions were included to fully understand the process and to make sure that all costs were considered. Some examples include: Who are the clients for the pellets? Do clients organise transport themselves when picking up the pellets? If not, do they pay the transport costs? Etc.

The complete questionnaire, all data received by Gert and the subsequent calculations made based on this information can be consulted in the Appendix part IX.18 and 20 respectively. Finally, on the 6th of May, a Teams meeting was set up with Gert Van Laer to go over all data together to make sure everything was clear.

11.Methodology applied to project part II – texturized vegetable protein

11.1. Market trends

Defining alternative businesses for the pellets has been done by the consultancy company Bundl. They performed so-called market scouting, meaning they scanned potential markets (value spaces) for which Boortmalt could use its rootlets for the production of more valuable alternatives. However, this market scouting has only been done for applications in the non-food industry, and the value space Bundle came up with were pet- and fish food, bioplastics, fertilizers, etc. Our company supervisor, Gianluigi Cafiero, brought us in contact with this consultancy company in order to know which methodology Bundl had used for its market scouting.

Although Bundl analysed the general market trends and opportunities for Boortmalt regarding malt by-products in the non-food sector, the company did not look yet into the strategic fit with Boortmalt for specific applications. It did not look into a possible profit and loss statement either. Bundl gave some examples of possible competitors and partners but did not contact them to do further market research. Bundl told us it focused on market size, growth and sustainability in order to determine what applications could be valuable.

For the food applications, Boortmalt is currently in contact with a pilot project regarding the production of plant-based meat alternatives in Switzerland. To have a first check of that market, the trends, and examples of plant-based products, Boortmalt contacted another consultancy company. The report, delivered to Boortmalt, mainly contained data resulting from surveys that were conducted around the globe in order to assess customer needs. Also, examples of start-ups that produce plant-based products in general were given. However, there was a lack of predictive data regarding the plant-based food market, and the plant-based meat alternative market in particular. Moreover, Boortmalt would produce TVP for malt burgers and other vegetarian and vegan applications, but TVP was not discussed in detail in the document.

As such, Boortmalt asked us to do an additional market analysis, identifying the next food megatrends related to plant-based products, with specific focus on plant-based meat alternatives. This information should be general but should also give a view on what customers expect, what their current pains are, and whether there is an interest or not in plant-based meat products. Besides general data, the future potential of plant-based meat alternatives should be quantified.

To get some general overview of what is happening in the meat market and what aspects actually cause a trend in the direction of plant proteins and plant-based meat alternatives, it is interesting to find a review paper as this usually summarizes many literature on a specific topic. Therefore, Google Scholar was consulted using the keywords ‘texturized vegetable protein’. When selecting a paper, two aspects were considered: the paper should be a review paper having a general title, and the date should be as recent as possible. Based on these criteria, the paper ‘Quality characteristics of meat analogues through incorporation of texturized vegetable protein: a systematic review (2022)’ was chosen. A quick scan of this paper showed that it was a review and that it dealt with topics of why there is pressure on the meat industry, consumers’ consciousness about health, animal welfare and sustainability, resulting in consumers going for plant-based (meat) alternatives. It also discussed TVP as a product, as well as the technique.

However, as this paper did not give too much detailed information, cross-references of this review paper were consulted: ‘A novel approach for turning the physiochemical, textural, and sensory characteristics of plant-based meat analogues with different levels of methylcellulose concentration’ was chosen as it further builds on quality characteristics that plant-based products are expected to

have, while 'Consumer perception and the role of science in the meat industry' further discussed market trends and customer views. One paper that was mentioned in the reference list of the review paper only had a title but no cross-reference. The title of this paper 'Plant-based meat analogues. In Sustainable Meat Production and Processing' was inserted in Google scholar, but was not found. However, the research results suggested a paper with an interesting title being 'Processing, quality, safety, and acceptance of meat analogue products', which has been read.

The next goal was to understand the technique behind TVP. For this, the keywords 'texturized vegetable protein technology' have been used in Google scholar. Two papers were selected to read after a first scan to check if the technique was clearly described in one or more paragraphs: 'Influences of extrusion parameters on physiochemical properties of textured vegetable proteins and its meatless burger patty' as well as 'Textured wheat and pea proteins for meat alternative applications'.

To find also challenges in the new plant-based meat alternative market, Euromonitor has been consulted. The keyword used in the database was 'plant-based', which led to a screen where 'analysis' could be clicked. Then, 'read articles' appeared of which 'Plant-based eating and alternative proteins' has been read.

Boortmalt not only wanted qualitative data about the market trends, but also numbers showing the future potential of the plant-based meat alternative market. For this, Google has been used as search engine where the keywords 'CAGR meat analogues market' were used. Then, a lot of websites have been consulted, just to see if there is a consensus in the market forecasts. More unknown websites such as Allied Market Research and Globe News Wire have been consulted, together with more known market forecast sites such as Statista and Fortune Business Insights. The CAGR and market potential found on these websites has been confirmed once more by the paper which had been used for the general market trends: 'Textured wheat and pea proteins for meat alternatives.'

11.2. Strategic analysis

11.2.1. Market attractiveness by Porter

Porter entails five forces to be discussed, which has been done by answering the guiding questions per force as described in § 7.1. of Part III Methodology.

To answer the questions related to the power of buyers, information about the market trends has been used. This has been supplemented with some background information about competitors, which was searched to complete the VRIO analysis. Moreover, some thoughts have been added that came up during the tasting meeting with the Swiss start-up on the 18th of May.

For the supplier bargaining power, the question of how important suppliers are for TVP producers has been answered by market trend data. Arguments to answer the questions related to the switching costs, product differentiation among suppliers and the amount of substitutes available have been answered by data about the main raw materials used for current TVP production, which was part of the research done for the market trends. Also papers discussing the TVP technology and potential as part of the market trends have been considered in building up the conclusion for the supplier bargaining power. The same data were used to check whether or not suppliers would have the intention to enter the TVP industry or not.

To discuss the threat of substitute products, the main aspect that has been considered was the comparison between products that are available on the market today, where attractiveness, price and switching cost for customers were looked at. Attractiveness was described by taste, texture, health-

related aspects as well as sustainability. This information was found in sources that were consulted when writing the market trends.

The barriers to entry have been described again by answering the guiding questions. More specifically, cost information about the prices of TVP made from different protein sources has been used, and was obtained via our company supervisor. Besides, to answer the questions, competitor information from the VRIO analysis was used as well. Next, information about the market trends and the TVP technology have been used as arguments to support the scores given to some questions. These arguments were found in papers read to describe the future market trends.

Porter's fifth force of intra-industry competition has been depicted based on market growth numbers, which were searched as part of the market trends. However, this force has mainly been described by using competitor information and comparing all different market players in the TVP market, as well as their product, level of commitment, etc.

11.2.2. Competitive analysis

To perform a VRIO analysis, information about the competitors was needed. Information about competitors was searched under the tab news on MarketLine as this includes recent developments of competitors. With the keyword 'vegetal protein' under the tab news, the article 'Roquette launches new plant-based protein from peas and fava beans' was found. With the keyword 'meat alternatives' under the tab news, multiple interesting articles were found that gave information about competitors which are active in the plant-based market. The articles 'Cargill potential leader in the plant-based meat market', 'Beyond meat: vegan burgers are going public' and 'Impossible foods closes bumper funding round' were read. With the search on MarketLine and by reading the previous mentioned articles, the following competitors were selected: Cargill, Beyond meat, Impossible food, Tyson, Smithfield and Roquette.

As mentioned before, when performing research about the trends of meat alternative products and the market potential, Google was used with the keyword: 'CAGR meat analogues market'. When scrolling through the results, information about competitors was also selected on different websites . On the website of Allied Market Research, the following competitors were selected: Amy's Kitchen, BeyondMeat, Cauldron Foods, Garden Protein International, Meatless B.V, VBites Foods, MGP Ingredients, Sonic Biochem Extractions Limited, Kellogg Company, Archer-Daniels-Midland Company. On Globe News Wire, Beyond Meat, Impossible Food, Maple Leaf Foods, Archer Daniels Midland Company, The Vegetarian Butcher, Gardein (Conagra Brands), MorningStar Farms (Kellogg NA Co.), Quorn, Amy's Kitchen, Tofurky were mentioned. On the website of Fortune Business Insights, and more specifically, in the report of the meat substitute market, the following competitors were mentioned: Bayer, Corteva, Beyond meat, Impossible Foods, Lallemand plant care Canada, Tyson Foods, Greggs, Marlow foods (Quorn), Conagra brands (Gardein), Unilever, Hilton food group, Kerry group and Savage river.

When reading the article 'Influences of extrusion parameters on physiochemical properties of textured vegetable proteins and its meatless burger patty 'about the technology of TVP, another competitor was selected being Wachsen Industry Co. Like mentioned before, Boortmalt worked together with a consulting firm to assess the trends in the plant-based food market. In the PowerPoint provided by the consulting firm, the following competitors were mentioned: Omnifoods, Tyson foods, Light live, Quorn, Beyond meat, vegetarian butcher, Impossible Food, improve and KMC Danish potato protein.

After all the possible competitors were selected, more information was gathered on the website of these companies. More specifically, the size of the companies, if they are active in the B2B or B2C market and if they produce TVP for meat alternatives was assessed. Some companies like Bayer and Kerry group were removed from the list as these do not play directly in the TVP market. Bayer wants to deliver the right seeds and pesticides in order that crops deliver the right characteristics to be used as a meat alternative but will not produce TVP itself. The Kerry group delivers high quality proteins that are used as dairy alternatives but not as meat alternatives. Based on this extensive research, the following list of companies was made. More attention was put on the competitors in the B2B market as Boortmalt would face these competitors with if they would produce TVP from rootlets.

- B2C: Impossible Food, Beyond meat, Nestlé (garden gourmet), Tyson, Smithfield, VBites, Kellogg Company MorningStar Farms (Kellogg NA Co.), Maple Leaf Foods, The vegetarian butcher (part of Unilever), Gardein (Conagra Brands), Quorn, Tofurky, Amy's Kitchen, Greggs, Omnifoods and Light live
- B2B: Cargill, Roquette, Meatless B.V, MGP Ingredients, Sonic Biochem Extractions Limited, Archer-Daniels-Midland Company, Hilton Food group, Wachsen Industry Co. and KMC Danish potato protein

11.2.3. Macro changes in the market by PESTEL

The PESTEL framework describes political, economic, social, technological, environmental and legal factors that might determine the future market outlook for plant-based meat alternatives.

First, for the political part, it was thought to look at the availability of subsidies for companies that invest in plant-based foods. To find so, the keywords ‘will governments give subsidies for plant-based foods?’ were used. A first article of BlueHorizon was read as it had the title: ‘Governments must invest in plant protein before it’s too late.’ To find more specific data about subsidies in Belgium, the keywords in Google were changed to ‘Belgian subsidies for plant-based foods.’ This resulted in an article about initiatives taken in Wallonia: ‘Wallonia aims to become major producer of meat substitutes’, which was selected as the preview from the article talked about an EU subsidy. Then, two other interesting websites were found, being it the website of The European Alliance for Plant-based Foods and the website of ProVeg International, that mentioned the title of ‘European Union research funding in cellular agriculture.’ On the website from The European Alliance, a click-through resulted in a press-release article ‘Plant-based foods movement gains international momentum’ which was read as well.

Next, the economic part of PESTEL was studied. Based on articles read when studying the market trends related to plant-based meat alternatives, and the TVP market in particular, it was mentioned that the price of those meat analogues was expected to decrease in the coming years, due to economies of scale. With that in mind, the keywords ‘price of meat alternatives’ were entered in Google. Between the research results, an article of CNBC was selected as it had an interesting title being it ‘Impossible Foods, Beyond Meat battle to achieve price parity with real meat.’ Another article ‘Plant-based meat will be cheaper than animal meat sooner than you think’ from the website VegNews was read. To find some more evidence-based information, the same keywords were used in Google Scholar which resulted in a summarizing article with title ‘How will cultured meat and meat alternatives disrupt the agricultural and food industry?’ Next, some numbers on consumer willingness to pay were found in a pdf document, which was the result of the political search using the keywords ‘Belgian subsidies for plant-based foods.’

After that, the legal factors that relate to plant-based meat alternatives were investigated. For this, the keywords '*Politieke aanpak voor verminderen vleesconsumptie en stimuleren plant-gebaseerde diëten in België'*[11] were used in Google. This resulted in a thesis with an interesting title being '*Maatregelen die de flexitariër stimuleren naar verminderde vleesconsumptie: een holistisch beleid'*[12] written in 2019 by a student from the faculty of economics and business administration at Ghent University. This gave a chance that the thesis would contain some political initiatives that eventually also have economic consequences related to the increase in plant-based food consumption. After scanning the table of content, the part '*holistisch beleid'*[13] was chosen to read. This part dealt with the effect of a greenhouse gas emission taxation. The text mentioned some studies, of which the papers have been consulted as well. Then, the title '*BKG-belasting'*[14] as mentioned in the thesis was translated to be used as next keyword in Google: 'GHG taxation to reduce meat consumption.'

Then, one of the first results was a website of the European Union having 'Taxes on meat to improve health & reduced VAT on healthy food' as title. This website discussed European proposals and future ideas. On this website, there was a link to another article dealing about this topic: 'EU Parliament vote 9-10 Sept on amendments Farm to Fork Strategy.'

Still, under the same keywords, and also from the same website as the latter article, an interesting source with title 'Increasing number of countries start taxing meat and dairy' was found and read. Next, an article had been used called 'current situation and future prospects for beef production in Europe – A review', to understand culture differences in meat consumption.

Lastly, for the legal part, the nitrogen decree has been mentioned but for more detail, a reference was made to § 12.2.3. Macro changes in the market by PESTEL, where this part has been discussed already in more detail.

After the political, economic and legal analysis, no extra articles have been searched for the social and technological parts of PESTEL. The reason is that a lot of information about these factors was already found during the search for market trends. The same holds for the environmental factor, although this has been extended by the political part discussing the GHG taxation.

11.2.4. A general overview by SWOT

For the SWOT analysis, all the information collected to apply the five forces of Porter, VRIO and PESTEL was used.

11.3. Customer value proposition

The customer value proposition is made for both the B2B customer, which are the plant-based meat alternatives producers, as well as for the B2C customer, who are the flexitarians. To assess the pains, gains and customer job in the customer segment, the literature review from the market trends was used. For the value proposition segment, the information to perform the strategic analysis of TVP was used.

[11] Translation in English: Political approach to reduce meat consumption and promote plant-based diets in Belgium
[12] Translation in English: Measures that encourage the flexitarian towards reduced meat consumption: a holistic policy
[13] Translation in English: a holistic policy
[14] Translation in English: GHG taxation

11.4. Financial analysis

To make an overview of how profitable the production of TVP would be, data for costs and revenues related to this process have been gathered during an informal meeting at the 31th of May. During this meeting, two of the three Swiss entrepreneurs, Josef Zehnder and Adrian Koller, joined.

As the Swiss start-up is still experimenting in order to find the best recipe and texture for TVP before starting large-scale production at Boortmalt, it will take some more time to design customized machinery. This means that identification of exact cost streams is not possible at this moment. However, based on experience, the Swiss start-up acted as primary source as they gave us some basic information based on their experience and based on connections they have with existing TVP producers. More specifically, estimations were given about how much it would cost per ton of rootlets to transport the rootlets from Boortmalt to a contract miller, to mill the rootlets and to transport these to an extrusion company, and to finally transport the produced TVP back to Boortmalt. Adding these costs resulted in the total cost per ton of rootlets when outsourcing TVP production.

Lastly, to calculate the profit per ton of TVP, the sales price of TVP was needed. Data about the current TVP selling price in the market, which is 2,50 euros per kg TVP, has been received from our company supervisor, who has a connection in that industry (Cafiero, personal communication, 2022).

Part IV – Results

12.Project Part I – Pellets

The rest streams of the malt production are currently used to produce pellets. Afterwards, the pellets from Boortmalt Antwerp are sold, via a broker, to compound animal feed producers in Belgium and the Netherlands. An example of a customer is Arvesta, this is the biggest Belgian company that provides products and services to farmers. One of its services is mixing different ingredients into compound feed and selling it to farmers (Arvesta, 2022).

The competitors in the market for Boortmalt Antwerp include other malt companies in Belgium that also produce pellets and producers of other ingredients of compound feed such as soy and fava beans.

The goal of the following analyses is to understand how the compound animal feed market will evolve the coming years and how profitable this business is. This is all analysed with the goal to compare this current business to other possible applications of malt by-products later on.

The main focus is on the pellet market in Belgium and the EU because Boortmalt Antwerp sells its pellets mostly to local producers in Belgium and the Netherlands. However, it might also be relevant to look at the world level as this can have an influence on the sales in the EU.

12.1. Market trends

The pellets from Boortmalt are sold to big producers of animal feed. This means that it can be mixed in feed for different types of animals. Looking at the quality of the malt, it is mainly used to make pig or cow feed (Louise Lecomte, 2022a). That is why the focus will be on these two markets specifically in the coming analysis.

The cow feed industry has definitely showed market attractiveness in the past. The compound annual growth rate in 2007 was 9% (Figure 12). After the financial crisis however, this rate dropped drastically to around 1% to then increase again to 2%, which has stayed constant at this level for the last 10 years. The predictions from the Belgian Feed Association are that the growth rate will further decline to 1,8% in 2022 and to 1,7% in 2023 (Figure 12).

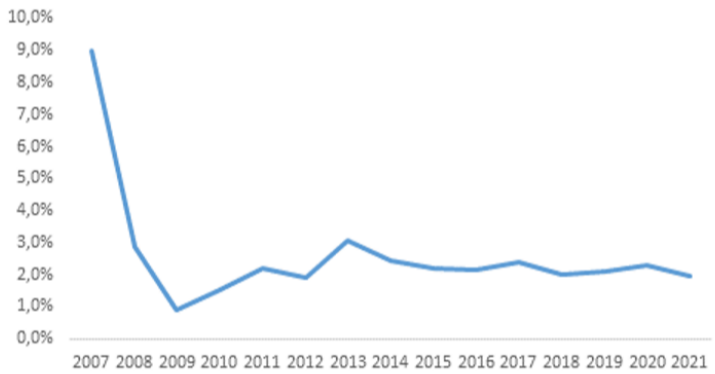


Figure 12: The evolution of the compound annual growth rate of cow feed industry in % from 2007 until 2021 in Belgium (Belgian Feed Association, 2022b).

Table 8: The production volume of cow feed in 1000 tonnes and the compound annual growth rate (%) in Belgium from 2006 until 2023 (Belgian Feed Association, 2022b).

Year	Production (1000 tonnes)	CAGR
2006	1 152	
2007	1 256	9,0%
2008	1 219	2,9%
2009	1 183	0,9%
2010	1 224	1,5%
2011	1 283	2,2%
2012	1 292	1,9%
2013	1 424	3,1%
2014	1 397	2,4%
2015	1 401	2,2%
2016	1 422	2,1%
2017	1 495	2,4%
2018	1 465	2,0%
2019	1 506	2,1%
2020	1 587	2,3%
2021	1 540	2,0%
2022	1 540	1,8%
2023	1 540	1,7%

Secondly, looking into the pig feed industry, growth numbers are looking worse as can be seen in Figure 13 and Table 9. In 2007, the growth rate was still 4,4%, whereas the predictions for 2023 show for the first time in history a decline in production volume.

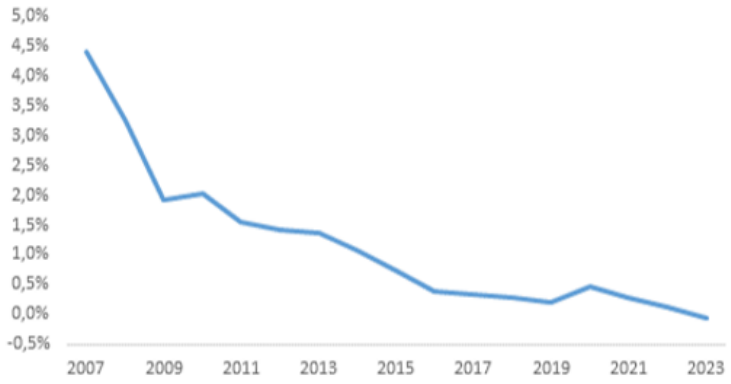


Figure 13: The evolution of the compound annual growth rate of pig feed industry in % from 2007 until 2023 in Belgium (Belgian Feed Association, 2022b).

The serious drop from 2007 until 2009 can be explained by the strict regulations on the protection of pigs, imposed by the European Union in a Council directive. In this directive, the living space per animal and environmental conditions became more strict, which led to less production volumes and a profit loss for many pig farmers (Council of European Union, 2008). There are even plans, descending from the European Green Deal, to impose new and more severe regulations on the pig industry (European Union, 2020).

Table 9: The production volume of pig feed in 1000 tonnes and the compound annual growth rate in Belgium from 2006 until 2023 (Belgian Feed Association, 2022b).

Year	Production (1000 tonnes)	CAGR
2006	3 412	
2007	3 563	4,4%
2008	3 638	3,3%
2009	3 612	1,9%
2010	3 699	2,0%
2011	3 688	1,6%
2012	3 716	1,4%
2013	3 751	1,4%
2014	3 721	1,1%
2015	3 644	0,7%
2016	3 546	0,4%
2017	3 643	0,3%
2018	3 529	0,3%
2019	3 505	0,2%
2020	3 639	0,5%
2021	3 558	0,3%
2022	3 487	0,1%
2023	3 380	-0,1%

In the Netherlands, there has been a strong decline in the production of pig feed, with a rate of minus 20% from 2014 until 2021, which can be seen in Figure 14. The amount of cow feed increased from 2014 until 2017 and declined again from 2017 until 2021 (Nevedi, n.d.).

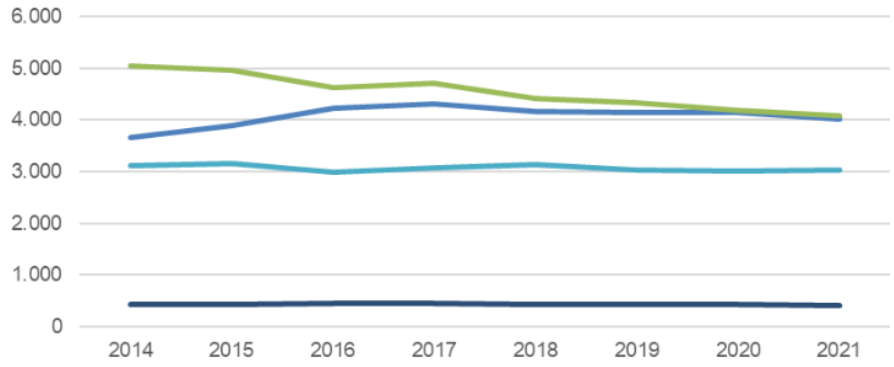


Figure 14: The production of cattle feed of the three biggest categories (cow, pig and chickens) in the Netherlands from 2014 until 2021, in tonnes x 1000 (Nevedi, n.d.). Legend: darkest blue: other compound feed, blue: cattle feed, light blue: poultry feed, green: pig feed.

Looking at the worldwide compound feed market, the predictions are positive. A 4,82% compound annual growth rate is predicted from 2021 until 2028. This is due to the rising demand and production of meat and dairy products as a result of the rising population and welfare in especially China, India and Indonesia (Fortune Business Insights, 2022). However, in Europe, FEFAC statistics show that there is a decrease of 0,16% in production volume of compound feed in 2021 compared to 2020. As can be seen in Figure 15, in Belgium, the compound feed market shrinked with 0,7% from 2020 until 2021 (FEFAC, n.d.).

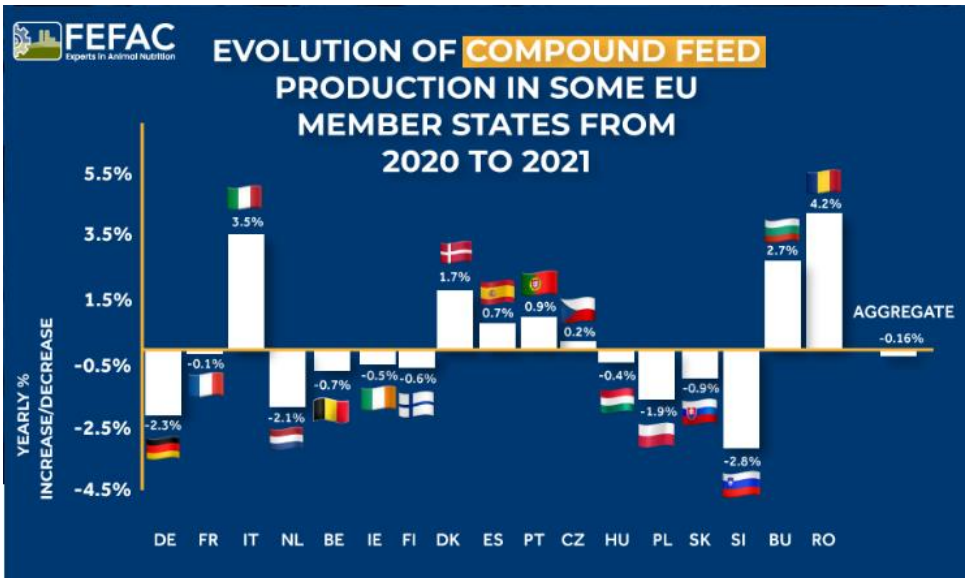


Figure 15: Evolution of compound feed production in some EU member states from 2020 to 2021 (FEFAC, n.d.-b).

Currently, about 7% of all greenhouse gasses in the EU are produced by the livestock industry (European Commission, 2020). Therefore, a positive note for the pellets of Boortmalt is that the BFA as well as the EU have plans to stimulate the use of innovative and sustainable products in animal feed (Belgian Feed Association, 2022). This includes rest streams from food products, such as malt. The EU describes these plans in the Farm to fork strategy as part of the European Green Deal. The EU has the intention to promote sustainable agri-food products and farming by investing 89 million euros in sustainable farming projects (European Commission, 2021). Concerning the BFA, they want 50% out of all cattle feed being made of rest streams from the food and biogas industry, which is now 43% (Belgian Feed Association, 2022c).

Looking at the general European meat industry, MarketLine even predicts worse numbers. The compound annual growth rate for the European meat industry from 2020-2025 would be 0% (MarketLine, 2021). This number is contradictory with the growth number shown of the cow feed industry in Belgium. The expectation would be that there exists a strong positive correlation between both sectors, but that is not always the case. One of the reasons that the cow feed industry would rise and the meat industry would decline is climate change. Within the PAS agreement, the fertilization standards became stricter. This means that the grass of cows is less high in protein. As a consequence, this has to be compensated by giving the cows more protein-rich food, which is good for the cow feed industry. Also, the feed is not only used for beef cows, but also for dairy cows (Sylvie Danckaert et al., 2018).

12.2. Strategic analysis

12.2.1. Market attractiveness by Porter

The first element of the Porter framework is the supplier bargaining power. No extensive elaboration will be done on this topic as no raw material must be considered when looking at ingredients for compound feed production. The conclusion is that this is a big advantage as the producer does not have to negotiate with suppliers.

The second element is the buyer bargaining power (Table 10).

Table 10: Porter buyer power framework feed ingredient market.

Power of buyers (→ appropriation of profits)		
Strong buyer power		**Weak buyer power**
There are few buyers (purchasing large volumes)	1 – 2 – **3** – 4 - 5	There are many buyers of our products
Products in our industry are largely undifferentiated	1 – 2 – **3** – 4 - 5	Product differentiation is key in our industry
Buyers in the industry face no switching costs	**1** – 2 – 3 – 4 - 5	Buyers in the industry face huge switching costs
Buyers in the industry are very price-sensitive	**1** – 2 – 3 – 4 - 5	Buyers in the industry are not price-sensitive
Products have little effect on our buyers' costs and quality	1 – 2 – 3 – **4** – 5	Products have huge impact on buyers' costs and quality

From the customer interview and internal Boortmalt information, it was clear that the buyers do not have big nor little bargaining power (Louise Lecomte, 2022a). This might however change in the future when more and more buyers are merging or acquiring as this trend is already there (Vilt, 2020). That is why the amount of buyers got a neutral score of three. In the example of Boortmalt, there are eight large buyers purchasing pellets at the Antwerp plant, buying each on average 10% of the total pellet volume in Antwerp (Pot, personal communication, 2022). This could eventually lead to a stock problem, not being able to sell all the pellets on time if one company stops purchasing.

Still in 2020, there were 160 compound feed producing companies in Belgium, which is a lot compared to the Netherlands, where there are only 60 companies for a much bigger livestock population than Belgium (Vilt, 2020). As such, in Belgium there is still room for mergers and acquisitions to be done between different compound feed producers, which eventually would increase their customer bargaining power. However, there is also a trend of mergers and acquisitions of malting companies so if these events grow at the same pace, the bargaining power will stay the same (Landbouwleven, n.d.).

Feed ingredients are all a bit different in taste, protein level and minerals but on the other hand, differentiation in products is not that important for animals compared to humans. That is why it got a neutral score of three. This is linked with the fact that switching costs from the one to the other product are also low which results in a score of one. On top of that, based on the customer interview, a low price is very important for the buyers (Louise Lecomte, 2022b). The price is determined by the market and once a seller increases its prices above the market price, buyers easily switch to cheaper products as a consequence of the forementioned low switching costs (Pot, personal communication, 2022).

However, a trend that is further weakening the buyer power, is the increasing gap between feed prices and animal product prices as can be seen in Figure 16. The figure shows that the price for raw materials is rising relatively more than the price that compound feed producers can ask from farmers. The reason is that it is more difficult for farmers to elevate the prices of their animal products. This puts more pressure on compound feed producers and farmers to work as efficiently as possible to still create a margin (FEFAC, 2021a). As a consequence, the cost and quality of the pellets have a huge impact on the compound feed producers' costs and quality. For example, changes in cost and quality in the animal feed will impact the value of the pig industry as animal feed constitutes no less than 32% of the total pig industry value (FEFAC, 2021a). All of this is evidence that it is difficult for compound feed producers to negotiate a cheaper price of pellets. That is why a score of four is given

Figure 16: The widening gap between producer prices and feeding stuff prices from 1995 until 2020 in the EU (FEFAC, 2021b).

Counting all the scores together (12 out of 25), the buyer power is considered average, meaning buyers do not have a significant influence on the price, nor they have a weak buyer power.

The third element of Porter investigates whether there are existing barriers to enter the market of cattle feed ingredients (Table 11). As already mentioned, a low price is important in order to sell the pellets, so economies of scale are a considerate advantage for producing companies of ingredients for compound feed.

It also seems to be relatively easy to find financial resources in order to enter the market. An example is Beneo, who has recently invested 50 million euros into the production of fava beans that can be used for both the food and feed market. Beneo invests in this as the demand for vegetable proteins is rising (Landbouwleven, 2022a).

Since the pellet production and sales is a B2B activity, establishing a network is considered to be very important. That is why it might be a barrier for start-ups to enter the market because it can be difficult to find and convince buyers. The market of cattle feed is historically an established market that is largely based on existing networks. Moreover, such networks are most of the time organised by brokers that connect buyers with suppliers.

The general conclusion is that the barriers to entry are average (score of 18 out of 30).

Table 11: Porters barrier to entry framework feed ingredient market.

Barriers to entry (→ profit potential of our industry)		
Weak entry barriers		**Strong entry barriers**
Firms in our industry do not enjoy economies of scale	1 – 2 – 3 – **4** – 5	Firms in our industry enjoy economies of scale
Switching costs for customers are low in our industry	**1** – 2 – 3 – 4 – 5	Switching costs for customers are high in our industry
Easy to find enough capital to run the business	1 – **2** – 3 – 4 – 5	Difficult to find enough capital to run the business
Easy to match the quality levels of incumbents' products	1 – **2** – 3 – 4 – 5	Difficult to match the quality levels of incumbents' products

Easy to have access to distribution channels	1 – 2 – 3 – **4** – 5	Difficult to have access to distribution channels
Government policy favors newcomers in the industry	1 – 2 – **3** – 4 – 5	Government policy protects the existing players
Incumbents will not react when newcomers enter	1 – **2** – 3 – 4 – 5	Incumbents will strongly react on new entrants

The fourth element is about the threat of substitute products, which is very high (Table 12). First of all because a lot of rest streams and type of grains can be used to mix in compound feed such as soymeal, maize, beetroot pulse, sunflower meal, wheat, rests from breweries, beans, etc. (National Dairy Development Board Anand, 2006). From these substitutes, soymeal is the most important (FEFAC, 2021a). However, as can be seen in Figure 17, there is a trend towards replacement of the substitute soy by co-products (to which malt by-products belong). This does not mean that the threat for substitute products has become weaker because other substitute products are also becoming more popular, such as the fava beans (Landbouwleven, 2022b).

Secondly, compound feed producers are able to switch substitute products easily because of the big variety of supplies. This makes the threat of substitutes overall high (score of 3 out of 10).

Table 12: Porters threat of substitutes framework feed ingredient market.

Threat of substitutes (→ a ceiling on prices)		
Strong threat of substitutes		**Weak threat of substitutes**
Attractive and cheap substitute products available	**1** – 2 – 3 – 4 - 5	No attractive and cheap substitute products available
Our customers are able to switch to substitute products easily	1 – **2** – 3 – 4 - 5	Customers are not able to switch to substitute products

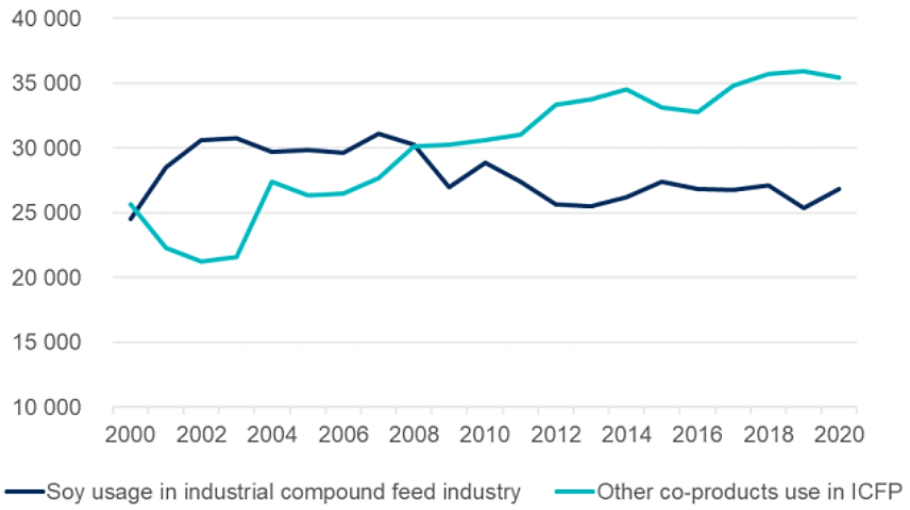


Figure 17: Usage of soy in the EU replaced by higher use of co-products in x1000 tonnes from 2000 until 2021 (FEFAC, 2021b).

The last element is about the intra-industry competition (Table 13). As already mentioned, a lot of products can be used to mix in compound feed and that is why the first factor in Table 11 received score one, which leads to strong rivalry. Secondly, as mentioned in the market trends, the industry growth of compound feed is slowing down with –0,16% in the EU which also result in a score of one.

What also plays a role is the rate of devotion to the business, which is not so high in this industry. Some companies, especially those with co-products, do not mainly focus on the production of animal feed. This could mean that investments of the company go to the main business and not to the rest stream valorisation.

A last strong point is the danger for excess capacity in the market, which scored a two. This is also the result of the big variety and all the possible streams that can serve as ingredients for the feed industry.

Counting everything together (16 out of 35), the intra-industry competition is average to high because of the declining market.

Table 13: Porter rivalry in the market framework feed ingredient market.

Rivalry in the market (→ distribution of profits)		
Strong rivalry		**Weak rivalry**
Competitors are numerous and/or are roughly equal in size	**1** – 2 – 3 – 4 - 5	There are a few dominant players in the market
Industry growth is slow	**1** – 2 – 3 – 4 - 5	Our industry grows fast
Exit barriers are high	1 – 2 – **3** – 4 - 5	Firms can easily leave the market
Rivals are highly committed to the business	1 – 2 – 3 – **4** - 5	Rivals are not committed to the business
Products are largely undifferentiated from the competition	1 – **2** – 3 – 4 - 5	Products are highly differentiated from the competition
Danger for excess capacity in the market	1 – **2** – 3 – 4 - 5	No danger for excess capacity in the market
Products in our industry are perishable	1 – 2 – **3** – 4 - 5	Products in our industry are not perishable

In Table 14, a summary of the Porter model can be found for the cattle feed market. The general conclusion is that the market is on the short term averagely attractive but becomes less attractive in the future.

Table 14: A summary of the Porter model for the cattle feed market.

A summary of the Porter model	
Force of Porter	**Result**
Buyer power	Average
Supplier power	Low
Threat of substitutes	High
Barriers to entry	Average
Rivalry in the market	Average to high
Conclusion	**The market is attractive on average**

12.2.2. Competitive analysis

To perform a competitive analysis, it is first determined how Boortmalt scores on the key success factors of the pellet market. Second, the resources and capabilities are assessed for which Boortmalt has a competitive advantage compared to other competitors. As competitors of Boortmalt, soymeal producers and other types of co-products that can be used as feed ingredient were selected.

TEST # 1:Does it meet the key success factors in the market?

In Table 15 underneath, the key success factors for the pellets/compound feed ingredient industry and the score for Boortmalt on each of these key success factors can be found.

From the customer interview, it was clear that good taste of the feed is important. If animals like to eat the feed, they are more likely to eat more and to gain more muscles, which leads to a good quality of meat. The score for Boortmalt is high because cows and pigs like the sweet taste of the pellets (Louise Lecomte, 2022b).

Secondly, a high protein level is also important when composing animal feed. Malt rootlets contain 30% of protein, while in the pellets from Boortmalt there is 19% of protein because other less protein rich ingredients are added. Compared to soy meal, which contains 35-40% of protein, Boortmalt does not score high on this factor, but average (Qin et al., 2022). FEFAC considers the pellets to be medium protein content, while soy meal is high protein content (Table).

Thirdly, as a low price is important in this sector, a high utilization of fixed assets is necessary. This accounts for Boortmalt as the company is using its pelletisers 24/7.

Further, quality control and know-how is important to measure the minimum feed requirements, following the GMP and International rules (Louise Lecomte, 2022b). Boortmalt scores average because the customers notice that Boortmalt meets the standard requirements, however the composition of the pellets is never consistent. Boortmalt only guarantees a minimum protein level of about 19% (Cafiero, personal communication, 2022).

To further reduce costs, it is important to have a low-cost product design and good engineering systems. This is high for Boortmalt because the company almost automated the whole process, which results in low labour costs . On top of that, the fact that Boortmalt does not produce consistent pellets, means that it does put a lot of resources into the measurement of the composition.

A factor where Boortmalt also scores well on, is the strong network and reputation it has within the compound feed industry. The pellets are for Boortmalt a historical market, so this means that Boortmalt has built connections.

Another element where Boortmalt gets a good score, is the accurate filling of buyer orders, which was highly valued by Arvesta (Louise Lecomte, 2022). Boortmalt has a limited storage capacity so it is forced to deliver its pellets every time. Besides that, Boortmalt is the biggest malting company in the world, which makes the company a bit more flexible in delivering. Good communication from Boortmalt means also efficient cooperation with its customers, which results in a cost reduction for the customers.

Of course, also a good price is important for the customers. Boortmalt does not opt for the maximum price, but for the optimal price. Sometimes, Boortmalt needs to give discounts because of the storage problem resulting in a cheap price for the customers (Pot, personal communication, 2022).

Finally, a convenient location is also important for the customers, as they are responsible for the transport to their production facilities themselves. Boortmalt has a good location because it is close to many feed producers in Belgium as well as in the Netherlands, two countries where the livestock industry is quite large and condense. The advantage with respect to soy meal is that Boortmalt's pellets are locally produced as transport costs include around 15-25% of the total product price (Cafiero, personal communication, 2022). Soy is mostly coming from outside of Europe (FEFAC, 2021b). Based on Figure 18, it can be concluded that 61% of all co-products for cattle feed are imported from outside

the EU. This means there is still an opportunity for European companies to upscale their production when sustainability and local products become more important. It can also be seen that for the high protein content, there is even a bigger opportunity, as only 28% is produced in the EU (FEFAC, 2021).

Table 15: Key success factors for the cattle feed ingredients market with corresponding score for Boortmalt.

Key success factors in the feed ingredient market	Score for Boortmalt
Good taste for animals	High
High protein level	Average
High utilization of fixed assets	High
Quality control know-how	Average
Low-cost product design and engineering	High
Network of wholesale distributors/dealers	High
Accurate filling of buyer orders - communication	High
Overall low cost – price	Average
Convenient locations – sustainability	High

Table 16: Division of protein levels in the feed industry.

Low protein	<15% of protein content
Medium protein	15-30% of protein content
High protein	30-50% of protein content
Super protein	>50% of protein content

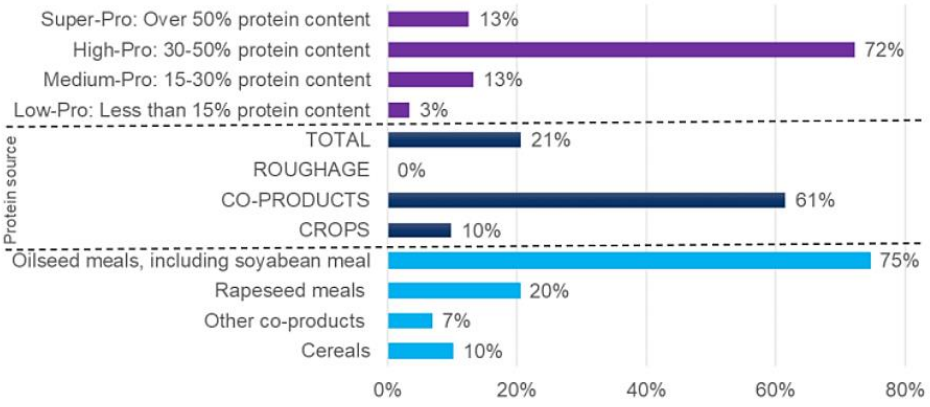


Figure 18: Percentage of the use of foreign origin feed, imported in the EU (FEFAC, 2021b).

TEST # 2:Does it have unique resources and capabilities?

Now the key success factors are defined for the pellet market and the score of Boortmalt for each key success factor, the next step is to define whether or not Boortmalt has a competitive advantage on certain areas compared to other companies (Table 17). Overall, it has been difficult to compare with other companies because inside information was not easy to find. However, the possible competitive advantages of Boortmalt are largely based on assumptions and some literature.

First, the good taste and high protein level of malt by-products can be seen as valuable, as this adds value for the animals. These aspects cannot be considered as rare because other malting companies have the same taste advantage and soymeal even contains more protein than malt. Most animal feed is currently made out of soybean meal because it contains high protein levels, it is highly digestible, it can be continuously delivered and it can be offered against a good price (Auzeral Julia, 2020).

The strong network of Boortmalt can be seen as rare because they have built this up through all their years of experience and by their reputation. This can however be imitated by other big companies that are also already for a longer time in the market.

The only area where Boortmalt has a competitive advantage is the accurate filling of buyer orders and their good communication. The customer finds this very important, as its production facilities have to run smoothly 24/7 in order to provide feed on time to the farmers. Boortmalt has succeeded in building good relationships with its clients by delivering on time (Louise Lecomte, 2022b).

Also the convenient location from Boortmalt is hard to imitate. Boortmalt is in fact closely located to its sales market in Belgium and the Netherlands, which reduces the transport costs. Moreover, as being local is becoming more important, other established malting companies in France such as Malteurop or Groupe Soufflet, are becoming less competitive for Boortmalt (and the other way around) (Firstkey, 2016).

Table 17: VRIO framework for pellets of Boortmalt.

	Valuable?	Rare?	Hard to imitate?	Organised around it?
Good taste	X			
High protein level (Good Manufacturing Practice, GMP)	X			
Low-cost product design/engineering	X			
Strong network of wholesale distributors/dealers	X	X		
Accurate filling of buyer orders - communication	X	X	X	X
Overall low cost - price	X			
Convenient location	X	X	X	

12.2.3. Macro changes in the market by PESTEL

For the pellet market, the legal and environmental factors from the PESTEL framework were defined to be the most important aspects to look at. These two elements are intertwined with each other as the legal frameworks are often a result of the awareness regarding climate change.

It is unsure whether or not the amount of livestock will be limited by law in the future. If this would happen, of course this will have a huge impact on the cattle feed production. At this moment, the Flemish government has reached an agreement that wants to reduce the amount of nitrogen in the agricultural sector, called PAS (Programmatische Aanpak Stikstof)[15] (Vlaamse Regering, 2022a). In the Netherlands, a reduction of nitrogen was not an option, so they chose for a more drastic way being it the reduction of livestock, which has a huge impact on the whole meat and cattle feed industry (Vlaamse Regering, 2022a). The discussions in the Netherlands and Belgium about the nitrogen problem are currently a hot topic. In the Netherlands, a strong decline in livestock and nitrogen is

[15] Translation in English: 'Programmatic approach to nitrogen.'

proposed by the current political coalition (Nu, 2022). There might be a possibility that Belgium also goes one step further if Belgium decides to follow the Netherlands.

The intention of the PAS agreement is to avoid a license stop and to give farmers the opportunity to reduce their nitrogen emissions. However, some argue that this is for some, especially smaller, farmers impossible and it would force them anyways to stop their activities (Vlaamse Regering, 2022).

The EU has also created a Common Agricultural Policy and renewed it recently which will be enforced from the 1st of January 2023. This has the goal to determine the future direction of the agricultural sector, including the animal feed sector (European Commission, 2022). Flanders is also developing a specific strategic plan, following the European Policy, which contains nine pillars, from which four are focused on sustainability and circular economy. The Flemish government says it wants to support protein feed resources coming from local companies in order to reduce the dependency on import from other countries outside the EU (Vlaamse Regering, 2022b). One of the other supporting measures is that a subsidy will be given to farmers who feed their cows with beer trot in combination with rapeseed meal because this reduces methane emissions with 13% (Landbouwleven, 2020). It is not researched yet if the pellets from Boortmalt would have the same effect but this is a possibility. The methane reduction measures are evolving very quickly, so new measures can pop up. The newly approved feed combinations can be found on the website of ILVO (2022).

The trends in the meat industry also have an effect on the feed ingredient market and will be further discussed in § 13.1 Market trends and § 13.2.3. Macro changes in the market by PESTEL for texturized vegetable protein in Part IV. .

From the perspective of technology, there is a trend towards more innovative and customised products amongst farmers to improve the efficiency of the meat production (Landbouwleven, n.d.). On top of that, innovation is considered to be the highest priority in the Common Agricultural Policy (Vlaamse Regering, 2022b). As feed costs contain a large part of the total costs for farmers, it is important to optimize the quality of feed in the future (Auzeral Julia, 2020).

12.2.4. A general overview by SWOT

For the pellet market, the strengths, weaknesses, opportunities and threats can be found in Table 18.

First of all, the strengths will be discussed, which are regarded as positive internal elements inherent to Boortmalt. The medium protein level of the pellets is a positive point as compound feed producers need this in their mix in order to give cattle enough proteins for meat and milk production (Louise Lecomte, 2022b). On top of that, Boortmalt scores high on the sustainability aspect, which is becoming more and more important. Boortmalt is contributing to a no-waste policy from rest streams and at the same time, it is sold to local compound feed producers so transport emissions are limited to a minimum (Boortmalt, 2021b). Boortmalt also has a strong network and reputation, which results in reaching more and bigger clients, such as Arvesta. Other strengths are the good taste as result of the malt, low-cost design of the process, the accurate filling of buyer orders and the good communication towards customers (Louise Lecomte, 2022b).

Boortmalt also has two weaknesses. The company does not have many storage space as this is limited to the volume of two trucks (Cafiero, personal communication, 2022). This sometimes results in the need to give discounts in order to get rid of the pellets in time (Pot, personal communication, 2022). The second weakness is the fact that the constant composition of the pellets is not monitored, as they throw all by-products in the mix without a consistent flow. The only parameter that is measured is the minimum requirement of 19% of protein (Cafiero, personal communication, 2022).

For Boortmalt, two opportunities can be unravelled. First, there is an opportunity to better promote the sustainability of the pellets. Boortmalt only has a market share of 0,33% in the compound feed market (including cow, chicken and pig feed). The market share is based on the 22 000 tonnes that Antwerp is producing on the total of 6,6 million tonnes produced compound feed in Belgium (Landbouwleven, n.d.). This means that it can easily maintain its position. Of course, Antwerp is also selling to some companies located in the Netherlands of which the volume is not taken into account here (Pot, personal communication, 2022). However and this is the second opportunity, Boortmalt's market share can still increase as the total average production per year of compound feed would decline due to the reduction in livestock (MarketLine, 2021).

Threats for Boortmalt can be the possible implementation of a future meat tax in Belgium or the Netherlands and corresponding with this a declining trend in the production of animal protein (True Animal Protein Price Coalition, 2021b). At this moment, the nitrogen decree in Belgium and the restricted laws in the Netherlands already tend to result in a reduction of growth in the feed industry. On top of that, with the Russian-Ukrainian war and crop failure through climate change, the prices of for example barley are booming and the price of the by-products follow the raw material prices (Pot, personal communication, 2022). As Boortmalt cannot control these circumstances, it could be possible in the future that selling prices of grain go down again and that the margin on by-products gets smaller.

Table 18: SWOT analysis for the pellets of Boortmalt.

Strengths	**Weaknesses**
- Medium protein level - Convenient location – sustainability – local by-products - Strong network and reputation - Good taste - Low-cost design - Accurate filling of buyer orders - Communication	- Not many storage space - No constant composition of pellets - Increasing costs due to very old machines
Opportunities	**Threats**
- Promote sustainability (being a local by-product) - Increase market share in total compound feed market	- Meat tax - Trend towards less demand for animal protein and more plant-based human food - Trend towards more innovative and customised products - Nitrogen decree - Volatile prices

Boortmalt can play out the strength of good taste, good protein level and sustainability to answer the increasing demand for sustainable co-products. If the company can combine this with the no-pesticides policy that Belgomalt, which is growing barley in Belgium, is already playing out, then Boortmalt could produce a fully sustainable product (Boortmalt, n.d.).

In order to overcome the mentioned threats, such as the declining demand, Boortmalt can use its reputation, convenient location and good network to stay in the market, unlike other smaller companies.

There is also a danger that a weakness could make a threat worse. This would be the case for Boortmalt if pellets from other companies are monitored more closely. If more parameters are checked, then this could answer the trend towards more innovative and customised products that farmers are asking for (Landbouwleven, n.d.). Innovation is considered to be the highest priority in the Common Agricultural Policy (Vlaamse Regering, 2022b).

A weakness that could prevent an opportunity from being captured, is the increasing costs of the old machines. If Boortmalt does not replace these machines, maintenance costs will increase and the company will not be able to increase its market share as it would be less price competitive (Cafiero, personal communication, 2022).

12.3. Customer value proposition

This customer value proposition looks into which customer pains Boortmalt could possibly solve, what it can create as gains and what products Boortmalt offers (Figure 19). The customers of Boortmalt Antwerp are considered to be compound feed producers in Belgium and the Netherlands (Pot, personal communication, 2022).

Compound feed producers buy medium to high protein ingredients in order to mix it in their animal feed products, which is eventually sold to farmers (Louise Lecomte, 2022b). Pellets are bought because of the easy transport possibilities, unlike for example dusty content that can be blown away. Also, most ingredients are transported dry because it would otherwise start to mold (Cafiero, personal communication, 2022).

After the customer interview, three pains came forward. No continuous delivery, no constant composition and too much fibre were mentioned as customer pains (Louise Lecomte, 2022b).

On the other hand, gains for customers are a high protein level, good communication from the producer, on time and continuous delivery and no annulations (Louise Lecomte, 2022b).

Boortmalt answers the customer job by offering qualitative pellets made from malt by-products that can serve as element of compound feed for cattle. The company can relieve a part of the pain of constant composition by promising a minimum requirement of 19% protein. Of course, a full assessment of all parameters is not solved with this. Secondly, Boortmalt is good at delivering on time because the company does not have big stock storage and so it has to get rid of the pellets as soon as possible (Cafiero, personal communication, 2022).

Boortmalt can also create gains such as maintaining a good communication and a good protein level.

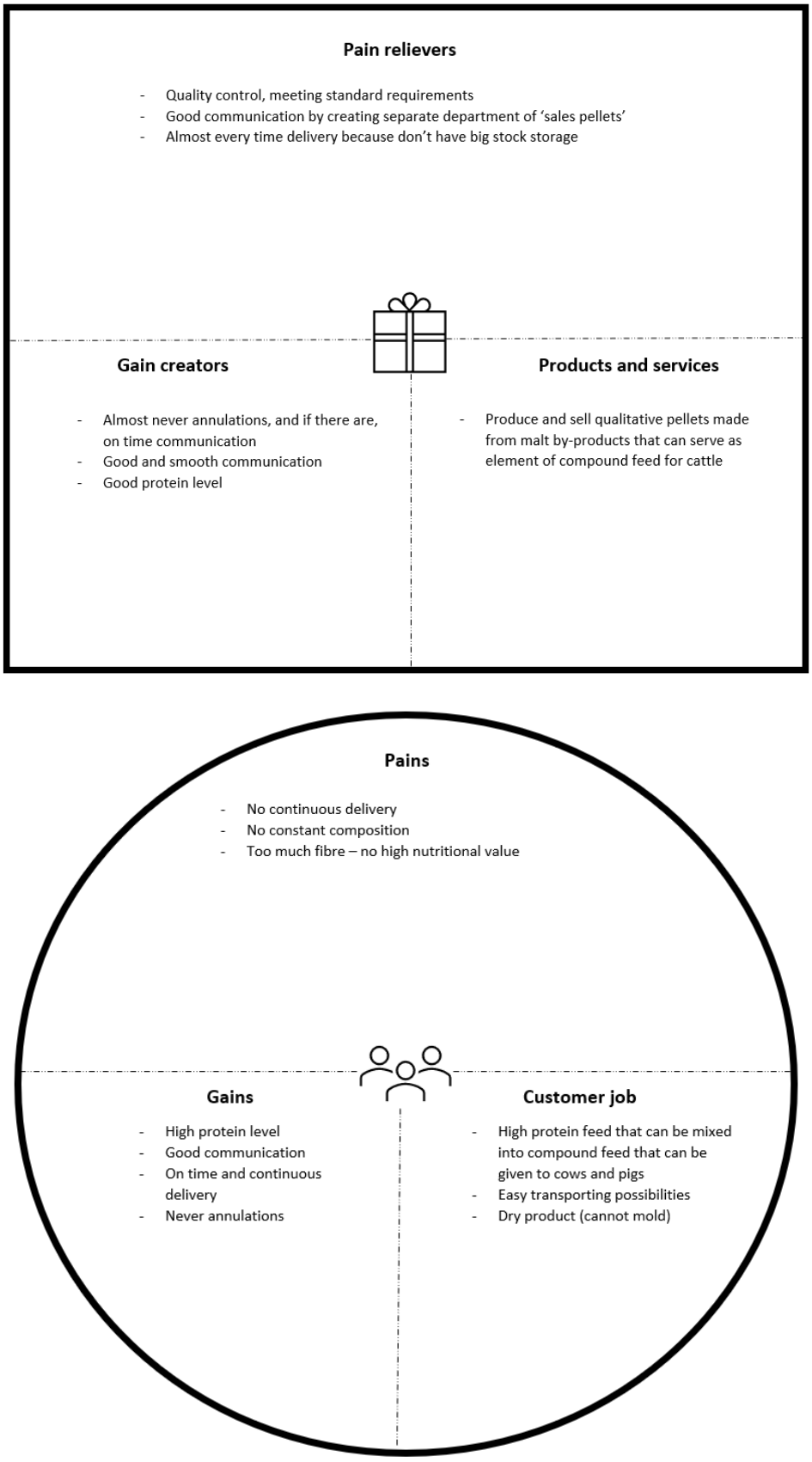


Figure 19: Customer value proposition for the customers of Boortmalt's pellets.

12.4. Financial analysis

To draft the profit and loss statement for the pellet production, information about revenues from pellet sales as well as all costs related to the production are needed. The total of all revenues and costs for this process have been calculated based on data received from the company (see Appendix part IX.21). The resulting P&L is shown in Table 19.

Table 19: P&L for pellet production process.

Profit and loss statement Boortmalt Antwerp – Pellet production for cattle feed Fiscal year June 2020 - July 2021	
Revenues	**3 240 000,00 €**
Pellet sales	3 240 000,00 €
Cost of goods sold	**216 847,36 €**
Raw materials	0,00 €
Transport of all by-products to mixing machine	39 000, 00 €
Mixing machine	9 047,50 €
Pelletizers	144 779,86 €
Cooling unit	7 020,00 €
Storage of pellets	17 000,00 €
Gross income	**3 023 152,64 €**
Operating expenses	**50 000,00 €**
Depreciation of transport system	0,00 €
Depreciation of mixing machine	0,00 €
Depreciation of pelletiser	0,00 €
Depreciation of cooling unit	0,00 €
Depreciation of silo's	0,00 €
Sales & management	50 000,00 €
Operating income	**2 973 152,64 €**
Financial revenues	**0,00 €**
Financial expenses	**0,00 €**
Income before tax	**2 973 152,64 €**
Tax rate (25%)	**743 288,16 €**
Net income	**2 229 864,48 €**

Revenues have been calculated based on volume sold, which is on average 1800 tonnes of pellets per month, and the corresponding price of 150 euros per ton for the fiscal year of June 2020 to July 2021.

For the cost of goods sold, costs have been calculated per step in the pellet production process. Before pellets can be made, all by-products have to be collected through mechanical transport into the mixing machine. This transport mechanism requires energy at a rate of 100 kilowatt hour every hour (kWh). Boortmalt's electricity cost within its current energy contract is 0,065 euros per kWh. Multiplying these two numbers with the production time of 6000 hours per year gives a total cost of 39 000,00 euros.

The cost of goods sold related to the mixing machine includes electricity, labour and maintenance costs. The electricity cost is 6 727,50 euros and is calculated as explained above. There is no labour cost as the machine works fully automated. The maintenance cost amounts to 2 320,00 euros every year.

For the pelletiser, there is an electricity cost of 74 100,00 euros and a total labour cost of 16 125,00 euros, including manual employee actions as well as cleaning time. The total maintenance cost is 37 840,00 euros and includes wages of 15 840,00 euros and a material cost of 22 000,00 euros a year. An additional cost for the pelletising step is the water which costs 3 064,86 euros a year.

After the pelletisation, the pellets need to be cooled by air. This cost is again an electricity cost, related to the usage of a ventilator, and amounts to 7 020,00 euros.

To transport the pellets from the mixing machine to the pelletiser further to the cooling unit and then to the silos, there is a total transport cost of 13 650,00 euros per year included. This cost is purely calculated as an electricity cost related to the electricity usage of the mechanical transport systems.

The final step in the process is the storage of the pellets. This cost includes payments to an external firm and amounts to 17 000,00 euros every year for storage.

Summing up all these costs results in a cost of goods sold of 216 847,36 euros. Deducting this number from the revenues results in a gross income of 3 023 152,64 euros.

The operating income is the result of the gross income minus all operating expenses. The operating expenses here include depreciation costs of the machines, and as these are all fully depreciated, this cost is zero. Another operating expense is the labour cost of two employees who are responsible for the management of the pellet production and the sales. This is not their main job as they only work on these tasks for 25% of their time. Based on the yearly employer wage cost, which is 100 000,00 euros, and the time spent, the total cost for sales and management of the pellet production has been calculated and amounts to 50 000,00 euros.

A more detailed overview of all sub costs is given in Table 20. All detailed calculations can be found in Appendix part IX.21.

Table 20: Detailed P&L for pellet production process.

Profit and loss statement Boortmalt Antwerp – Pellet production for cattle feed Fiscal year June 2020 - July 2021	
Revenues	**3 240 000,00 €**
Pellet sales	3 240 000,00 €
Cost of goods sold	**216 847,36 €**
Raw materials	0,00 €
Transport of all by-products to mixing machine	39 000, 00 €
Mixing machine	***9 047,50 €***
Electricity	6 727,50 €
Labour	0,00 €
Maintenance	2 320,00 €
Pelletizers	***144 779,86 €***
Water	3 064,86 €
Electricity	74 100,00 €
Labour	16 125,00 €
Maintenance	37 840,00 €

Transport to cooling unit	13 650,00 €
Cooling unit	***7020,00 €***
Storage of pellets	***17 000,00 €***
Gross income	**3 023 152,64 €**
Operating expenses	**0,00 €**
Depreciation of transport system	0,00 €
Depreciation of mixing machine	0,00 €
Depreciation of pelletiser	0,00 €
Depreciation of cooling unit	0,00 €
Depreciation of silo's	0,00 €
Sales & management	50 000,00 €
Operating income	**2 973 152,64 €**
Financial revenues	**0,00 €**
Financial expenses	**0,00 €**
Income before tax	**2 973 152,64 €**
Tax rate (25%)	**743 288,16 €**
Net income	**2 229 864,48 €**

An important note here is that there is no cost linked to the usage of the raw materials for the pellet production. The raw materials, which are the rootlets in this case, are by-products of Boortmalt's malting process. By-products as such, which are otherwise seen as waste, are not incurred as a raw material cost when further processed (AccountingTools, 2022).

The operating income still amounts above two million euros. When dividing this number by the sales revenue, the operating margin can be calculated. For the pellets, the margin is 91,8% which is very high. Practically, it means that for every euro of sales, Boortmalt earns 0,918 euros.

No financial revenues nor financial expenses are linked to this pelletising process. The net income is obtained after deducting corporate taxes, which are 25% in Belgium, and amounts to 2 229 864,48 euros (pwc, 2022). The pelletisation process is thus very profitable.

A sidenote should be made regarding the selling price of the pellets. This follows the market price of other feed ingredients such as soy meal, and has been fluctuating between 120,00 and 300,00 euros per ton of pellets in the past. A sensitivity analysis has been performed to understand what the effect is of this change in price on the pre-tax profit. When pellets are sold at 120,00 euros per ton, then the pre-tax income amounts to 2 325 152,64 euros, or thus, the margin is 89,7%. When the selling price of the pellets is about 300,00 euros per ton, which is the case for instance with the current war in Ukrainian, then the income before tax is 6 213 152,64 euros. The operating margin is then 95,9%. As such, Boortmalt's margin increases when the market price of other feed ingredients increases as well.

13. Project Part II – Texturized vegetable protein

About six months ago, Boortmalt started analysing how it can diversify its business. The company hired two consulting companies, one to scan the application of Boortmalt's by-products in the food market and one for the non-food market. In the first place, Boortmalt chose to focus on TVP, one of the main ingredients of plant-based meat alternatives because of the growing market for meat alternatives (Cafiero, personal communication, 2022). Our goal is to perform a more in-depth analysis of the TVP and plant-based meat alternatives market.

Boortmalt is considering working together with three entrepreneurs from Switzerland who have experience in the food industry. Alfons has a master's degree in food science and is already for 20 years a food distribution owner. Adrian has a lot of experience in providing engineering solutions for agrotechnology and food industry and has started up multiple companies. Josef is already for 30 years the owner of a food manufacturing company and has a lot of knowledge about innovation in the food market and the technology to produce TVP (Cafiero, personal communication, 2022).

On 18th of May, the three entrepreneurs gave a pitch and presented the products that could be made out of the by-products, both rootlets as dust, of Boortmalt. These products all have an application in the food industry and can roughly be divided in high and low processed products (Figure 20). The low processed products are bread, recyclable dishes and TVP and contain a higher percentage of Boortmalt's by-products. The high processed products are burgers, sausages and schnitzels that contain either the rootlets or TVP that is made of the rootlets. For our research, the focus is on the meat alternatives that contain TVP made from rootlets (Zehnder, personal communication, 2022).

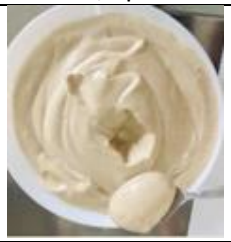
				
Burger patty	**Burger patty**	**Schnitzel**	**Bread (no flour)**	**Waterproof > 6H**
Water, sunflower TVP, **Rootlets 0-5%,** Coconut oil, Binders, Spices	Water, Blend **Rootlets** TVP, **Rootlets 5-10%,** Coconut Oil, Binders, Spices	Water, Wheat TVP, **Rootlets 5%**, Crumbs, Binders, Spices	Mix **(Dust 83%)** (Grain Flake formed) Fibre, Salt, Spices) Water, Syrup, Oil	**Dust 84%,** Bi-product waste, Water, Oil, Fibre
				
Milk replacer	**Salad dressing**	**Sausage**	**Textured vegetable protein**	**Waterproof > 72H**
Water, Oil, **Dust 2%**, Fibres, Sugar, Salt	Oil, Water, Vinegar, **Dust 4%**, Salt	Water, **Dust 7.5%**, Oil, Binders, Spices	Plant protein (Blend or just Sunflower), **Rootlets 5-15%**	**Dust 73%**, Bi-product waste, Water, Oil, Fibre

Figure 20: Overview of the products that are made by the Swiss start-up with Boortmalt's by-products.

The strategy of Boortmalt would be to collaborate with the Swiss start-up to jump into the TVP market. The Swiss start-up has a lot of experience in the food industry and the technology to produce TVP and are currently experimenting with Boortmalt's by-products. On this point, it is not clear yet how the collaboration would take place on the long term (Cafiero, personal communication, 2022).

Both companies want to pursue an agile method where a first product is launched without a brand name. In this way the brand name of Boortmalt is not linked with the product and feedback can be easily collected. Boortmalt can then adjust the product and launch again the adjusted product. In this way, Boortmalt can find out if the malt taste is appreciated by customers and if there is a fit between Boortmalt and the start-up. Afterwards, Boortmalt can decide how to continue with the collaboration (Cafiero, personal communication, 2022).

The competitors of Boortmalt are other TVP producers as Roquette, Cargill, Archer-Daniels-Midland Company (ADM), Meatless, MGP Ingredients and Sonic Biochem Extractions Limited. A more in-depth description of Boortmalt competitors is given in the VRIO analysis. The competitors of the Swiss start-up are the companies that produce plant-based meat alternatives. Here, two types of companies can be distinguished. One the one hand, the Swiss start-up will face competition of plant-based meat pioneers like Beyond meat and Impossible foods (MarketLine, 2020). These companies have grown exponentially the past decade and have spent large amounts of capital on product improvements and international expansion. On the other hand, they would have to compete with large scale food manufacturing & marketing companies like Nestlé, Tyson and Smithfield (MarketLine, 2020). These companies have multiple products with a respected brand name and have years and years of experience in advertising and product branding.

13.1. Market trends

Driven by the COVID 19 crisis, consumer's consciousness regarding health, climate change, and animal welfare cause a new mega trend in the food sector: the trend of plant-based proteins (Bakhsh et al., 2022; Euromonitor International, 2021; Maningat et al., 2022; Troy & Kerry, 2010). In that way, the meaning of quality within the meat industry has changed. In the past, quality stood for safety, sensory and shelf-life while the definition of the word now changes to nutrition, well-being and health (Troy & Kerry, 2010).

For centuries, people have been eating meat for different reasons being it either during social gatherings or because of the sensory or nutritional value. Meat contains some important high-quality proteins that are essential for the human body, but also contains vitamins, iron, zinc and other important micronutrients that are not available in plant-based products (Bakhsh et al., 2022a; Maningat et al., 2022a). Although meat's value, there is a shift to plant-based diets.

The first trigger for this shift has come from the many scientific reports describing negative health effects such as diabetes type 2, cardiovascular diseases and even some types of cancer that are related with meat consumption (Bakhsh et al., 2022a; Euromonitor International, 2017; Troy & Kerry, 2010). Moreover, meat has been put recently on the list of carcinogenic to humans by the World Health Organisation cancer department in consultation with the international agency for research on cancer (Bakhsh et al., 2021).

Besides these health-related side effects, the meat industry is mainly under pressure because of sustainability issues. Meat production is known for its extensive land, water and energy use as well as deforestation and emission of greenhouse gasses. To make it more concrete, currently 26% of all Earth's ice-free surface is being occupied by grazing livestock, while a total of 33% of all croplands is used to grow crops for animal feed (Rubertsson, 2019; van der Zee, 2018). To obtain free land for

livestock production, a total area of 13 billion hectares is subject to deforestation each year. This consequently puts pressure on soil fertility, biodiversity and on water sources. Numbers show that livestock production is responsible for 70 to 85% of the global water footprint, and that the production for 1 kg of beef requires more than 6812 litres of water. Another important aspect is the fact that livestock contributes to 7% of total greenhouse gas emissions, while animal agriculture as a whole contributes to 25-30%. Keeping these numbers in mind, it is clear that meat production is an inefficient process as plant proteins are converted to animal proteins by their metabolism using all these resources. For beef in particular, it is known that only 1% of the gross energy input is converted into edible food (Bakhsh et al., 2022b; Maningat et al., 2022b; Rubertsson, 2019). That the meat industry impacts climate change has been confirmed by the United Nations government programme of 2018, in which it was declared that the meat production is the world's most urgent problem (Euromonitor International, 2021b).

When studying market trends related to meat consumption, there is still an increasing demand despite the negative customer perceptions. Forecasts mention a global market expansion of 15% between 2018 and 2027 (Bakhsh et al., 2022a; Euromonitor International, 2017). This trend is due to the income increase in developing countries as well as the rising world population. That is where the new sustainability challenge comes in, to fulfil the rising demand in protein by products other than meat. New protein sources with less environmental impact will have to be discovered and used. Additionally, policy makers expect people to change from unhealthy food to healthy alternatives in line with their changing lifestyle, and for the meat industry, it will be key to focus on innovation in order to guarantee economic growth (Troy & Kerry, 2010).

Plant-based proteins contribute to four sustainable development goals, being responsible consumption and production, climate action, sustainable cities and communities as well as good health and wellbeing (Euromonitor International, 2017). This means that these vegetable proteins can answer and partially solve the customer pains related with meat consumption. The question is only how? Because plants and meat are far from the same products. Plant-based proteins can be used for the production of meat alternatives, also known as meat substitutes, fake, mock or imitation meat. As Maningat, Jeradechachai and Buttshaw (2022) say, the definition of meat substitutes is: "Meat analogues are products that share aesthetic and physicochemical properties such as taste, texture, aroma, and mouthfeel with real meat." Meat substitutes entail two categories of products, being that of cell-based meat and plant-based meat replacements (Sun et al., 2021).

Cell-based meat or lab-grown meat is meat that is cultured in a controlled lab environment. Although the first lab-grown meat burger became reality in 2013, it was only commercially available in 2020 in Singapore (Euromonitor International, 2021b). This concept can be of interest for countries that are otherwise dependent on meat import (eg. Japan), but at the moment, cultured meat costs a multiple of conventional meat and research is still at its infancy, so a commercial breakthrough is not excepted the coming years (Bakhsh et al., 2022a; Euromonitor International, 2021b; Sun et al., 2021).

On the other hand, there are the plant-based meat products with as one of the most well-known examples being the 'Impossible burger' produced by the US company Impossible Foods. These products resemble meat, but are mainly composed of plant proteins. The company claims that the Impossible burger has more bioavailable protein, iron and fat and no cholesterol compared to a beef burger (Sun et al., 2021).

When producing alternative meat-burgers, it is important to take the main customer quality criteria into account. Figure 21 shows what customers relate to quality when it comes to meat consumption and production (Troy & Kerry, 2010).

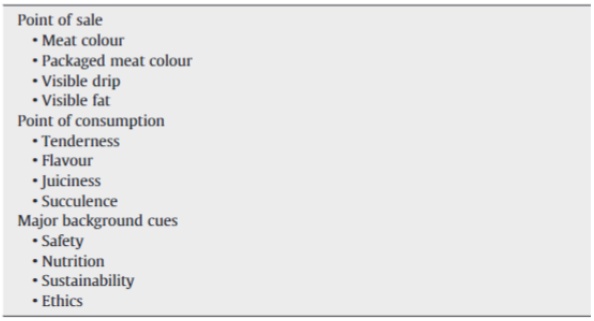


Figure 21: List of quality criteria that customers value in general, but also at the point of sale and consumption.

A lot of research has been performed already on how to implement plant-based proteins in a way that the burger has the same texture, taste and appearance as a real meat burger. Texture and physiochemical properties are top of mind for all researches, and a well-known technique to convert the structure of plant proteins into a meat-like texture is texturization. There exist a dozen of techniques to give plant proteins a fibrous structure by texturization, but the most common way to do so is through extrusion as this is a cost-effective and flexible method that can be used with a wide variety of plant protein sources (Bakhsh et al., 2022a). Different types of extrusion methods can be distinguished, but in general, it is through a combination of mechanical pressure and heat that proteins are denatured until a textured, fibrous product is obtained. Turning proteins into texturized vegetal protein (TVP) allows the protein to withstand hydration and cooking, which are important characteristics for the final product in which TVP is used, like burgers (Maningat et al., 2022a; Samard et al., 2021).

TVP as a technique has been invented in 1960, and since then, it has been widely applied on pea, wheat, rice and mainly on soy. Soy has several reported advantages such as its abundance, high-quality amino acid composition, similar protein profile as compared to animal proteins, little cholesterol and its low cost. Moreover, texturized soy protein has the right absorption and gelling qualities needed to make meat analogues (Bakhsh et al., 2022a). However, nowadays, the scope of alternative proteins is enlarging due to allergenic concerns related to soy and its image as genetically modified organism (GMO) (Sun et al., 2021). Research into alternative protein sources is being continued, and here is where Boortmalt can come in with the malt-rootlets, that contain about 30% of protein.

In line with the change in consumer behaviour towards meat consumption, there is an increasing interest for plant-based products such as the meat analogues. European consumer research divides customers with interest in this market into four main groups. First, there are the people who would like to reduce their meat consumption mainly driven by health factors. This health driver is seen as the most important one, and numbers show that 37% of these people say to feel healthier and better when eating plant-based meat alternatives (Euromonitor International, 2021b; Sun et al., 2021). Second, there are consumers that want to reduce their meat intake because of sustainability and animal welfare considerations. A third category are those who are more convenient and cost-conscious oriented. Lastly, there is group of people who are innovation oriented, and thus very much interested in new products produced with new technologies (Sun et al., 2021). All together, these people are the so-called flexitarians that boost the trend of plant-based products, and as they constitute 22.5% of the global population, their role is even more important compared to vegans or vegetarians. Globally, one out of five people belongs to one of the four mentioned customer categories, which is a 21% increase compared to 2020. Besides these flexitarians, 16% of people worldwide try to follow a plant-based diet. Reports show that this trend will be further boosted by the younger generation: while young adults are more likely to be vegan or vegetarian, only 25% of young adults between 15 to 29 years old

never eat plant-based alternatives. Moreover, people between 30 and 44 years old are likely to try to follow a plant-based diet (Euromonitor International, 2021c).

In general, the meat substitutes' retail value is forecasted to increase by 15,9% across 2021-2025 (Euromonitor International, 2021b; Maningat et al., 2022a; Market Data Centre, 2022; Wunsch, 2020). The compound annual growth rate predicted until 2030 amounts to 7.6% where the global meat substitute market size is expected to grow from $ 5 477,7 million in 2020 to $ 11 230,1 million in 2030. Moreover, the segment of texturized vegetable protein is expected to grow the fastest. This is because texturization allows for the structure of plant proteins to closely mimic a meat-like texture (Allied Market Research, 2022; Fortune Business Insights, 2021; Maningat et al., 2022a). Besides, the fact that meat substitutes become more affordable, and that government regulations are trying to limit meat consumption make that there is a future potential for plant-based alternatives including meat-analogues (Euromonitor International, 2017).

Nevertheless, this industry also faces some challenges. First, many plant proteins do not contain all essential amino acids. Essential amino acids are the ones that cannot be synthesized by the human body, and that therefore need to be supplied from food (Lopez & Mohiuddin, 2020). For Boortmalt's rootlets specifically, all essential amino acids are present (Mancinelli Eugenio Marco sas Vle Marconi & Cafiero, 2022; Mancinelli Eugenio Marco sas Vle Marconi, 2019). However, this can be compensated by other dietary products. Second, as taste and appearance are crucial parameters for customer acceptance, and as TVP products still differ from meat, optimization of the technical 's parameters is needed (Bakhsh et al., 2022a; Sun et al., 2021). Another important challenge is the fact that plant-based alternatives are said to be healthier without there being a lot of evidence. This challenge is also known as the Health Halo challenge. People perceive processed food as unhealthy, and as plant-based meat alternatives are indeed highly processed, consumers want to see evidence related to health if they exchange meat for meat-analogues. A first initiative to answer this need is set in May 2021, when Beyond Meat and Stanford University decided to set up a plant-based diet fund. It is a five year project where both parties want to assess the health impact of plant-based meat alternatives to create the transparency that customers ask for (Euromonitor International, 2017).

In short, the meat industry is under pressure because of ethical, health and sustainability issues identified as main customer pains. On the other hand, the number of flexitarians globally is rising which pushes the demand for plant-based meat alternatives. Apart from some challenges that are being tackled, this market has future potential, and could therefore be interesting for Boortmalt to jump into with its protein-rich rootlets. Using the rootlets for human consumption instead of animal feed can potentially increase the value .

13.2. Strategic analysis

13.2.1. Market attractiveness by Porter

The five forces of Porter can be applied to understand the market environment and its potential to see how attractive it can be for the company to dive into the market of plant-based proteins by the production of TVP.

The first aspect of Porter's model deals with **customer bargaining power**, of which the analysis is shown in Table 21.

Table 21: Analysis of customer bargaining power in the TVP market.

Power of buyers (→ appropriation of profits)		
Strong buyer power		**Weak buyer power**
There are few buyers (purchasing large volumes)	1 – 2 – 3 – **4** - 5	There are many buyers of our products
Products in our industry are largely undifferentiated	1 – 2 – **3** – 4 - 5	Product differentiation is key in our industry
Buyers in the industry face no switching costs	1 – 2 – **3** – 4 - 5	Buyers in the industry face huge switching costs
Buyers in the industry are very price-sensitive	1 – **2** – 3 – 4 - 5	Buyers in the industry are not price-sensitive
Products have little effect on our buyers' costs and quality	1 – 2 – 3 – **4** - 5	Products have huge impact on buyers' costs and quality

There is the growing trend of customers demanding plant-based meat alternatives. Numbers show that this market is profitable, which means that many start-ups emerge to produce vegan meat alternative burgers. Besides the small start-ups, there are also bigger names such as Nestlé that start to produce these vegan burgers (MarketLine, 2020). As such, there are lots of different buyers which means that a TVP producing company is not dependent on a select group of customers, which decreases the buyer power.

In terms of product differentiation, there is not a company yet that has found the best TVP recipe until now, and TVP from different companies resemble each other at this moment. The only difference is the raw material used, but also here, most companies use soy, wheat or pea which does not create lots of differentiation. Finding the best recipe for TVP will be key to create competitive advantage. This is certainly true if you know that the taste of TVP in the end also can contribute to the taste of the burgers (Cafiero, personal communication, 2022).

Although the products resemble each other, the protein source determines the ultimate taste of the TVP. This means that for the customers, who are the burger producing companies, there is a switching cost as they adjust the burger recipe to the taste of the TVP. It is known that TVP made from soy does not taste the same as TVP made from wheat or rootlets (Samard et al., 2021). However, the switching costs are not huge but rather moderate.

Buyers in this industry are expected to be quite price sensitive. If a cheaper TVP is available that has a neutral or better taste than current options, then it is expected that companies will switch supplier. Soy TVP for instance is known for sometimes having an unpleasant taste (Qin et al., 2022; Samard et al., 2021; van Tonder, 2018). This aspect increases customer bargaining power again.

This is also linked with the fact that the quality and the cost of TVP will determine the quality and the cost of the final products in which it will be used. To apply it for Boortmalt, during the tasting of meat alternative burgers produced by the Swiss start-up, some people experienced a bitter taste when eating the TVP. This taste will also influence the taste of the final products, which might ask for the addition of extra taste additives in order to mask the taste coming from TVP. This makes customers more loyal once they have a TVP supplier that delivers good tasting and good quality TVP.

Combining these elements objectively into a number, the total score for the TVP market for customer bargaining power is 16/25. This means that the customer bargaining power is rather low. Customers are not exercising pressure on TVP producers and are not expected to do so in the future. This also

means that the TVP industry's profitability is not really determined by its customers, which are the meat alternatives producing companies.

The second force is called the supplier bargaining power (Table 22), and with a score of 21 out of 30, the supplier bargaining power is rather at the weak side. For the industry, that is a positive thing as a weaker supplier bargaining power will put less pressure on companies to pay higher prices to their suppliers or to pay quicker, which thus is positive for the profitability of TVP producers. The reasons why the supplier bargaining power is weaker is firstly because there is no real consolidation between key suppliers.

Further weakening that power is the fact that suppliers' products are not really differentiated combined with the availability of lots of substitutes. TVP today is mainly made from wheat, pea and soy which means that there are not many types of products that can be supplied. However, there are lots of suppliers for wheat, pea and soy which decreases the power of every single supplier. Moreover, every protein-rich product can be used for TVP production. Today, TVP can be made from by-products, as is the case with soy, but also from whole crops, as is done with pea, fava bean and wheat.

What further increases the variety of substitutes is that although TVP was only made from products with a protein content about 45-70% in the past, TVP can now be made from sources having a protein level of 25%. However, the higher the protein content, the more elastic TVP is which increases elasticity and thus the resemblance with real meat. But when applying a technique called air classification, it is possible to increase the protein content from the raw material (Cafiero, personal communication, 2022). This decreases the point of differentiation between different protein sources. As such, the raw material mainly determines the taste, but besides this, different suppliers having different protein sources are not much differentiated from each other. This also lowers the switching cost, weakening the power of suppliers.

One aspect that increases the power of suppliers is the fact that there might be a threat for suppliers to enter the TVP production industry. TVP can be made from whole, protein-rich crops but also from by-products. This means that food companies that have protein-rich by-products and that have the capital to invest in TVP production, might start producing TVP themselves instead of selling their by-products to external TVP producers.

Table 22: Analysis of supplier power for TVP market.

Power of suppliers (→ appropriation of profits)		
Strong power of suppliers		**Weak power of suppliers**
There is consolidation among our key suppliers	1 – 2 – 3 – **4** - 5	There is no consolidation among our key suppliers
Our key suppliers serve many industries	1 – 2 – 3 – **4** - 5	We are very important customers for our key suppliers
We face huge switching costs when changing suppliers	1 – 2 – **3** – 4 - 5	We face no switching costs when changing suppliers
Our suppliers' products are very differentiated	1 – 2 – 3 – **4** - 5	Our suppliers' products are not differentiated at all
There are no substitutes for our suppliers' products	1 – 2 – 3 – **4** - 5	Many substitutes for our suppliers' products are available
Our suppliers threaten to enter our industry	1 – **2** – 3 – 4 - 5	Our suppliers have no intention to enter our industry

A third aspect within Porter's model is the **threat of substitute products**, which is presented in Table 23.

Table 23: Analysis of threat of substitutes in the TVP market.

Threat of substitutes (→ a ceiling on prices)		
Strong threat of substitutes		**Weak threat of substitutes**
Attractive and cheap substitute products available	1 – 2 – 3 – **4** - 5	No attractive and cheap substitute products available
Our customers are able to switch to substitute products easily	1 – **2** – 3 – 4 - 5	Customers are not able to switch to substitute products

There are not that many TVP producers in the market today. Moreover, TVP available on the market is mainly made from soy, and some portion also from wheat and pea. There are some downsides linked with TVP from soy, such as the less attractive taste as well as the presence of allergenics. Besides, importing soy is not sustainable as it has to come from far (Qin et al., 2022; Samard et al., 2021). In the market today, there is not the optimal TVP yet, so there is still potential for companies to gain a huge competitive advantage. This means that the potential profitability of the TVP industry is quite high.

So the products that are available today, are not 100% attractive, and although TVP is made from a different source, the products today resemble each other at the level of quality and structure, knowing that structure is an important criterium to use TVP for vegan burger production (Zehner, personal communication, 2022).

The fact that there are no real attractive products today, with the fact that TVP made from different protein sources resembles each other in texture, makes that the threat of substitute products is average. This can be confirmed by the score for this force, which is 6 out of 10.

The threat of new entrants, also described as **barriers to entry,** is the fourth force (Table 24).

Table 24: Analysis of level of entry barriers in the TVP market based on scoring.

Barriers to entry (→ profit potential of our industry)		
Weak entry barriers		**Strong entry barriers**
Companies can easily adopt the technique to produce TVP	1 – **2** – 3 – 4 - 5	Companies cannot easily adopt the technique to produce TVP
Firms in our industry do not enjoy economies of scale	1 – 2 – 3 – **4** - 5	Firms in our industry enjoy economies of scale
Switching costs for customers are low in our industry	1 – **2** – 3 – 4 - 5	Switching costs for customers are high in our industry
Easy to find enough capital to run the business	1 – **2** – 3 – 4 - 5	Difficult to find enough capital to run the business
Easy to match the quality levels of incumbent's products	1 – 2 – **3** – 4 - 5	Difficult to match the quality levels of incumbents' products
Easy to have access to distribution channels	1 – 2 – 3 – **4** - 5	Difficult to have access to distribution channels
Government policy favors newcomers in the industry	1 – 2 – **3** – 4 - 5	Government policy protects the existing players
Incumbents will not react when newcomers enter	1 – 2 – **3** – 4 - 5	Incumbents will strongly react on new entrants

The total score for barriers that make entrance in the TVP market more difficult, is 27 out of 45, which is average to a bit higher. The fact that it is not easy for new companies to enter, which thus increases the level of entry barriers, is determined by different factors.

First, the price of TVP is determined by the raw material. Today, TVP is mostly made from soy, of which the price is about 2,5 euros per kg for soy with a protein level about 60%. This is lower due to huge product volumes compared to TVP made from pea or fava bean, for which the price for 60% of protein is about 5 euros per kg (Cafiero, personal communication, 2022). In order to decrease the price and to be competitive, economies of scale in the industry will be required for different types of protein sources and that is why this factor leads to a strong entry barrier.

Second, firms such as Roquette and Cargill that start with or already have experience with TVP production, have already an established distribution network to sell TVP (Roquette, 2019a). This network is even worldwide, as this is where these companies are present. To create such a network, years are needed for a new entrant unless a big company is interested to purchase such a start-up.

A last aspect that reduces the amount of new entrants is the fact that within about 20 years, it is expected that cultured meat will take up the biggest volume of the meat market (Gerhardt et al., 2020). This means that new companies might already start looking to produce this, instead of first going into the vegan meat alternative market.

However, aspects that lower the entry barriers are the fact that there exist many techniques to produce TVP. Moreover, as long as no optimal TVP recipe is found, customers have relative low switching costs. Another factor that reduces entry barriers is the fact that capital can be quite easily found when companies want to jump into this market. This is because TVP can be used as an ingredient for vegan burgers, for which the market outlook is profitable and growing. Besides, there are lots of food companies that will want to purchase smaller start-ups that produce such burgers which will enable the bigger food companies to also sail on the new vegan trend. These factors increase the threat of entry, and thus the profit potential in that market due to a price decrease. At the same time, companies will spend more money on keeping their customers satisfied by improving products and services.

The last point of Porter's model is the **intra-industry competition**. The elements that determine the rivalry within the TVP market are shown in Table 25.

Table 25: Analysis of level of entry barriers in the TVP market based on scoring

Rivalry in the market (→ distribution of profits)		
Strong rivalry		**Weak rivalry**
Competitors are numerous and/or are roughly equal in size	1 – 2 – 3 – **4** - 5	There are a few dominant players in the market
Industry growth is slow	1 – 2 – 3 – **4** - 5	Our industry grows fast
Exit barriers are high	1 – 2 – **3** – 4 - 5	Firms can easily leave the market
Rivals are highly committed to the business	1 – **2** – 3 – 4 - 5	Rivals are not committed to the business
Products are largely undifferentiated from the competition	1 – **2** – 3 – 4 - 5	Products are highly differentiated from the competition
Danger for excess capacity in the market	1 – 2 – 3 – **4** - 5	No danger for excess capacity in the market

Products in our industry are perishable	1 – 2 – **3** – 4 - 5	Products in our industry are not perishable

In the TVP market, there are only six players being it Roquette, Cargill, Archer-Daniels-Midland Company (ADM), Meatless, MGP Ingredients and Sonic Biochem Extractions Limited. Of these players, it are only Roquette, Meatless and Cargill that are playing in the European market. These companies are currently producing TVP, which is an ingredient for vegan meat alternative burgers or other vegetarian applications, which is a rapid growing market with a CAGR of 15,9% across 2021-2025 (Euromonitor International, 2021). Therefore, the demand for TVP is also increasing fast which also reduces the risk of producing too much TVP, or thus having excess capacity. These aspects make that the rivalry in the TVP market is not so strong yet.

What increases competition though is that current companies are all investing in finding and optimizing a good TVP recipe, as the taste and texture of TVP determine the structure of the final products. As said before, there is no optimal recipe for TVP found yet, but the company that will be able to create TVP with an optimal taste and texture, will gain huge competitive advantage. Thus, in the meantime, TVP is mainly produced from soy, wheat and pea that result in similar products, increasing competition as well. As such, there are some big players, but no one with an optimal product which makes the rivalry in the market somewhat lower than average, which is according to the score of 22 out of 35. Rivalry in the future can still increase, which will then affect TVP industry's profitability negatively.

The outcome of the Porter model is summarized in Table 26.

Table 26: A summary of the Porter model for TVP.

A summary of the Porter model	
Force of Porter	**Result**
Buyer power	Average to low
Supplier power	Low
Threat of substitutes	Average
Barriers to entry	Average
Rivalry in the market	Average to low
Conclusion	**The market is attractive**

Entering the TVP market as a new company has the advantage that both buyers and suppliers will not really put pressure on your profitability. Also the fact that the rivalry in the market is not really intense is attractive. This is linked with the threat of substitutes which is also average. It is not too difficult to enter the market as the barriers to entry are average. On the other hand, it also means that when a new company is playing in the market, that there are no real barriers protecting the market as such.

13.2.2. Competitive analysis

Boortmalt wants to form a partnership with a Swiss start-up company that has a lot of experience in food production, to produce TVP. To understand the strength of Boortmalt's competitive advantage of the TVP in the food industry, a VRIO analysis will be performed. For the VRIO analysis, it is assumed that Boortmalt would work together with the Swiss company and can count on its expertise.

TEST # 1:Does it meet the key success factors in the market?

The first step in the VRIO analysis is to assess what the key success factors are for TVP production. After performing a literature review about the TVP market, key success factors about technology, manufacturing, distribution, marketing and skills were determined (Table 27).

Boortmalt itself doesn't have a lot of knowledge about the food market as its main focus is the beer market. Because of its potential collaboration with the Swiss start-up, that has experience in the food market, it would have the right knowledge and technology to be able to produce TVP with the right taste, texture and appearance.

The product innovation capabilities of Boortmalt for TVP are considered high. The Swiss start-up has complementary profiles and has knowledge about the product itself and the engineering part to produce TVP. Because of the collaboration, Boortmalt scores high on this key success factor.

The rootlets are by-products of the malting process so if Boortmalt wants more rootlets, it will have to produce more malt. Although the availability of rootlets depends on the malt production, it is not a limitation as Boortmalt Antwerp is the biggest malting company in the world and produces on average 21 600 tonnes of pellets per year. Pellets consist on average of 60 % rootlets, so the company has 12 960 tonnes of rootlets by-products each year. The rootlets' protein content is 30% which results in the availability of protein sources of 3 888 tonnes each year (Cafiero, personal communication, 2022). Besides Antwerp, Boortmalt has also multiple plants all around the world so if scale up is needed, Boortmalt could collect the rootlets from the other facilities. Furthermore, the company can also buy other protein sources. Because of the high protein volume in Antwerp and the possibilities to collect and buy protein sources, the ability to achieve scale economy is considered as high (Cafiero, personal communication, 2022).

With TVP, Boortmalt would enter the food market. The Swiss start-up has experience in the food market but because there is no optimised TVP from rootlets yet, the ability to capture the experience curve is low.

Malt is used to produce beer and Boortmalt has the in-house knowledge to perform quality controls for malt. If Boortmalt produces TVP, it would have to assess food gradeability and so it will have to perform more sophisticated quality tests (Cafiero, personal communication, 2022).

Boortmalt owns 27 malting plant that our located in 14 different countries in 5 continents (Boortmalt, 2021a). The locations of the malting plants of Boortmalt are chosen based on its market for malt. To be able to fulfil demand for malt all around the world, malt is transported between the different production facilities of Boortmalt. A good collaboration and supply chain management are essential to set this up. However, the market of TVP is not the same as the market for malt resulting in other supply chain requirement. Especially as TVP will not be transported as bulk. The score of Boortmalt for the key success factor supply chain management capabilities is considered as average.

For the marketing related key performance indicators as clever advertising and respected brand name, it is needed to take into account the short term and long term perspective. On the short term, Boortmalt scores low on clear advertising as there is still no optimized TVP yet. For respected brand, Boortmalt scores average because it has a respected brand name in the B2B market for beer but not for food.

On the long term, it depends if Boortmalt is able to distinguish itself from the other TVP producers. The TVP that is made from rootlets has a specific malt like taste which is now considered as appreciated by the customers but further customer feedback needs to be collected (Cafiero, personal communication, 2022). If Boortmalt is able to get this taste on point and is able to play out the

sustainability aspect of the TVP from their by-products, the company could score high on clever advertising and respected brand name.

As a next step, a reassessment needs to be done that considers the evolutions in the market and the effect on Boortmalt for the key success factors. The market of meat alternatives is expected to rise over the coming years but more competitors are also entering this market. The key success factors that are currently low for Boortmalt are the key success factors related to marketing. So, a lot will depend on how the taste of the rootlets TVP containing products would be perceived and if Boortmalt is able to make the taste together with the sustainability aspect their unique selling proposition.

Table 27: Key success factor for the TVP market with corresponding score for Boortmalt.

Key success factors	**Score for Boortmalt**
Technology around taste, texture, appearance of TVP	Average
Product innovation capabilities	High
Ability to achieve scale economies	High
Capturing experience curve	Low
Quality control know-how	Average
Distribution network	Average
Supply chain management capabilities	High
Clever advertising	ST Low; LT High
Respected brand name	ST Average; LT High

TEST # 2:Does it have unique resources and capabilities?

In the second test of the VRIO analysis, a comparison with competitors is made to understand which resources and capabilities result in a competitive advantage for Boortmalt (Table 28).

The market for TVP is a profitable, growing market. Therefore many companies, both start-up as big companies, are entering the market. If Boortmalt enters the food market with TVP, it will have to face large companies who are already active in the food market as Roquette, Cargill, Archer-Daniels-Midland Company (ADM), Meatless, MGP Ingredients, KMC Danish potato protein and Sonic Biochem Extractions Limited.

Related to innovation in protein products Roquette and ADM are the key players. Roquette is a French company that is a global leader in plant-based ingredients and vegetal proteins with a strong focus on innovation. Roquette used to make TVP only from pea and wheat but in 2019 Roquette launched a new line of TVP from fava beans and expanded the TVP line from pea with improved taste and texture performance and improved nutritional profile (Roquette, 2019b, 2022a).

ADM is an American multinational company that invented TVP in the 1960s. The company has a strong technical support and expertise in extrusion and currently produces TVP from pea, wheat and soy (Archer Daniels Midlands Company, 2022).

MGP Ingredients is also an American company that produces TVP. Originally the company only made TVP from wheat but it invested to make also TVP from pea protein (MGP Ingredients, 2022).

Cargill is another big player that has a joint venture with Puris. Cargill has a lot of experience in buying crops and handling ingredients but not in the production of TVP. In 2018, Cargill has set up a joint venture with Puris and invested 25 million (MarketLine, 2020). Puris is a an American food company

producing plant-based, non GMO food ingredients that is headquartered in Minneapolis. In this joint venture, Cargill delivers the pea protein to Puris that makes TVP from this pea protein. To be able to keep up with the increasing demand for its pea protein product, Cargill invested another 75 million in Puris (Byington, 2020; Cargill, 2019).

Sonic Biochem Extractions Limited produces soy protein and texturized soy protein in India (Sonic Biochem Extractions Limited, 2022).

Meatless is a Dutch company that produces TVP since 2005 from lupine, wheat, pea, fava beans, rice and quinoa (Meatless, 2022).

Another European player in the TVP market is KMC Danish potato protein. This company diversified its business from selling exclusively potato starch to the production of potato based products such as TVP (Stine, 2022).

So, there are already some players in the market for TVP but some of these companies are less active in the European market. Because Boortmalt would start the production of TVP with rootlets coming from Antwerp, more attention was given to big companies active in the European market. The European based companies are not long active in the market for TVP production and are still experimenting to optimize its TVP.

The taste of the TVP from rootlets could become one of the biggest advantages of Boortmalt as the malt like taste is very characteristic. Currently, the taste of the TVP is not perfect as some bitterness, sandiness and the fibres are coming through too much. The bitterness is also a barrier for the meat alternative producers, as only a small fraction of bitter TVP can be added to not influence the burger taste too much (Cafiero, personal communication, 2022). Because of the collaboration with the Swiss start-up, Boortmalt could be able to improve the taste according to the customers wishes. Boortmalt is the only company that would make TVP from rootlets as most of the competitors make TVP from soy, pea or wheat. Both soy and pea are part of the Leguminosae. The proteins from this family have a distinct beany and hay like flavor that is hard to mask and is not generally considered as tasty (Qin et al., 2022; Samard et al., 2021; van Tonder, 2018). The taste of texturized wheat on the other hand is neutral which eliminates the need to mask flavors but also not contributed to an distinct product (Beneo, 2022). Because Boortmalt could count on their specific malt like taste and the experience of the Swiss start-up, the taste is considered as valuable, rare and hard to imitate. The only disadvantage is that the taste is not yet optimized so Boortmalt cannot play out this unique characteristic.

Currently, the texture of meat alternatives does not fully resemble the texture of meat. As the texture of meat alternatives depends on the texture of TVP, technology will be needed to optimize the texture of TVP. Boortmalt counts on the experience of the Swiss start-up to optimize the texture of TVP but on this point, the TVP that is made from rootlets does not have a competitive advantage related to texture.

The product innovation capabilities are considered as valuable because this will determine if Boortmalt is able to optimize the taste and texture of its TVP. For this resource, Boortmalt is really dependent on the collaboration with the Swiss start-up as it has the experience and knowledge about the technology in the food industry. Because Roquette and ADM have a lot experience in protein innovation, the product innovation capabilities of Boortmalt are not considered as rare or hard to imitate.

The TVP of Boortmalt will in fact be made of a waste stream and fits in the circular economy concept. Because of the growing awareness for sustainability, this is considered as valuable. Other commonly protein sources for TVP are soy, wheat, pea and fava beans. TVP made from soy protein is also

produced out of a waste stream as the soy flour obtained after production of soy oil is used as the soy protein source. Also for the production of wheat protein, waste streams of wheat are used. Pea and fava beans proteins on the other hand are produced directly from the raw pea and fava beans and not from a waste stream (Cafiero, personal communication, 2022). Because soy and wheat TVP are also made of a waste stream, the fact that the TVP of Boortmalt is made of by-products of the malt process is not considered as rare or hard to imitate.

Boortmalt will use its rootlets, a by-product of the malt process, to produce TVP. Therefore, Boortmalt is not dependent on suppliers to provide the protein source. For the cost of the raw material, Boortmalt only needs to consider the opportunity cost to not be able to make pellets out of its rootlets and it does not have to pay his suppliers. The independency of suppliers is considered as valuable, rare and hard to imitate as most TVP producers need to buy their protein source. Boortmalt is also organised around this as the rootlets are collected separately during the malt production process.

Like mentioned, most TVP producers need to buy their protein source. Boortmalt does not need to pay its supplier for this raw material and has also access to an enormous amount of protein as there is 3 888 tonnes of rootlets protein available each year only in Antwerp (Cafiero, personal communication, 2022).

Researchers discovered that phytochemicals are present in malt rootlets and that these have potential health benefits (Koistinen et al., 2020). If it is confirmed that phytochemicals are present in the malt rootlets of Boortmalt and absent int other commonly used TVP protein sources, then Boortmalt has a competitive advantage. The only disadvantage is that Boortmalt currently has not tested it and that a lot will dependent if Boortmalt is able to make the presence of phytochemical an unique product characteristic.

Out of customer interviews, it was clear that Boortmalt is considered as a reliable partner and so already has a respected brand name in the B2B market. Boortmalt could use its reputation as a reliable partner to also become a respected supplier of TVP. The only disadvantage is that Boortmalt is not active in the food market. Other competitors like Roquette who are already a long time active in the food market, have an advantage compared to Boortmalt.

The last strength that needs to be considered is supply chain management capabilities. Because Boortmalt's global presence and collaboration between the different production facilities, it has optimized supply chain management capabilities. Of course, with TVP Boortmalt would face a lot of competitors who also have global presence like Roquette and Cargill (MarketLine, 2020).

TVP is now mostly made from soy, wheat and pea which have a protein content of 35-40%, 8-20% and 20-30% respectively (Meng & Cloutier, 2014; Žilić et al., 2011; Cafiero, personal communication, 2022). Rootlets have a maximum protein level of 30%, which is lower compared to soy but higher than wheat and pea. Today, there exist a technique, called air classification, which can be used to increase the protein content. The level of protein content is proportional to the elasticity of the TVP, and the higher the elasticity, the better the TVP resembles the structure of real meat. As rootlets have a rather low protein level, the application of air classification might be needed to increase TVP quality (Cafiero, personal communication, 2022). This imposes an extra cost for Boortmalt, which will increase the price. However, as the situation is the same for wheat and pea, having to apply this process is more seen as competitive parity.

A competitive disadvantage for Boortmalt is the fact that rootlets contain gluten. Wheat also contains gluten and soy is a major allergen. Other protein sources like pea and fava beans don't contain gluten

and are not a major allergen. Therefore companies like Roquette are investing to make TVP out of pea and fava beans (Roquette, 2019a, 2022b).

Table 28: VRIO analysis to analyse Boortmalt's competitiveness in the TVP market.

	Valuable?	Rare?	Hard to imitate?	Organised around it?
Taste	X	X	X	Not yet (X)
Texture	X			
Product innovation capabilities	X			
By –product (circular economy)	X			
Independent of suppliers	X	X	X	X
Volume	X	X	X	X
Phytochemicals	X	X	X	Not yet (X)
Respected brand name	X			
Supply chain management capabilities	X			
Protein-content	X			
Allergenics				

13.2.3. Macro changes in the market by PESTEL

The market for plant-based meat alternatives today might look different tomorrow due to macro events happening around the world. It is important to look ahead, in order to be proactive for what might be coming. PESTEL is the framework that is used to assess the macro environment of the meat analogue market, in which Boortmalt would operate when it decides to produce texturized rootlet protein to be used for the production of meat alternatives. A clearer view on future changes related to political, economic, social, technological, environmental and legal aspects is proposed, and each of these aspects is discussed in more detail.

The market trend analysis made clear that there is shift towards plant-based products, mainly driven by social awareness around climate change and sustainability, ethics and health, with the latter been boosted by the COVID-19 pandemic. It is known that the supply chain of meat results in environmental challenges, because of the extensive energy, land and water use as well as the portion of GHG emissions that the industry emits. All of this puts an enormous pressure on the meat industry, while it causes the emergence of companies and start-ups trying to produce plant-based meat alternatives as well as cultured meat. This transition asks time, and is not only boosted by customer preferences.

The transition is also fostered by legal actions which are led by governmental bodies, and even the European commission. A particular example, which has been explained in more detail before, is the Flemish nitrogen decree. In the light of this regulation, the amount of livestock will be decreased, and consequently the amount of cattle feed needed will decline as well. This means that for Boortmalt, the future of pellets might be uncertain, and looking for another way to valorise the rootlets might be necessary. Moreover, if the amount of livestock decreases, less animals will be available for meat production which will also result in a decrease of meat consumption or thus an increase in demand for plant-based, protein-rich meat alternatives.

On the other hand, a decreasing amount of livestock means that less grassland will be needed for the animals as well. This free space can then be used to grow protein-rich crops such as pea, fava or other plant sources to be used to extract plant protein. Boortmalt has a good relationship with farmers who already grow such crops. They could take over those grasslands to provide Boortmalt with extra protein, besides the rootlets today.

However, it is not the nitrogen decree only that will cause change. Regulatory bodies could sail on the waves of change in customer preferences for plant-based diets, or at least, the reduction in meat consumption. It is not easy to just convince people to eat less meat, and Wirsenius et al. (2011), Edjabou and Smed (2013) as well as Säll and Gren (2015) each performed studies that discussed the possible effect of a GHG-taxation. In general, the concept is to put a tariff on meat products of which the price is determined by the level of GHG emissions emitted, expressed in carbon dioxide equivalents, to produce that particular type of meat. This proposal has been tested in Denmark, Sweden and in the EU-27, of which the results were promising. The consumption of red meat was reduced the most, knowing that this type of meat puts the most pressure on the environment (Opsomer, 2019). As these results only came from studies, it was interesting to check whether or not the European Union already has taken some initiatives in that direction. Information coming from the European coalition states that taxation would be a good solution to stimulate consumers to reduce meat consumption for health and environmental considerations. The taxation that the EU proposes would, in addition to a GHG burden, also take health overconsumption into account. Examples of tariffs would be for instance 50 eurocents per 100 grams of beef, veal or processed meat. For chicken, a tariff of 20 eurocents per 100 grams could be used, while for pork it would be 40 eurocents. The revenues coming from imposing these taxes could then be used to decrease the VAT on healthy foods such as vegetables, to compensate low income groups or to support farmers who take initiatives to improve sustainability or animal welfare. The prediction is that if all EU countries would install these type of meat taxes, meat consumption could be reduced with 50%, which in turn leads to a reduction of GHG emissions with 120 Mton per year. Moreover, this reduced consumption would also lead to a saving of 9 billion euros annually in public health (Remmers, 2021; True Animal Protein Price Coalition, 2021a).

However, as the outlook of these taxes is bright, reality shows that the tax is not yet installed in many countries. Only the UK and Spain currently have meat taxes, and Spain already increased the tax on meat in 2011 while decreasing the VAT with 4% on vegetables. Countries as New Zealand, Germany and Denmark have not yet installed the taxes, however, they announced to do so. The Netherlands for instance are considering the implementation and conducted already several studies about it. On the other hand, they are already actively declining the number of livestock for environmental reasons (True Animal Protein Price Coalition, 2021b). For Belgium in particular, no information has been found dealing about GHG-tariffs. A note that can be made here is that the effect and popularity of taxes is

country and culture dependent. Countries where meat is part of the culture, there might taxes have less impact (Hocquette et al., 2018).

This makes clear that the role of regulations can play a significant impact on climate change, and also on how the meat and plant-based industry will look like in the future. Although taxes do not seem to be implemented easily, several political supporting programs have been activated in recent years to support the shift from meat consumption towards meat alternatives. For Belgium specifically, Wallonia announced that it plans to use part of the EU subsidy to invest in the industry of plant-based proteins and meat alternatives with the goal to take up a 5% share of this European market (Hope, 2021). Furthermore, several types of grants have been given by the EU such as a two million grant for the 'Feed for Meat' project of the Dutch cultured meat pioneer Mosa Meat, given in October 2021. The goal was to use this money to improve the production process to lower costs. In July 2021, the European Commission paid part of a 10 million funding given to Gourmey, a French company producing cultured-poultry. One year earlier, in October 2020, another EU grant was given to advance the technology but also improve customer acceptance. This grant was received for the Meat4all cultured-meat project under the European Horizon 2020 R&D framework, led by BioTech Foods, a Spanish company (Proveg international, 2022).

Besides these subsidizing initiatives, also several advisory bodies have been founded. The European Alliance for Plant-based Foods (EAPF), which is an organisation that tries to accelerate the shift towards plant-based foods, is one example. They do it by providing incentives for sustainable farming, by allocating more funds for research and innovation, by trying to remove barriers to introduce plant-based products in the market, by establishing a framework for sustainable food labelling, by boosting transparency between producers and consumers, etc. (European Alliance for plant-based foods, 2022a)**.** Moreover, the EAPF is part of a global working group called International Plant-based Foods Working Group. This group consists in its turn of seven international plant-based food associations that cooperate and share expertise to accomplish their mission to support the trend of plant-based foods worldwide (European Alliance for plant-based foods, 2022b).

What is clear is that investments made by the EU are mainly focussed on research and innovation related to cultured meat, and not with plant-based meat alternatives, the market for which Boortmalt would produce TVP. There is a particular economical reason for this: cultured meat is expected to dominate the future meat market in the long run. This is because this type of product has the least environmental impact as it requires much less land and water compared to meat or meat alternatives. Another argument is that growing meat in a controlled way allows for tailor-made nutritional diets, and the possibility to answer all types of customer preferences.

To make it more concrete, Figure 22 can be consulted.

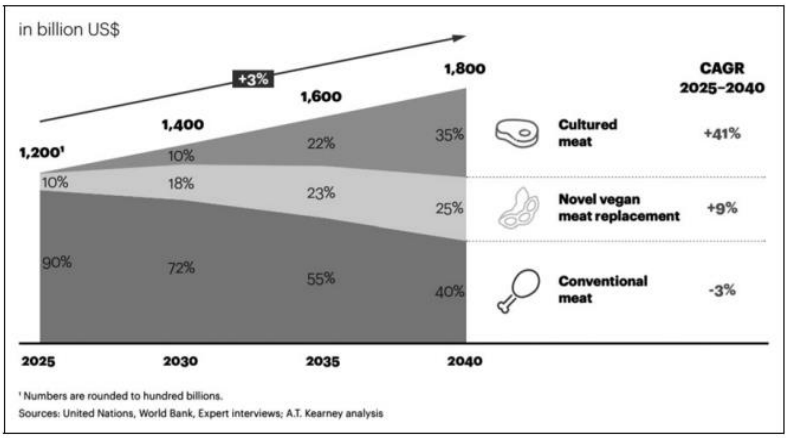


Figure 22: Evolution of market potential for cultured meat, novel vegan meat replacements and conventional meat (Gerhardt et al., 2020).

The cultured meat market has an expected CAGR of 41% from 2025 to 2040, and will become the most important meat-replacement product by 2040. It is expected that besides the advantages of cultured meat, people in Western countries are open for it, and even 50% of Western population indicated in surveys that they would buy it regularly. That the commercial potential, which includes addressable market share, expected growth and price competitiveness, for cultured meat is expected to be the highest, is shown in Figure 23 (Gerhardt et al., 2020).

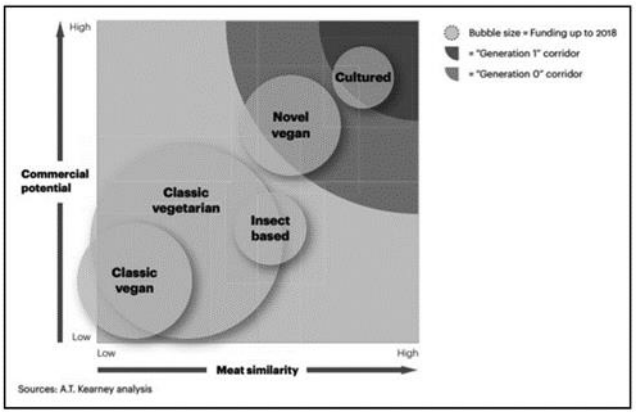


Figure 23:Commercial potential of different meat alternative product categories (Gerhardt et al., 2020).

The question is then what the role of the novel vegan meat replacement products in the future would be? These products are expected to build a bridge between the situation today, and the future where lab-grown meat will dominate. As the market for plant-based meat alternatives only is a fraction of the total meat market today, there is still significant room for these products to grow and take over a bigger part of the market (Gerhardt et al., 2020). Even when cultured meat would take up the highest market share, the market for plant-based meat replacements will continue to grow, although the growth rate will decline when cultured meat will dominate (Figure 22). This means that the plant-based meat alternative market has future potential, and that it is a profitable market. As such, it is an opportunity for Boortmalt to be part of this market by its TVP production.

Moreover, cultured meat is not commercial available yet, because of the high price. This is the result of many technical barriers that should be overcome first, and will be of prior focus (Gerhardt et al.,

2020). That price is a main barrier for spending money on sustainable food alternatives is shown by a European survey performed by the European Consumer Organisation in 2020 (The European Consumer Organisation, 2020). Results showed that in general, only 20% of consumers would spend more money, and in Belgium particularly, it would only be 12.4%. The problem holds not only for cultured meat, but also for other meat alternatives. The high price would be due to several reasons. First, plant-based meat and cultured meat companies do not have reached the same economies of scale as animal meat manufacturing companies do today. Second, some plant protein sources have to travel a long-way, such as pea protein, as these are at this moment only raised in a handful countries. Third, the demand for meat alternative products should also increase (Cohen, 2021). Well-known companies like Impossible Foods and Beyond Meat have done efforts to decrease the price (Axworthy, 2022). Price reduction of (plant-based) meat alternatives can also be established by the trend that bigger companies such as Cargill work together with start-ups, sharing thus their knowledge and scale advantages (Cohen, 2021).

13.2.4. A general overview by SWOT

SWOT stands for strengths, weaknesses, opportunities and threats and is in fact a summary of all frameworks that have been applied until here. Table 29 shows the SWOT analysis for Boortmalt based on the market trends, the model of Porter, the VRIO and PESTEL analyses. The SWOT analysis allows to make strategic recommendations. On the one hand, the analysis makes it easier to assess which strengths can help capture the opportunities or overcome threats. And on the other hand, it also allows to define if the weaknesses could hinder Boortmalt in capturing opportunities or could make the threats worse.

First, the strengths that can help to capture the opportunities or to overcome threats will be discussed.

One of the biggest strengths of Boortmalt is the fact that its TVP is made out of rootlets, a local by-product of the malting process. With its TVP, it is possible to make a high value added product out of a by-product which is the definition of circular economy and fits within the sustainability concept. Barley, the source of the rootlets, can also be made in a sustainable way with regenerative farming methods (Cafiero, personal communication, 2022). One of the main reason that customers are switching to plant-based proteins is sustainability. Boortmalt would have a competitive advantage if the company is able to market their product as sustainable.

Another competitive advantage is the potential lower price of meat alternatives made out of Boortmalt's TVP. Because the TVP will be made out of a by-product, Boortmalt will not have to buy the raw materials and will not have to pay for transport. As a result, Boortmalt could compete with the low price of TVP made from soy. The price of TVP made from soy is low because it is also made of a waste stream and the production of soy enjoys the benefits of economies of scale (Cafiero, personal communication, 2022). Lowering the price of meat alternatives could result in a higher customer base and could increase the switching cost for the customers.

The other two aspect that are unique of Boortmalt's TVP are the taste and the presence of phytochemicals(Koistinen et al., 2020). Because the TVP is made of a by-product of the malt process, the TVP has a characteristic malt-like taste. Because of the taste, Boortmalt should not focus on meat-analogue burgers but should make burgers with a malt-like taste. Most of Boortmalt competitors make TVP from soy, pea or wheat that does not result in a characteristic taste. Boortmalt could really differentiate itself from its competitors with its unique taste and potentially have a share of the market. Because of the taste, Boortmalt will have an unique product which could overcome the threat of the low switching cost for the customers. Although an important side mark should be made. The taste of the TVP is not yet optimised and further customer testing should be done to assess if the malt taste is appreciated by the customers. Moreover, Boortmalt should investigate how to reduce the bitterness of the rootlets to improve the taste of TVP (Zehnder, personal communication, 2022). Besides taste, the presence of phytochemicals could result in a competitive advantage as there is an increasing demand for healthy products but here again, Boortmalt will need to test if phytochemicals are present in their rootlets(Koistinen et al., 2020).

For the production of TVP, Boortmalt will collaborate with the Swiss start-up that have a lot of experience with the production of TVP. Currently there are not that many companies that produce TVP and there is no best TVP yet (Zehnder, personal communication, 2022). Boortmalt has the opportunity to become one of the best producer for TVP as the market is still in evolution. For TVP, Boortmalt will have to compete with companies that have more experience in the food industry but the Swiss start-up can already partially provide the learning curve. Another advantage of the collaboration with the

Swiss start-up is that it has the knowledge to also make other products besides plant-based meat alternatives out of the rootlets like recyclable dishes. Furthermore it also makes products with the dust, the other by-product of the malt process.

Another strength of Boortmalt is the fact that the company has in Antwerp only a total rootlets production of 12 960 tonnes/year. Furthermore Boortmalt can collect rootlets form its other facilities or buy other protein sources. Boortmalt has good relationships with their barley producing farmers (Cafiero, personal communication, 2022). As more grassland will become available due to the decreasing amount of livestock, the farmers could use this space to grow other protein-rich crops that can be delivered to Boortmalt. With its easy scale up, Boortmalt is able to fulfil the increasing demand for plant-based protein.

Secondly, the weaknesses are discussed that could hinder Boortmalt in capturing opportunities or could make the threats worse.

A weakness of Boortmalt is that it is currently not organised to jump into the food market as their core business is malt for beer and distilling. Most of the employees have knowledge about the beer market but less about the food market. The company will also have to find new customers which will slow down the speed to capture a part of the market. To enter the food market, Boortmalt is also dependent on the knowledge and expertise of the Swiss start-up. Other competitors like Roquette are very experienced in the plant-based protein market and can develop products faster and more efficient. Because Boortmalt is not organised to enter the food market and the dependency of the Swiss start-up, Boortmalt is not able to scale up as fast as its competitors. This is crucial in the market for plant-based proteins because it is considered as a transitional period until the cultured meat technology is established, which is expected to be the case by 2040.

A lot will depend on the taste and texture of Boortmalt's TVP. If the taste and texture is unique, it will be possible to overcome the weaknesses and to capture the opportunities. As a first step, Boortmalt will have to invest in product testing and collecting customer feedback to optimize the taste and texture of its TVP.

Table 29: SWOT analysis for Boortmalt and the plant-based meat alternatives market.

Strengths	Weaknesses
- **Differentiation**: Instead of striving for meat-analogue burgers, making TVP with unique malt flavour → link with their malt identity, which is until now core of Boortmalt (needs to be proven) - **Swiss start-up** with experience → have knowledge to improve the taste, texture, etc. - **Product valorization**: using rootlets, which are a by-product, to produce TVP for human consumption fits in the sustainability perspective of customers that for this reason want to reduce their meat intake - **Independent of suppliers** for the production of TVP: raw materials are	- **Rootlets** have **bitter taste** which results in bitter TVP - **No experience for Boortmalt in plant-based** protein, learning curve does not exist yet - Boortmalt enters new B2B market so has to **find new customers** - Boortmalt is **dependent** on the Swiss start-up on the technology for TVP production - **Not yet strong connection** with Swiss start-up but common point of joint venture - **Boortmalt not organised to step into food market,** especially around decision making - TVP from rootlets **contain gluten**

rootlets, which are by-product from Boortmalt's core activity being malting - if **Phytochemicals** are present could be added value - Good relationship with customers, Boortmalt has a **respected brand** in the b2b market. If Boortmalt launches TVP, it would play in the B2B market and could maybe count on their reputation as a reliable partner and respected brand (in further stage) but only reputation in beer market not food - TVP of Boortmalt will be made of **by-products** - **Quick access to lots of protein** - **Possibility to produce cheaper TVP** → cheaper because of low cost of raw materials - Barley can be **made in sustainable way** (regenerative farming method) - Boortmalt's rootlets **contain all essential aminoacids** - Good **relationship with farmers** of barley, wheat and other plants	
Opportunities	**Threats**
- **Consumer awareness** related to climate change, sustainability, health and animal welfare cause demand for plant-based alternative foods to rise - Negative pressure on the meat industry because of extensive land, water and energy usage as well as **GHG emissions** - Political: **nitrogen decree**, bright future related to GHG taxation - Livestock will decline, this makes more **grassland available** - Foundation of **advisory bodies** such as European Alliance for Plant-based Foods and International Plant-based Foods Working Group that try to boost the market for plant-based foods worldwide - **Rootlets as alternative for soy** → increase market share that can be captured - The market for plant-based meat alternatives is only a fraction of the meat market, and thus still has lots of **potential to grow**; profitable market (volume, CAGR, price show that) so although cultured meat will dominate, market will still grow	- Not sure of **customers like malt taste of TVP** - High **market price** for TVP plant-based meat alternatives - **Big names** specialized in plant-proteins and TVP production (eg. Cargill (Puris), Roquette etc.) → Boortmalt has to start building up the knowledge and might be too late - **Emergence of start-ups and companies** that start to produce plant-based meat alternatives - Lots of subsidies, but mainly focussing on cultured meat - **Cultured meat** is the long-term solution: this market has a CAGR of 41%. Advantages of cultured meat are related to the efficient resource usage, as well as the possibility for tailor-made diets - Meat replacement products that are not cultured meat are **part of a transition period until cultured meat is established**, which is expected to be the case by 2040.

- Still many **technical barriers to overcome for cultured meat production** - **Price of cultured meat is now too high** and is the main barrier for commercialization - **Not many companies** that produce TVP and there is **not the best TVP yet**, so opportunity to become one of the best is still there (market is in evolution) (texture and taste not there yet eg. soy not very good taste, wheat has no taste) - **Lots of alternative products possible** to make with the proteins present in the rootlets like fish feed, petfood, recyclable dishes, fermentation, etc.	

13.3. Customer value proposition

To have a better understanding what the customers pains are and how Boortmalt could solve these pains and/or create value for its customers, the customer value proposition is used. This framework is applied to the customers of Boortmalt so the B2B customers that would buy the TVP to make plant-based meat alternatives and to the B2C customers that would buy the plant-based meat alternatives that contain TVP from rootlets.

First, the framework is applied to the customer that buy plant-based meat alternatives (Figure 24). There are three reasons why people buy plant-based meat alternatives namely health, animal welfare and sustainability (Maningat et al., 2022).

Although there is a rising trend for eating more meat alternatives, there are still some problems related to these products. Currently, meat alternatives do not taste like meat and there is not a lot of variation in the taste. Also, the texture of meat alternatives does not resemble the texture of meat. Another pain point is that the price of meat alternatives is still higher compared to meat (Qin et al., 2022).

Like mentioned, sustainability and health are two of the main reasons why people switch from eating meat to eating plant-based meat alternatives but these are also the reason that meat alternatives are coming under pressure. Related to health, there is a growing concern that meat alternatives contain too many additives and that there does not exist a clean label. Besides, there is also not yet evidence that eating plant-based meat alternatives are beneficial for your health. Related to sustainability and health, soy is a common ingredient in meat alternatives that is mostly grown outside of Europe and can result in an allergenic reaction for some people (Qin et al., 2022; Samard et al., 2021).

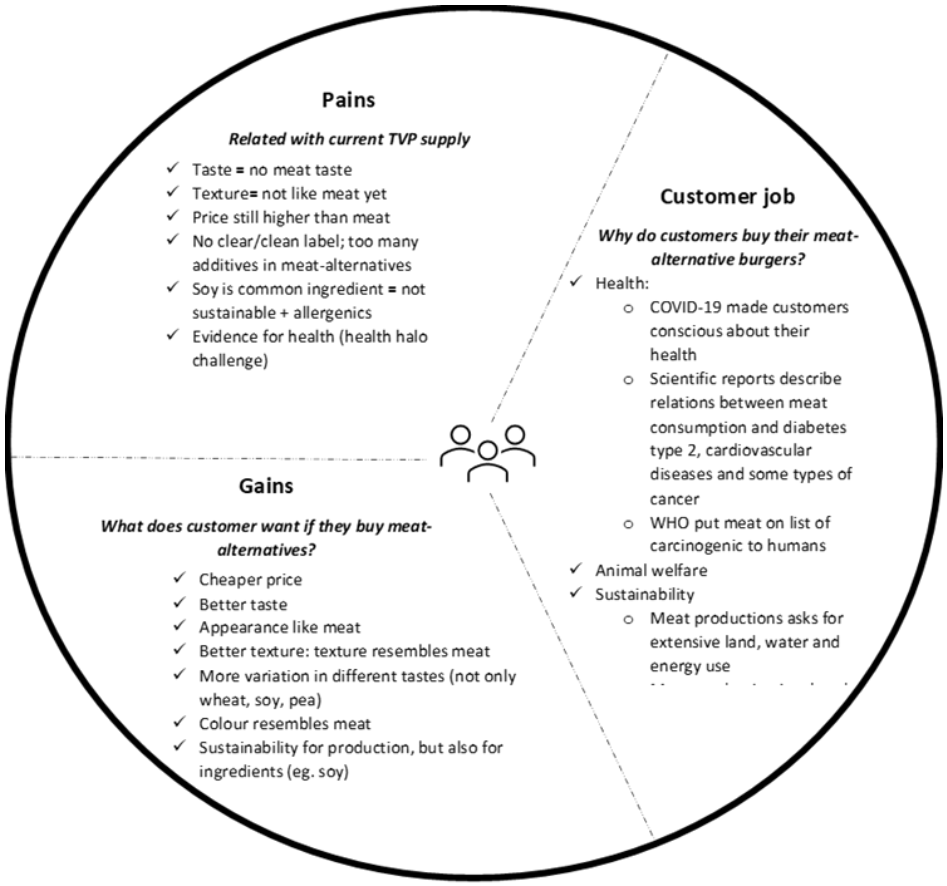
Boortmalt would make TVP out of its by-products from the core malting production, the rootlets. The TVP of Boortmalt can then be used to make plant-based meat alternatives. Because Boortmalt would use a local by-product of the barley grains to make TVP, the TVP from Boortmalt would be more sustainable compared to TVP that is made from protein sources like soy that are grown outside of Europe. Because the raw material to make TVP is a local by-product, Boortmalt has no raw material and transport costs and could lower the price of TVP that could result in a lower price for meat alternatives.

Another pain that can partially be solved with Boortmalt TVP, is that meat alternatives contain a lot of additives. Some of the additives are added to mimic the colour of meat. The colour of rootlets and so

also the colour of the meat alternative can be altered by roasting or drying the rootlets (Cafiero, personal communication, 2022). Therefore less additives need to be added in the formulation to make plant-based meat alternatives.

The meat alternatives that are made from Boortmalt's TVP would have an unique malt like taste. This taste does not resemble the meat taste but can become an unique selling proposition for Boortmalt as there are currently no other competitors that could provide TVP with an unique taste. However, the eventual taste of the meat alternatives is not only determined by the taste of TVP but also by the other ingredients that are added in the formulation and consumer testing will be needed to assess if the malt taste is really appreciated by the customers.

A last unexpected gain creator is the presence of phytochemicals in malt by-products that have a beneficial health effect (Koistinen et al., 2020).



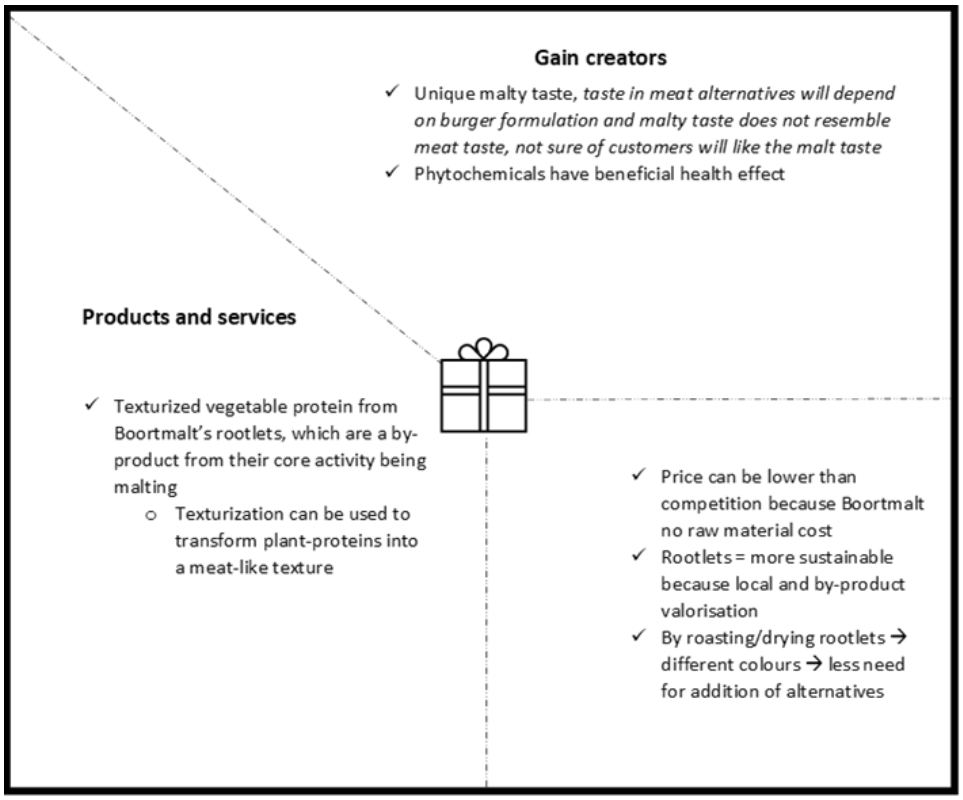


Figure 24: Customer value proposition for the plant-based meat alternatives customers (B2C).

After it is clear how Boortmalt can solve the pain and create gains with its TVP to the end customer, it is also important to focus on how Boortmalt's TVP can solve the pains for the producer of meat alternatives. That is why the customer value proposition is also applied to the direct customer of Boortmalt, the company that buys TVP to make plant-based meat alternatives (Figure 25).

Currently the texture of these plant-based meat alternatives is not yet optimized. TVP is the essential ingredient to resemble the structure of meat. A lot of companies are still experimenting with the technology to produce the best variant of TVP in order to resemble the meat texture.

Furthermore the taste of plant-based meat alternatives is also not yet optimized and can also be modified with TVP as this is one of the main ingredients. TVP made from soy and pea have a beany and hay like flavour which is hard to mask (Qin et al., 2022; Samard et al., 2021; van Tonder, 2018). TVP from wheat does not have this disadvantage as its taste is neutral but on the other hand it also not results in a distinct flavour for the meat alternative if TVP from wheat is used (Beneo, 2022). The taste of Boortmalt TVP also entails an extra challenge for the meat alternative producers. The rootlets have a bitter taste which also affects the taste of the produced TVP. This limits the dosage of TVP that burger producers can use in their burger formulation (Zehnder, 2022).

Another pain is that most TVP is made from soy. Soy is linked with allergenics and is not sustainable because soy is mostly grown in north and south America and needs to be imported. Specifically, 75% of all soy is imported in Europe (FEFAC, 2021b). Furthermore, soy coming from Brazil is not appreciated by Europeans as this soy mostly has a genetically modified organism (GMO) status.

TVP from Boortmalt has the malt like taste which is better than no taste like TVP from wheat or a bad taste like TVP from soy. TVP made from rootlets is sustainable as the rootlets are by-product and a local product. Furthermore it provides an alternative for TVP from soy and allows meat alternative

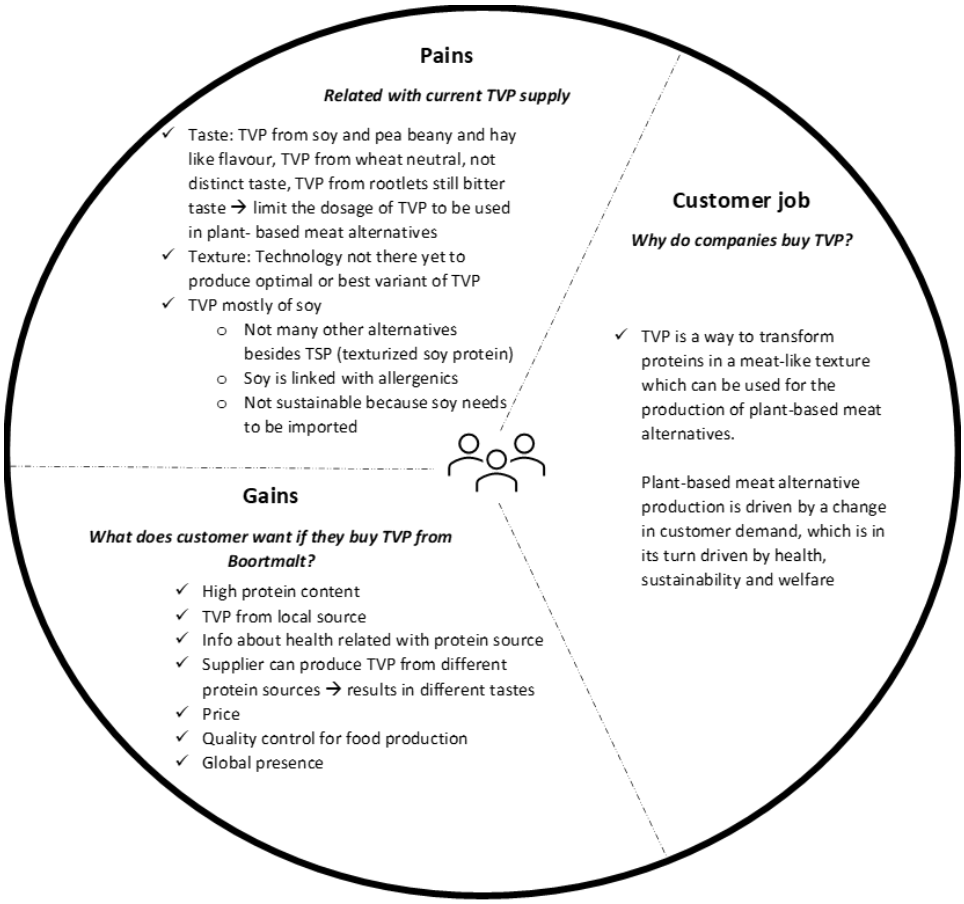
producers to not only experiment with adding additives for taste and texture but also using TVP from another protein source.

A gain creator is the fact that Boortmalt has easy access to huge volumes of protein rich rootlets. If Boortmalt customers want more TVP, Boortmalt has the capacity to easily scale up its production of TVP.

For the meat alternative producer it is important to have access to low cost TVP as currently the price of plant-based meat alternatives is too high. Boortmalt does not have a raw material cost besides the opportunity cost to not be able to produce pellets with the rootlets. This gives Boortmalt more flexibility in setting the price for its TVP.

Another gain creator is that Boortmalt can change the colour of its TVP due to roasting and/or drying (Zehnder, personal communication, 2022). This gives the meat alternative producer more flexibility and less ingredients will need to be added which will be appreciated by the end customer. Additionally, if the technology to produce TVP would be further optimized so that taste and texture can be improved, less processing will be needed to produce taste burgers with a good texture. This also reduces again the need for other products and ingredients to be added when making the burger which leads to a clean label. This is what customers appreciate.

Like mentioned before in the B2C perspective, the malt taste does not resemble the taste of meat. So if burgers are made with TVP from Boortmalt with a distinct malt taste, it is better to put these products in the market as malt burgers instead of meat alternatives burgers as the taste is not like meat and does not tackle this pain of the end customer. However by product testing, it needs to be assessed if customers like the malt taste.



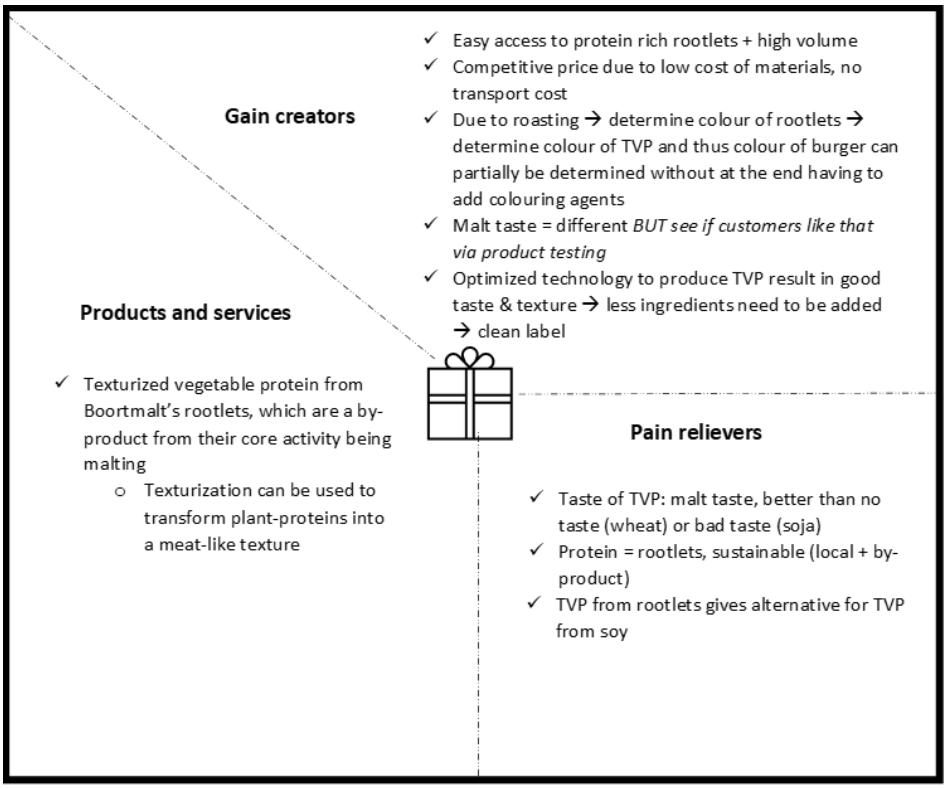


Figure 25: Customer value proposition for the plant-based meat alternatives producers (B2B).

13.4. Financial analysis

If Boortmalt would decide on jumping into the TVP market, the company would start a collaboration with the Swiss start-up company. The Swiss start-up has knowledge regarding the different technologies and machinery for TVP and plant-based burger production, and are currently doing R&D with Boortmalt's by-products. Moreover, they can also provide Boortmalt with a customer network. However, the collaboration is a long-term goal and how it might look like is not determined yet.

Boortmalt has the ambition to invest in an own TVP production plant in the future. When building its own plant, the Swiss start-up will provide a tailor-made production process for Boortmalt, where capacity is determined by Boortmalt's budget at the one hand but also by the amount of rootlets available at Boortmalt, and on the other hand the best TVP recipe, which is still under investigation at this moment. The product design is not there yet, which makes it difficult to make an estimation of the profitability of the TVP production process.

The Swiss start-up has some contacts with other TVP production plants as well as knowledge about the basic process design. As such, they gave us some numbers of the cost of each step in the TVP production when this would be outsourced. An overview of this process is shown in Figure 26.

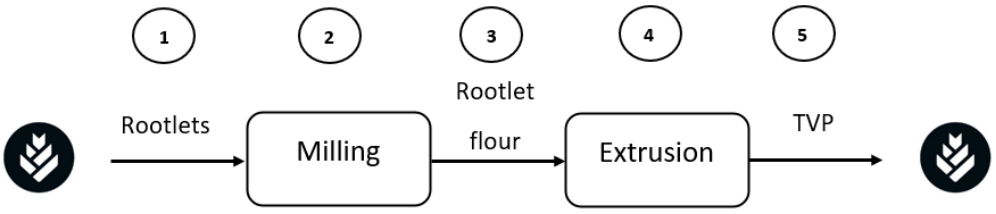


Figure 26: Overview of processing steps of rootlets when Boortmalt outsources the TVP production.

The rootlets will be transported to a milling facility. This comes with a transport cost of the rootlets (1), and the cost to mill the rootlets (2). Next, the milled rootlets, or the rootlet flour (3), has to be transported to an extrusion company (4) which add up costs. Finally, the TVP should be delivered back to Boortmalt, where it is stored. This is again a transport cost (5). Table 30 shows the exact numbers of the costs.

Table 30: Overview of costs related to outsourcing of TVP production.

Activity	Cost
(1) Transport rootlets to miller	70 €/ton
(2) Milling of rootlets	110 €/ton
(3) Transport of milled rootlets to extruder	70 €/ton
(4) Extrusion of rootlets to TVP	650 €/ton
(5) Transport of TVP to Boortmalt	210 €/ton
Total outsourcing cost	**1 110 €/ton**

The reason why the transport cost of TVP is three times that of (milled) rootlets is because the volume increases when rootlet protein is transformed to TVP. Therefore, more trucks are needed to transport the same amount of TVP compared to (milled) rootlets. When adding up all these costs, the total outsourcing cost amounts to 1110 euros per ton.

The selling price of TVP is 2,5 euros kg or thus 2500 euros per ton (Cafiero, personal communication, 2022). Based on this information, and together with all costs, a preliminary P&L can be made (Table 31).

Table 31: Profit and loss statement for Boortmalt when TVP production is outsourced.

Profit and loss statement Boortmalt Antwerp – TVP production in an outsourced configuration All numbers are expressed as euros per ton Fiscal year June 2020 - July 2021	
Revenues	**2 500,00 €**
TVP sales	2 500,00 €
Costs of outsourcing	**1 110, 00 €**
Operating income	**1 390,00 €**
Financial revenues	**0,00 €**
Financial expenses	**0,00 €**
Income before tax	**1 390,00 €**
Tax rate (25%)	**347,50 €**
Net income	**1 042,50 €**

The pre-tax income, expressed in euros per ton of TVP, amounts to 1 390,00. The operating margin for Boortmalt when outsourcing the TVP production would be 69,5%. Outsourcing the TVP production is a profitable process for Boortmalt. Optimizing the product design and increasing the production volume to reach economies of scale would decrease production costs and increase the margin in the future.

Part V – Discussion

Boortmalt is known as the biggest malting company in the world. Producing malt as ingredient for beer or whiskey is its core business. Malting results in several by-products being husks, small barley grains, broken malt grains and rootlets. Today, these are all mixed and transformed into pellets that are sold for making cow and pig feed. Pellet production is done by using roll presses, but these machines are old and fully depreciated. Before providing CAPEX to invest in new machines, Boortmalt wants to investigate if there is no other, more valuable way for its by-products to be valorised. More specifically, Boortmalt wants to find out if its malt by-products can be used in food applications for human consumption. If that would be the case, Boortmalt would diversify its business to secure the future of the company.

This project focussed specifically on the valorisation of the malt rootlets, and the expectation is that using these rootlets in applications for human consumption could create more value compared to the current pellet production.

Boortmalt contacted the consultancy company Shakup Factory for a first general market scouting to discover for which food applications rootlets can be used. One suggestion was to look into texturized vegetable protein (TVP), which can serve as an ingredient for plant-based meat alternatives. This company provided an overview of TVP and how it is produced, as well as why it is an interesting product by giving some general customer trends and market information. Although TVP is only one potential application for rootlet valorisation, it was chosen to investigate this market in more depth as Boortmalt was already in contact with a Swiss start-up that has experience and knowledge in TVP production.

The goal of this in-company project at Boortmalt was to dive deep into this texturized vegetable protein market as well as the market for vegan meat alternatives. The goal was to supplement the information received from the consultants with more in-depth data about the market. Moreover, an answer needed to be found on the question if this market would be a fit with Boortmalt or not. Next, the strategic potential and financial benefits for Boortmalt had to be compared with the current pellet production. To summarize, the objective of this ICP was to answer the following research question: *"*What creates more value for Boortmalt: using the malt rootlets in the pellet production for cattle feed, or to use these to produce texturized vegetable protein?"

14. Project part I – pellets

The Porter framework showed that the economic attractiveness of the feed ingredient market is rather average and in the future even low. The buyer power is average because compound feed producers cannot negotiate cheaper prices, but on the other hand can easily switch to other suppliers. The supplier power is low because there is no supplier when talking about by-products, which is a huge advantage compared to companies that need to buy raw materials for TVP production. The barriers to entry are average because on the one hand economies of scale are important but on the other hand there is a low customer switching cost and the quality of the pellets does not really matter compared to human food. Next, the threat of substitutes is high because almost everything can be used in cattle feed. Lastly, the intra-industry competition danger is average to high because the market growth is declining and in some areas there is even no growth anymore.

Looking into the future potential of the market, a decline has been predicted for the growth rate to a level of 1,7% for cow feed and –0,1% for pig feed by 2023 in Belgium. Also in the Netherlands, there is a decline in feed production. Worldwide, there is a growth rate of 4,82% from 2021 until 2028, mainly

caused by countries such as China and India due to the rising welfare. Looking into Europe, there was a decrease in feed production of –0,16% last year. The conclusion is that there could be potential export possibilities to China and India, but as sustainability is getting more important, this is unlikely to happen. Moreover, transport cost typically make up 15-25% of the final product price. Exporting pellets outside Europe would result in a sharp price increase for the pellets. Then, Boortmalt would not be able to keep its current low price which is advantageous for local sales in Belgium and the Netherlands.

Additionally, the BFA and the EU are stimulating the use of co-products in animal feed, which can lead to a mild decline instead of a strong decline in the demand for malt pellets. That is why, regardless the nitrogen decree and a menacing meat tax, the pellets of Boortmalt can still be produced for quite a long time.

In terms of competition, Boortmalt scores well on the key success factors in the feed ingredient market. In addition, the accurate filling of buyer orders and good communication can be seen as its competitive advantages, which also translate into a good pre-tax profit of 2 973 152,64 € for the fiscal year of June 2020 to July 2021.

Based on the economic attractiveness of the feed ingredient market and Boortmalt's competitive advantages, Boortmalt was positioned in the business opportunity matrix (Figure 27). In the future, the feed ingredient market will become less attractive which makes Boortmalt's position less attractive.

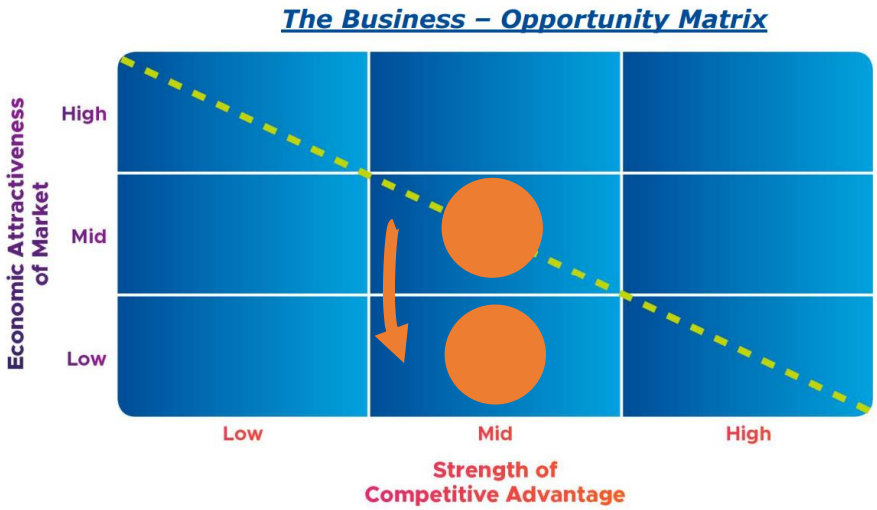


Figure 27:Business opportunity matrix for Boortmalt in the feed ingredient market.

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15. Project part II – Texturized vegetable protein

The current COVID-19 pandemic made people more aware about their health. This aspect, together with the increasing consciousness about climate change and sustainability and the attention for animal welfare all contribute to one trend: a reduction of meat intake that leads to an increase in demand for plant-based products. The meat industry is under pressure because of the negative health effects such as obesity and cancer, and because of the production that asks for extensive land, water and energy

use while animal agriculture emits 25-30% of all greenhouse gasses. However, the increase in population and income in developing countries will lead to an increase in demand for meat. It cannot be neglected that meat is a valuable source of high-quality protein so there is a big sustainability challenge here: how can the increasing demand for protein be answered by other products than meat that do not put that much pressure on the environment?

The answer is vegan plant-based meat alternatives, which are products that resemble meat but are made from plant proteins. The number of worldwide flexitarians is increasing, and they boost this market to have a CAGR of 15,9% from 2021 to 2025. However, plant proteins are not the same as animal proteins. There exists a technique, called texturization, to convert the structure of plant proteins in a chewy texture. This results in texturized vegetable protein, which then can be used in vegan plant-based meat alternatives as TVP mimics the structure of real meat.

Until today, TVP is mostly made from soy that is mainly produced in the US and Brazil, and thus has to travel far before it can be processed. This soy is also known to be GMO, which is not appreciated in the EU. Moreover, soy also contains allergenics and is known to have a less good taste after texturization. Besides soy, wheat and pea are also commonly used protein sources.

The trend and rising demand for plant-based meat alternatives is not only fed by these social and environmental considerations. Also legal and political factors support this trend. On the legal side, there is the nitrogen decree, also known as PAS, which will lead to a decrease in the amount of livestock over the years. This means that less animals will be available for meat production. Besides this decree, there is also the future possibility that a meat tax will be implemented. Studies have shown that such a GHG taxation reduces the meat consumption which is beneficial for the environment. Moreover, reduced meat intake also leads to substantial healthcare savings. On the political side, there is the emergence of advisory bodies such as the European alliance for plant-based foods and the International plant-based foods working group.

The PESTEL analysis revealed one economical aspect that sets a different light on this market: by 2040, it is expected that the meat market will be dominated by cultured meat. That this is a promising food product is also confirmed by the fact that the European Union is providing subsidies for R&D in this field. Although cultured meat might take up the biggest market volume and might slow down the growth of plant-based meat alternatives, the market for these meat analogues will still grow.

It is clear that there is a new big megatrend, being that of the plant-based proteins and plant-based meat alternatives. As TVP is a common used ingredient in these products, TVP production might be an interesting field for Boortmalt to dive into. However, the question is how attractive the market for TVP production is today? This is determined by the model of Porter that investigates and compares the amount of customers and suppliers, how the different TVP products resemble or differ from each other, what the industry barriers are as well as how fierce the competition is today. For the TVP market in particular, there are a lot of companies that jump in that meat alternative market making different types of burgers or other meat alternatives. This means that there is a lot of demand for TVP as well. On the supplier side however, there are only a few companies that start investing in TVP production. This results in the absence of many types of TVP in the market, which are mainly made out of soy, pea or wheat. All companies are currently searching for the best recipe to produce TVP and no company is the best yet. The intra-industry competition in the market is thus quite low, because of the similarity of TVP produced by only a few players, but also because of the fact that this industry is fast-growing. In terms of market entry barriers, it is not unsurmountable to enter the market. On the one hand, it is difficult to have access to distribution channels and to reach scale of economies which is important in

this industry. On the other hand, the barriers are lowered as it is easy to find capital for this growing market combined with the availability of techniques to produce TVP and the low switching costs between companies. To summarize, Porter's model shows that the market is medium to highly attractive.

The next important question that should be answered is if Boortmalt answers to all minimum requirements that are needed to play in the TVP market. These minimum requirements are also known as industry key success factors. Industry key success factors for the TVP market are a good technology to produce TVP with a good taste, texture and appearance, having product innovation capabilities, the ability to achieve scale economies as well as to capture an experience curve, having quality control know-how, a distribution network and supply chain management capabilities but also a respected brand name and the capability to perform clever advertisement. In total, Boortmalt scores average on the key success factors meaning the company has the resources and capabilities to play into the TVP market. However, the company can strengthen its ability to play in the markein the future t when it can establish a respected brand name and learns to advertise. If Boortmalt will sell TVP, it will play in the B2B market, just as is the case with the pellets today. No advertisement is done for the pellets, which means that Boortmalt will have to learn how to advertise in a B2B environment.

Scoring well on the key success factors is just enough to play in the TVP market, but in order for Boortmalt to perform well, it is better to have some competitive advantages. Assessing Boortmalt's competitive advantages has been done by comparing the company with its competitors in a VRIO analysis. The results of the VRIO showed that Boortmalt's competitive advantages would first be on the level of taste. TVP made from soy is linked with some taste issues, while TVP made from wheat does not really have a taste. Moreover, producers of meat alternative burgers often try to mimic the taste of meat, however, no real success has been booked up till now. Boortmalt would not aim to mimic meat taste, but would differentiate itself from the competition by making TVP that bring in the taste of malt. During the tasting meeting with the Swiss start-up that produced burgers with Boortmalt's TVP, it was clear that also the burgers had that malty taste. However, for the Swiss start-up, there is one big disadvantage being it the fact that the rootlets bring a bitter taste to the TVP. This makes it more difficult to create a good burger formulation, as too much malt TVP can result in a bitter burger. As such, Boortmalt only could distinguish itself from the competitors by providing malty TVP if the bitterness is tackled.

Second, Boortmalt is independent of suppliers for bringing in protein as raw material for TVP production, which is also beneficial as Boortmalt has direct access to lots of protein. This is because the rootlets are a by-product of the company's core activity being malting. Of course, when Boortmalt Antwerp could not answer customer's demand for TVP, rootlets might be imported from other Boortmalt plants abroad. Additionally, Boortmalt has good relationships with barley farmers. As the amount of livestock will decline, more grassland will become available that these farmers can use to produce protein-rich crops as protein source for Boortmalt's TVP production.

Third, researchers from the University of Eastern Finland discovered the presence of phytochemicals in rootlets from malted barley. Phytochemicals are said to have health-beneficial effects, which would thus answer the demand for healthy products of current customers.

However, there is a 'but' related to Boortmalt's competitive advantages. The taste and presence of phytochemicals would be the main points of differentiation, which Boortmalt could use as part of future marketing campaigns to sell its TVP. The problem is that there is no evidence that customers would like burgers with the malty taste of TVP. Product testing should thus be done first to confirm a

product-market fit. Second, also the presence of phytochemicals should be investigated for Boortmalt's rootlets before this aspect can be seen as a real point of advantage.

Before making the decision to use the rootlets for TVP instead of pellet production, the profitability of TVP production needs to be investigated. Boortmalt is currently in contact with a Swiss start-up with whom Boortmalt might start a collaboration in the future. The Swiss start-up has knowledge and experience with TVP production and are currently using Boortmalt's rootlets to produce TVP and meat alternatives. As the production process for TVP production at Boortmalt is not designed yet, no detailed financial calculations could be done. Boortmalt's TVP is expected to sell at a price of 2,50 euros per kilogram, or 2 500,00 euros per ton. The total cost of outsourcing is 1 110,00 euros and includes milling and extrusion costs to come to TVP as well as all transport costs from Boortmalt, between the different contract manufacturers and back to Boortmalt. As there would be no financial revenues nor expenses linked with this outsourcing setup, the income before tax would be 1 390,00 euros per ton of TVP sold, and is thus a profitable process.

When the results of the product testing are positive, and when the collaboration for this with the Swiss start-up went fluently, Boortmalt would probably invest in its own TVP production plant. This means that this profitability analysis will have to be reviewed, and an investment analysis will have to be made too. This was not possible during this project yet, as exact cost information is not known as long as the process design is not made.

To summarize the findings of the TVP market once more, a SWOT analysis has been performed. The conclusion is that if a product-fit of the malt-tasting burgers and the presence of the phytochemicals are confirmed, then Boortmalt could use these points to differentiate itself from the competition. The phytochemicals could then also answer the customer requirement of healthy products. As rootlets are by-products, this is also fits in the sustainability concept. Besides, as Boortmalt has direct access to this protein source, no import is needed compared to soy, which has to travel far. In terms of price, if rootlet TVP would indeed be sold at about 2,5 euros per kilograms, then it could be price-competitive with soy. Next, it would also be possible for Boortmalt to scale-up the TVP production rather quickly. Boortmalt itself has no experience with TVP production, and competitors like Roquette and Cargill are already working on TVP production for several years. This means that Boortmalt is lacking behind in building up its learning curve in this area. However, when Boortmalt can collaborate with the Swiss start-up this gap can be reduced as the Swiss start-up can share its knowledge and experience with Boortmalt in a partnership. Moreover, the competitors neither have found the best TVP recipe yet, so there is still a chance for Boortmalt to take advantage of this. Another positive aspect of the collaboration is that, if Boortmalt in the end would not really secure a good market share, the Swiss start-up is also investigating the possibility to produce other products than TVP with Boortmalt's by-products. An example is the production of no-flour bread made with protein and fibre. This could also enlarge Boortmalt's future potential in the food market.

Although Boortmalt has a good outlook in terms of jumping into the TVP market, there is an important note to make. The company is at this moment in the very beginning of considering to start with TVP production. There is a small team working on finding potential applications to valorise the malt by-products, but due to the hierarchical structure of the company, the decision making process is going rather slow. It means that Boortmalt is at this moment not yet organised to enter the TVP market nor to set up a collaboration with the Swiss start-up. Additionally, although the selling market for TVP is also B2B, TVP will not be a bulk business as is the case for pellets. There, Boortmalt will also have to tailor its business model. Next, as Boortmalt enters a new market, it will take time to build a new customer base and to transfer its reputation and credibility of being masters in what they do. Another

point is that the market for plant-based meat alternatives is already booming several years, and that competitors are already working with TVP in that same timeframe. Boortmalt has to build its experience from scratch, and is very dependent on the Swiss start-up. The plant-based meat alternative market is growing fast, which results in an increasing demand for TVP. If Boortmalt wants to capture value out of this market, it will have to jump fast before the market will grow less due to the disruption caused by cultured meat.

Looking at the business opportunity matrix in Figure 28, Boortmalt is positioned on the line where the economic market attractiveness economic market attractiveness is medium to high while the competitive advantage is medium in the short term. However, when the presence of phytochemicals and the market fit with the malt taste is confirmed, Boortmalt would improve its position.

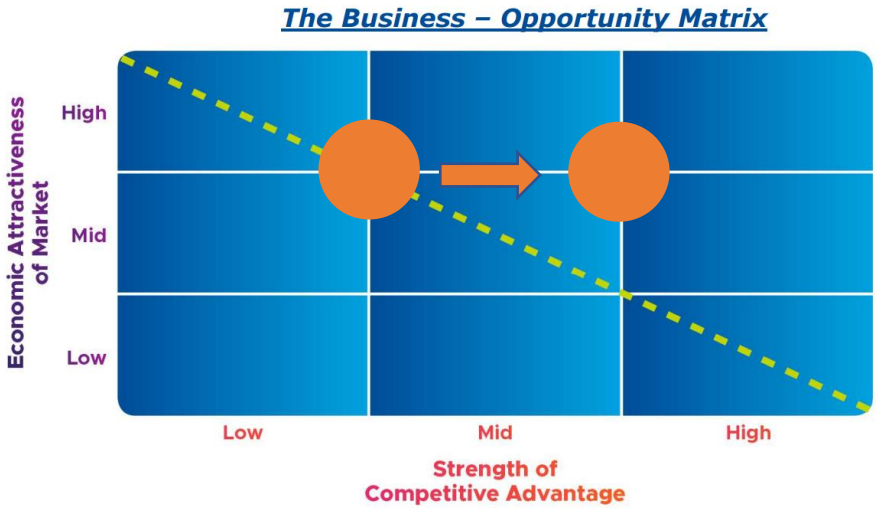

Figure 28: Business opportunity matrix for Boortmalt in the TVP market.

16. Comparison between pellets and TVP

The goal of the in-company project is to decide if Boortmalt should keep using the rootlets for pellet production, or if this by-product should be used for TVP production. To answer this question, the economic attractiveness, competitive landscape and future potential of both markets has been compared. This has been supplemented with a profitability analysis for both production processes. As such, both financial and strategic value are evaluated.

The market for TVP looks bright and the growing trend in demand for plant-based meat alternatives is fuelled by consumers, but also by legal and political actions. Boortmalt has the resources to dive into this market, and can create competitive advantage by the fact that it has quick access to a huge amount of protein. The malty taste of the TVP and the presence of phytochemicals should be investigated, by product testing and lab tests respectively. If the presence of phytochemicals in the rootlets would not be confirmed by research, Boortmalt would lose a competitive advantage, but as the competition in the market is not strong and as Boortmalt fulfils all market criteria that are needed to play in the TVP market, Boortmalt can still go with the TVP production. The most important job now to be done is getting evidence that customers like burgers with the taste of malty TVP. If customers are not liking the TVP, then Boortmalt and the Swiss-company should find a way to mask the malt flavour before going to the market. Of course, then Boortmalt is losing one of its most valuable competitive advantages and competing against other players like Roquette or Cargill might be much more difficult.

Also the profitability analysis linked with the production of TVP in an outsourced configuration showed a positive result. The net pre-tax profit per ton of TVP would be 1 390,00 euros. The operating margin as calculated was 69,5%. The operating margin for the pellets is 91,8%. However, these margins cannot really be compared with each other. The operating margin for the pellets is high due to cost advantages reached by economies of scales. Moreover, the costs for the pellet production are lower because the machines are old, and no depreciation costs are included in the operational expenses. The data for costs related to the TVP production process where informally received during a meeting with the Swiss company. No source for this has been received, and it is not clear what the costs actually entail regarding variable or fixed costs. As such, operating margin for TVP and pellets cannot be compared yet. When the product design for the TVP production process is made, a detailed P&L should be drafted to understand the product margin.

The market for plant-based meat alternatives will grow with a CAGR of 15,9% from now until 2025 worldwide, while the global market for compound feed will grow with a rate of 4,87% until 2088. However, looking at the global market for Boortmalt as sales market for its pellets might not be interesting, as Boortmalt will not sell its pellets too far away, as this would increase cost due to transport. The sales market for pellets consists of Belgium and the Netherlands, of which there is a decline in growth for cattle and pig feed. More specifically, the CAGR of cattle feed will decline from 1,8 to 1,7% in the next year while for pig feed, the market will decline with -0,1% in 2022-2023. This decline will be further stimulated in the coming years by legal actions such as the nitrogen decree that will result in a reduction of the livestock. The consequence will be a reduced demand for feed in general.

The age of the pelletisers, the negative market outlook for cattle feed, the rising trend of plant based products and the profit potential of TVP, makes that Boortmalt should decide on using the rootlets for TVP production instead of pellet production. One of the criteria when choosing a market was also sustainability. Both applications fit in the idea of circular economy, but reusing by-products for human

consumption is even more valuable. This would also allow Boortmalt to increase its product portfolio within the food market which increases strategic value for the company.

Boortmalt has contact with the Swiss start-up and is planning to set up a collaboration with them. This would be very advisable as it can bring in the knowledge and experience that is needed to produce TVP. However, the market for TVP and plant-based protein is rapidly evolving and Boortmalt will have to move fast if it wants to secure its position in the market. Product testing, setting up the collaboration and building an own facility will take time. The production volume of TVP will start small, and will be scaled-up over years. Until the moment that all rootlets are devoted to TVP, the rootlet surplus can still be used to produce pellets with the old machines. As such, the production of pellets can be used as a cash cow.

A last point that cannot be neglected is that if Boortmalt turns from pellets to TVP, current employees that are working on the pellet production and sales will lose their function. Via HR, care should be taken of this people and it should be checked if it is possible to train and transfer them to the new business unit where rootlets are valorised into TVP.

Part VI – Conclusion

Boortmalt is the masters of malt, but would like to play in food markets others than malt for beer and whiskey. Sustainability is at the core of the business, and therefore, Boortmalt wants to diversify its business by using malt by-products. This in-company project focused on one by-product specifically, being the malt rootlets, which are valuable due to its protein content. Today, the rootlets are mixed with other by-products such as small barley grains and husks into pellets for cattle feed.

After a first hint of a consultancy company to use the rootlets for valorisation into texturized vegetable protein as ingredient for plant-based meat alternatives, this market has been investigated in depth.

While the future of feed is more uncertain as the market growth is declining the amount of flexitarians across the world that boost the trend towards plant-based meat alternatives is increasing. More and more people choose to limit their meat intake due to health, ethical and sustainability considerations. While the global demand for meat is still rising due to increasing levels of development and income, plant-based proteins should replace animal proteins as these are putting too much pressure on the environment.

As the market for TVP production is attractive, and as Boortmalt fulfils all minimal requirement to play in this field, Boortmalt can start focussing on the food megatrend of plant-based proteins. However, the question of competitive advantage still needs to be answered. This should be done by first conducting product testing to know if malty TVP is appreciated by customer. The second aspect is the presence of phytochemicals which should be investigated, but if present, can answer the demand for healthier products than meat.

The main recommendation, besides the fact that the TVP market is potentially a more valuable market for Boortmalt, is that the company might not wait too long to jump into the market as it is rapidly evolving. This could create more strategic value for Boortmalt, as it could expand its market share in the food market besides beverages.

Part VII- Future steps

In this section, an action plan will be discussed for the pellets, TVP and how Boortmalt should scan the potential of other applications for its by-products.

For the pellets, only one client, Arvesta, was interviewed because of the limited response of the other customers that were contacted. Boortmalt should perform more interviews to know what the compound feed producers will desire in the future to tackle the declining demand for feed and how Boortmalt can help with this. As such, the customer value proposition canvas can be filled in more accuratly. Furthermore, if Boortmalt wants to remain an important supplier of feed in a declining feed market, it is important that the company plays out the fact that its pellets are made of by-products which fits in the sustainability concept.

Boortmalt already produces pellets for a long time, as the feed industry is an established industry. The pelletisers are old and need regular maintenance to keep on running. On a certain moment, Boortmalt should make an investment analysis where the cost of buying new machines is compared with the situation where the maintenance cost increases and a potential shutdown results in a loss of revenues.

Also, one of the limitations of our research was the fact that it was difficult to obtain numbers and processes of the competitors in the pellet market. That is why information in the VRIO analysis was largely based on internal information from Boortmalt itself and assumptions. In order to make a more thorough competitive and market analysis, certain industry reports[16] should be bought.

If Boortmalt eventually decides to step out of the pellet business, the company will need to consider the human aspect and discuss how to rearrange functions.

For TVP, whether Boortmalt succeeds in capturing a share of the market will depend on the taste. Currently in this research, it is assumed that the malt taste will be the unique selling proposition of Boortmalt's TVP. In order to overcome this insecurity, product testing needs to be done to assess if the malt taste is appreciated by potential customers and could result in a competitive advantage for Boortmalt. Because of the collaboration with the Swiss start-up, product testing can be done quickly. Boortmalt could work together to produce a first product without a brand name and collect feedback of potential customers. Afterwards, the product can be adjusted and more customer testing can be performed. In this way, the company is able to optimise its product.

Another potential unique product characteristic is the presence of phytochemicals in malt by-products that would have a beneficial health effect. Boortmalt will need to test if phytochemicals are also present in its by-products. The beneficial health effect could become very important as people are becoming more skeptical about the health of highly processed food like plant-based meat alternatives. In the Health Halo challenge, people want to have evidence for the general statement that plant-based meat alternatives are healthier than meat.

Boortmalt's TVP will be made from a local by-product, the rootlets. Boortmalt will have to use the opportunity of the rising sustainability awareness to market its TVP. Furthermore, the malt taste and presence of phytochemicals should also be used in the marketing after the necessary tests are performed and led to a positive result.

[16] Such as the report of the Allied Market Research on Cattle Feed Market by Cattle Type (Beef and Dairy) and Distribution Channel: Global Opportunity Analysis and Industry Forecast 2021-2027 on the following website: https://www.alliedmarketresearch.com/cattle-feed-market-A09494

Also some further steps need to be taken to improve the applied frameworks. The customer value proposition was conducted for the B2B and B2C perspective based on literature market research. Extensive interviews will need to be conducted to really understand the customer job, the pains and the gains of the buyers and producers of plant-based meat alternatives. Because of the limited time, the interviews could not take place. The competitive advantage of Boortmalt was assessed by applying the VRIO framework. For this framework, competitors needed to be analysed. The analysis of the competitors was performed by literature research and by scanning the websites. To gain more insight information, connections with people active in the TVP industry will be very useful.

Some last future steps for Boortmalt's TVP are related to the financials. The financials for TVP are based on the initial phase where Boortmalt would outsource its production. After Boortmalt succeeds in optimizing its product, the company could invest in its own machines to produce the TVP. The financial analysis for this situation will need to be performed again and should be conducted in the same way as the financial analysis of the pellets has been made. For each step in the process, the costs related to electricity, labor, water, maintenance, ingredients, etc. will need to be assessed. Additionally, an investment analysis should be made to assess if it is profitable for Boortmalt to buy its own machinery or not.

Boortmalt can use our methodology to perform a market analysis for the other potential applications in which rootlets can be used like for example pet food, fish feed, fermentation, etc. After the market analysis is performed, Boortmalt should invest in searching reliable partners. The knowledge and expertise of these partners, will partially determine if Boortmalt is able to successfully enter a new market. Furthermore, a financial and investment analysis must be made to assess the profitability of the new application.

A last consideration for Boortmalt is to allocate more people in the scanning of new applications for Boortmalt's by-products. When frameworks are applied to new markets, it is important to take into account multiple perspectives and to have a discussion. Besides, a team is also needed to speed up the process as it is crucial to step fast into a new market in order to capture the full potential of this market.

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Part IX – Appendix

17. Written out interview with Louise Lecomte from Arvesta

Legend

S = Students

L = Louise Lecomte

Interview

S: First of all, thank you very much for your time to do this interview. We are 3 students from Vlerick Business School and we are currently working on a market analysis project for Boortmalt. They produce pellets for cattle feed and we want to understand the future potential of this market. Therefore, we need of course the voice of the customer so thank you for willing to answer our questions during this interview.

S: Can we ask you what is your function within Arvesta?

L: Of course, I am responsible for buying the raw materials for compound feed that Arvesta is producing. I am already working here for 8 years.

S: Do you know how long Arvesta has been client of Boortmalt?

L: I actually have no idea, it is anyway longer than I work here.

S: How did Arvesta got into contact with Boortmalt?

L: This happened through the broker Derigran. This is the result of years of relations. Derigran does a lot of the marketing and sales of malt for Boortmalt.

S: What is important for you when buying cattle feed?

L: The quality is always very important, those from Boortmalt are good. Also the delivery certainty, making good appointments that can be fulfilled, is important for us, as our machines are running the whole time, there needs to be input the whole time. Last but not least, price is of course also important for us.

S: Why do you buy from Boortmalt?

L: We always buy what is available on the market. Let's say that if Boortmalt says tomorrow that they can't deliver, then we look for something elese. We are always looking for diversification on the level of suppliers in order to guarantee continuous delivery. The fact that we can trust Boortmalt in delivering, makes it a good supplier.

S: Did it already happen that there were no pellets available?

L: It happened recently, it can always happen one time. But from Boortmalt Antwerp, communication about this happens correctly. But of course, a cancelled delivery has a direct impact on us.

S: Are you satisfied with the services of Boortmalt? If not, what could improve?

L: The price compared to other raw materials is good, there are no big disadvantages of the product itself, so we are satisfied.

S: What do you think of the location?

L: It is a good location, we don't have any complaints about it.

S: Now about the quality of the pellets, do you ever ask for specifications, do you follow up on the content of the cattle feed?

L: Yes because this is legally mandatory, on the basis of the GMP and we regularly do analyses on that.

S: Then, in comparison with other competitors, what is the biggest difference between the pellets of Boortmalt and the competitors?

L: Well, there is a lot of grains, a lot of protein sources (such as sunflower, rapeseed meal), fibres and everything of by-products in the industry (among which malt rootlets, but there are not many big malt rootlets suppliers). Boortmalt is one of the best, from the biggest class. If the malt pellets are not available, well the end price will vary, but we will just reformulate. It is not for the protein that malt rootlets are chosen for. Raw materials we can't live without are grains, protein sources such as soy meal, sunflower seed scrap, but malt rootlets are not in this category). Protein is used to stimulate milk and meat production.

S: How many tonnes per year do you buy from Boortmalt?

L: On month basis, 210 tonnes, this is the fixed amount, but often we buy more if we have a peak production because in the plants we can get away with it easily.

S: For what animals are those volumes then used?

L: We do linear programming on the basis of price and quality and then we can see to which animals it can go. But mostly, it goes to cows and pigs. Malt rootlets contain quite some protein and poultry does not really need that. Every animal has its own needs.

S: Are the pellets from Boortmalt sometimes directly sold to farmers?

L: No, pellets are not many times directly sold, it will be almost always mixed with other things.

S: Last but not least question: The meat market is under pressure. If you keep that in mind, together with the nitrogen decree, do you think the amount of cattle, and thus the amount of cattle feed needed in the future will decline? Why (not)?

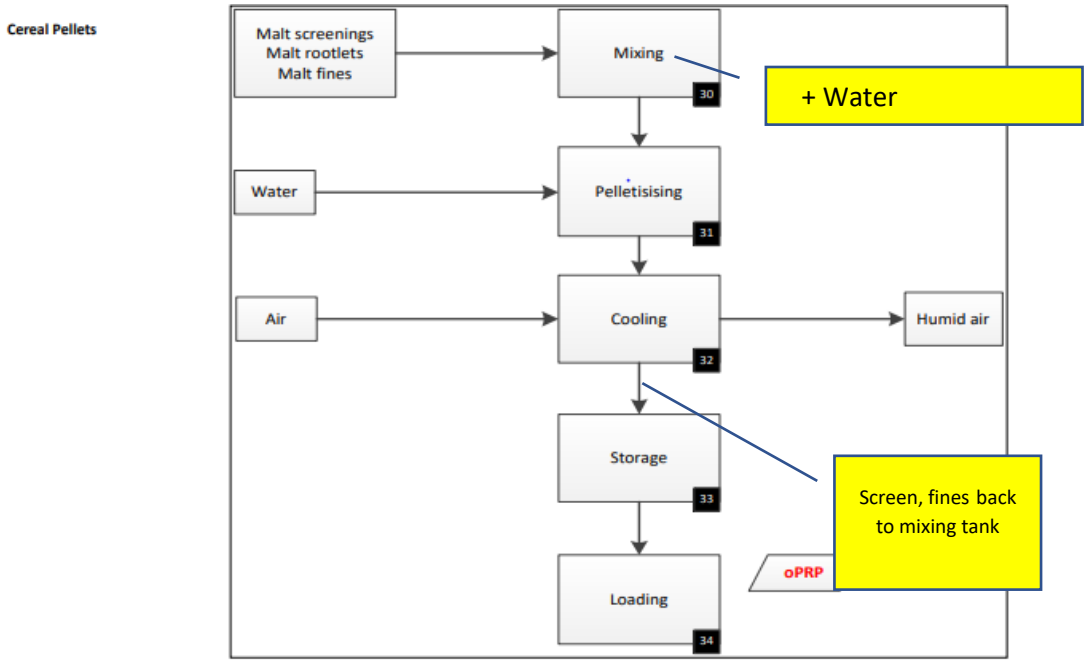
L: The Netherlands is already far more advanced in that than Belgium. Arvesta takes this into account, but it is not yet legally binding in Belgium. But that will come for sure. The nitrogen decree is under pressure. Netherlands is a frontrunner, so we will have to follow. Sustainability will probably translate into more ships and less trucks. On the other hand, in certain product categories, you can also buy sustainable raw materials, more local, a bit the direction of Boortmalt, which is already pretty local. On the short or long term, there will be less meat. The impact we can feel it already today. There will be a mandatory reduction of livestock with 20% or more. So are there plans to find alternatives? Yes. The Belgian compound feed industry is split up. So I think there will be more acquisitions, but also companies that will have to stop. You also have to be competitive, there is a harsh competitive battle. Within Arvesta, we have certain visions to guarantee the future of the company.

18. Questions and answers pellets

The goal is to make a P&L to get an overview of the level of profitability of converting byproducts to pellets for animal feed.

In order to come to our P&L we need information about the revenues and the cost streams. In this document we provide an extensive list of all the information needed to get insights in the profitability of the byproducts.

From Christophe Lemmens we received the flow chart of the pelletising process.



Revenues:

volume of pellets (22840 ton july 20 -june 2021) x average price (This information was already given by Gianluigi)

- Average price
  - Now: 200 euro/ton (exclusive work)
  - 18 months ago: 150-180 euro/ton
  - Is it possible to provide us a range/fluctuation of the selling price of the pellets? Asked to commercial team, separated file will be send

Costs

Transport of all the byproducts to the mixing machine (number 30 in product flow chart):

1) Electricity (transport of byproducts to pelletisers?) 133 kw installed (75%used) or 100 kWh every hr
2) How did the transport work (pneumatic transport, mechanic?) Mechanic, screws, elevator

Mix machine

3) Electricity (euro/Kwh, how much kwh, amount of activity (time)) 23 kW installed (75%used) or 17.25 kWh/hr
4) Depreciation of the mixing machine 30 years old…

5) Labor costs
    - Hourly wage of employees 18 €/Hrs
    - How many time do your employees spend on this, to check the machine or perform manual actions?
      0 hrs
6) Maintenance costs
    - how many hours do your maintenance people spend on the maintenance of this machine 40 hrs/year
    - what is the wage of the people that do the maintenance? 22 €/hrs
    - other cost like the components to keep the machine running? 1000 €/year
    - Is the maintenance performed by an external company? internal
    - How many times a year and what is the duration of a maintenance break? 2/year, full day

Pelletiser

7) Water
    - How much water do you add? 7 m^3/hrs
    - What is the cost of this water? 0.9 €/m^3
8) Electricity of pelletisers
    - euro/kwh 65 €/mWh
    - how much kwh 2 x 110 kW installed, 190 kWh (beide machines samen)
    - amount of activity (time)) 6000 hrs/year
9) Labor costs of pelletisers
    - Hourly wage of employees 18 hrs/hr
    - How many time do your employees spend on this, to check the machine or perform manual actions?
      Every 24 hrs : 30 min greasing + 1 hrs small tasks
10) Maintenance cost
    - how many hours do your maintenance people spend on the maintenance of this machine 40 hrs/month
    - what is the wage of the people that do the maintenance? 22 €/hrs
    - other cost like the components to keep the machine running? 22.000 €/year
    - Is the maintenance performed by an external company? internal
    - How many times a year and what is the duration of a maintenance break? 1 time/week 5 hrs (2 people)
11) Depreciation costs of the pelletising machines ?
12) Capacity of the two pelletising machines
    - Are both pelletising machines constantly running yes
    - If not, can you provide us the productive time
    - Capacity: flow (how much pellets are produced each hour) +/- 3.7 ton/hrs/2 machines

Transport after pelletiser, 10 kWh every hr

Other costs

13) Labor cost of cleaning the spilled pellets and rootlets
    - Hourly wage of employees 16 €/hrs
    - How many time do your employees spend on this? 1 hr/ working day

Other information

14) Can you give us an overview of all the byproducts that come together in the mixing machine? (volume of each byproduct?) no
15) Do you use all the byproducts in the pelletising process? Gianluigi told us that pellets consist of 55-60 % of rootlets and 45 -40% of dusting. So is it the case that you process all the rootlets and then add dusting so that the pellets are a mix of 55-60% rootlets and 45-40% dusting? If not all byproduct are used. What is then the waste cost of not used byproducts and spilled pellets? All goes to pellets
16) Transport cost of the pellets to client also cost for Boortmalt? Cost clients
17) Storage of pellets
    - Do you store the pellets? 3 vertical bins of 60/30/30 ton and vertical storage 1000 ton
    - How long can you store the pellets? Dry for years
    - What is the cost of storage? (holding cost) no cost
    - Pellet demand (seasonal?, volume?) More in winter, see separate mail
18) Who are the clients that you sell your pellets to? Animal feed production, they mill our pellets to blend with other products to reproduce pellets
19) To compare with malt: what is the current selling price of malt? Today more than 700€/ton

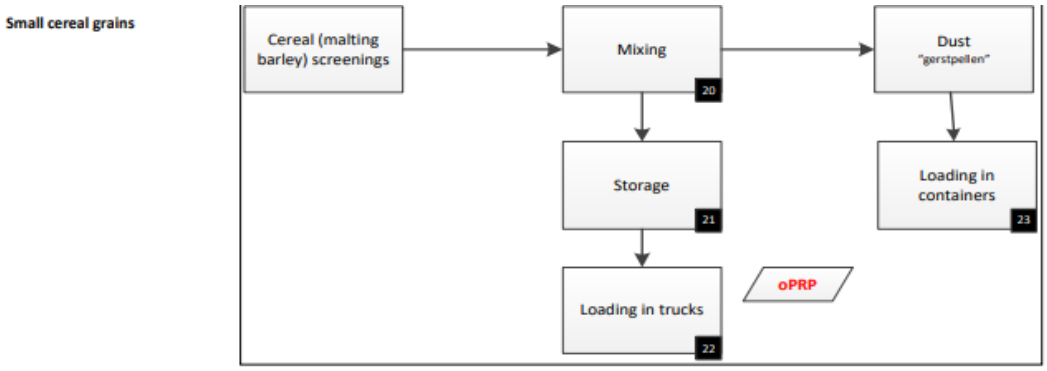
In the document of Christophe Lemmens, we also received the flow chart of small cereal grains. What is this exactly? Is this the process where you mil the barley grains to dust to make malt flour or is this another process?

Not clear for me, from the barley cleaning we have:

- good barley, to our maltings

- small barley, sold as animal feed (trucks)

- dust, loaded direct in containers and sold as dust



19. **Lab analysis food-gradeability rootlets**

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VAT N°/Fiscal Code: 01649590203

Test Report n°:
22/6258 Rev.0

A1-MQ-SEZ.5.10 Ed. 1 Rev 3

Company:	Reference: **Gianluigi Cafiero**
Farm/Client:	**BOORTMALT NV-SA Antwerpen**
Sample:	**Barley rootlets 14/04/2022**
Date received:	**02/05/2022** Start date: **02/05/2022** End date: **18/05/2022**
Sample N.°:	**6258/1** Sampled by: **by the customer**

PARAMETER	METHOD	As is Basis	Dry Basis	Units
MOISTURE:	105°C, Reg. CE 152/2009	**5,66**		% (g/100g)
DRY MATTER:	By calc (100-Moisture)	**94,34**		% (g/100g)
AMIDO Enzimatico esclusi D-glucosio e Maltodestrine	AOAC 996.11 Enz. Megazyme K-TSTA p.to (e)	**5,80**	**6,15**	
Aflatoxin B1:	Fluorescence IAC: B1 rev 3 2006	**< 0,5 (LoQ)**		ppb (mcg/kg)
DEOXYNIVALENOL:	E.L.I.S.A. + column for complex matrices: DON Rev 1: 2008	**< 40 (LoQ)**		ppb (mcg/kg)
ZEARALENONE:	E.L.I.S.A. + column for complex matrices: ZEA Rev. 2: 2011	**< 25 (LoQ)**		ppb (mcg/kg)
FUMONISINS (B1, B2, B3):	E.L.I.S.A.: FUM Rev 0:2013	**<250 (LoQ)**		ppb (mcg/kg)
MOLD:	Dilution and seeding	**9000**		UFC/g
YEAST:	Dilution and seeding	**45000**		UFC/g
Calcium (Ca):	X-Ray Fluorescence (XRF)	**0,318**	**0,337**	% (g/100g)
Chlorine (Cl):	X-Ray Fluorescence (XRF)	**0,363**	**0,385**	% (g/100g)
Potassium (K):	X-Ray Fluorescence (XRF)	**1,642**	**1,741**	% (g/100g)
Magnesium (Mg):	X-Ray Fluorescence (XRF)	**0,158**	**0,167**	% (g/100g)
Sodium (Na):	X-Ray Fluorescence (XRF)	**0,016**	**0,017**	% (g/100g)
Sulfur (S):	X-Ray Fluorescence (XRF)	**0,380**	**0,403**	% (g/100g)
Phosphorus (P):	X-Ray Fluorescence (XRF)	**0,648**	**0,687**	% (g/100g)
Iron (Fe):	X-Ray Fluorescence (XRF)	**120,6**	**127,8**	ppm (mg/kg)
Copper (Cu):	X-Ray Fluorescence (XRF)	**13,2**	**14,0**	ppm (mg/kg)
Zinc (Zn):	X-Ray Fluorescence (XRF)	**110,7**	**117,3**	ppm (mg/kg)
Manganese (Mn):	X-Ray Fluorescence (XRF)	**86,9**	**92,1**	ppm (mg/kg)
Silicon (Si)	X-Ray Fluorescence (XRF)	**1,75**	**1,85**	% (g/100g)
DCAD (Ender 1971):	By calc (Na+K)-(Cl+S); Ender et al. 1971		**9,26**	m. eq/100g
Calcolo ENERGIA	Calcolo con formule INRA: vedi note rapporto.	**4515,00 Lorda**	**4786,11**	Kcal/kg
Salmonella:	ISO 6579-1:2017	**Assente**		n° in 25 g
ESCHERICHIA COLI beta-glucuronidasi positiva	UNI ISO 16649-2:2010	**630**		UFC/g
Vitamin A	Subcontracting Laboratory Method (E)	**<2000 (LoQ)**		U.I./kg
Vitamin E (as DL-alpha-tocopherol acetate)	Subcontracting Laboratory Method (E)	**11,1 u=6,7**		ppm (mg/kg)
TRIPTOFANO	Metodo del laboratorio in subappalto (E)	**0,186 u=0,021**		% (g/100g)
ACIDO FITICO	Metodo del Laboratorio in sub-appalto (E)	**<0,1 (LoQ) (*)**		ppm (mg/kg)
SELENIO:	Met. del Laboratorio in subappalto (E)	**0,049 u=0,011**		ppm (mg/kg)

LABORATORIO ANALISI ZOOTECNICHE
di Mancinelli Dr Eugenio e Dr Marco s.a.s.
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Tel. 0376.528295 - Fax 0376.528362
e-mail: info@lazoovet.it | www.lazoovet.it
VAT N°/Fiscal Code: 01649590203

Company:		Reference: **Gianluigi Cafiero**	
Farm/Client:	**BOORTMALT NV-SA Antwerpen**		
Sample:	**Barley rootlets 14/04/2022**		
Date received:	**02/05/2022**	Start date: **02/05/2022**	End date: **18/05/2022**
Sample N.°:	**6258/1**		Sampled by: **by the customer**

L'esecuzione delle analisi di Triptofano, Selenio, Vitamine A ed E sonostate commissionate al Lab. CHELAB - MERIEUX Nutriscience di Resana(TV), accreditato ACCREDIA n° 51.

L'incertezza di misura **(u)** è stata calcolata con un fattore di copertura k=2 corrispondente ad un livello di probabilità di circa il 95% o come intervallo di confidenza calcolato ad un livello di probabilità di circa il 95% .
LoD: limite di rilevabilità, individua un intervallo di confidenza dello zero ad un livello di probabilità del 99%. LoQ: limite di quantificazione. Non Rilevabile: indica un valore inferiore al LoD. Tracce: indica un valore compreso tra LoD e LoQ.

L'esecuzione delle analisi di Salmonella E. Coli ed Acido Fiticosono state commissionate al Laboratorio al Laboratorio Gamma di Cavriago (RE), accreditato ACCREDIA n° 1028.
(*) LoQ espresso in Fosforo Fitinico corrisponde ad <0,01295 ppm
Il Rapporto di Prova dei rispettivi laboratori in Subappalto relativi ai risultati ottenuti sul campione a noi consegnato, rimangono a disposizione presso il LABORATORIO ANALISI ZOOTECNICHE sas per un periodo di almeno 10 anni dall'emissione.

Gonzaga,18/05/2022

The Area Manager
The Technical Management
Dr Eugenio Mancinelli

20. Calculation P&L pellets

Profit and loss statement pellet production Boortmalt for 1 year

Revenues	**3 240 000,00 €**
Pellet sales	3 240 000,00 €
Cost of goods sold	**216 847,36 €**
Raw materials	- €
Transport of all byproducts to mixing machine	39 000,00 €
Mixing machine	9 047,50 €
Pelletizers	144 779,86 €
Cooling unit	7 020,00 €
Storage pellets	17 000,00 €
Gross income	**3 023 152,64 €**
Operating expenses	**50 000,00 €**
Depreciation of transport system	- €
Depreciation of mixing machine	- €
Depreciation of pelletiser	- €
Depreciation of cooling unit	- €
Depreciation of silo's	- €
Sales & management	50 000,00 €
Operating income	**2 973 152,64 €**
Financial revenues	- €
Financial expenses	- €
Income before tax	**2 973 152,64 €**
Tax rate (25%)	**743 288,16 €**
Net income	**2 229 864,48 €**

Source: Belgium - Corporate - Taxes on corporate income (pwc.com)

General information

Revenues	**3 240 000,00 €**	**/year**	
Volume	1800,00	ton/montl	average value
Volume per year	21600,00	ton/year	
Price/volume (€/ton)	150,00 €		18 months ago: 150-180 euro/ton (sensitivity) --> 120-300 and possibly higher in the future

Cost of goods sold	**- €**	**/year**	https://learn.financestrategists.com/explanation/cost-accounting/by-products/
1. Raw materials	**- €**	**/year**	
Raw material: Dusting	- €		
Raw material: Rootlets	- €		
2. Transport of all byproducts to mixing machines	**39 000,00 €**	**/year**	
Total Electricity usage	100,00	kwh/h	
Total productive time	6000,00	hrs/year	
Cost of electricity	0,07 €	/kWh	65 €/Mwh
Total electricity cost	39 000,00 €	/year	
3. Mixing machine	**9 047,50 €**	**/year**	
Electricity cost	**6 727,50 €**	**/year**	
Total Electricity usage	17,25	kwh/h	
Total productive time	6000,00	hrs/year	
Cost of electricity	0,07 €	/kWh	65 €/Mwh
Total electricity cost	6 727,50 €	/year	
Labour costs	**- €**	**/year**	
Hourly wages of employee	27,00 €	/hr	18 €/hr x 1,5 to calculate cost for employer
Hours	- €		
Total cost	- €		
Maintenance costs	**2 320,00 €**	**/year**	
Hourly wage of maintenance employee	33,00 €	/hr	22 €/hr x 1,5 to calculate cost for employer
Hours	40,00	hrs/year	
Total wage	1 320,00 €	/year	
Material costs for machine repairment	1 000,00 €	/year	

4. The pelletiser	**131 129,86 €**	**/year**	
Water	**3 064,86 €**	**/year**	
			75% of total amount of water is added at the mixing step, the other 25% is used in the presses to finetune the dough
Amount of water	7,00	m^3/hrs	(also 20% possible variation on the total amount of water added)
Cost of water	0,90 €	/m^3	
Capacity pelletiser	3,70	ton/hrs	for the two machines combines, so total capacity
Total yearly capacity	1800,00	ton/year	
Volume pelletiser	486,49	hrs/year	
Total cost of water	3 064,86 €	/year	
Electricity	**74 100,00 €**	**/year**	
Total Electricity usage	190,00	kwh/h	
Total productive time	6000,00	hrs/year	
Cost of electricity	0,07 €	/kWh	65 €/Mwh
Total electricity cost	74 100,00 €	/year	
Labour costs	**16 125,00 €**	**/year**	
Hourly wage of employee on pellet machine	27,00 €	/hr	18 €/hr x 1,5 to calculate cost for employer
Hours spent	1,50	hr/day	
Number of working days on the machine	250,00	days	The machine runs 6000 hrs/year; machine is checked by employee every 24 hours
Total labour cost for working on the machine	10 125,00 €	/year	
Hourly wage of cleaning employee	24,00	/hr	16 €/hr x 1,5 to calculate cost for employer
Cleaning time	1,00	hr/day	
Total cleaning time	250,00	days/year	The machine runs 6000 hrs/year; machine is checked by employee every 24 hours
Total labour cost for cleaning	6 000,00 €	/year	
Maintenance cost	**37 840,00 €**	**/year**	
Hourly wage of maintenance employee	33,00 €	/hr	22 €/hr x 1,5 to calculate cost for employer
Hours	480,00	hrs/year	Total hours for 2 employees is 40 hrs/month
Total wage for maintenance	15 840,00 €	/year	
Material costs for machine repairment	22 000,00 €	/year	

5. Transport to cooling unit	**13 650,00 €**	**/year**	This transport covers all transport parts after pelletizing
Total Electricity usage	35,00	kwh/h	
Cost of electricity	0,07 €	/kWh	65 €/Mwh
Total productive time	6000,00	hrs/year	
Total electricity cost	13 650,00 €	/year	

6. Cooling unit	**7 020,00 €**	**/year**	
Total Electricity usage	18,00	kwh/h	
Cost of electricity	0,07 €	/kWh	
Total productive time	6000,00	hrs/year	
Total electricity cost	7 020,00 €	/year	

7. Storage pellets	**17 000,00 €**	**/year**	
Loading activity from silo to silo	7000,00	ton/year	
Truck volume	25,00	ton/truck	
Amount of trucks	280,00	trucks	
Time for employee to load truck	0,50	hr/truck	
Hourly cost for loading truck (wage & other)	50,00 €	/hr	No need to multiply by 2,1 because external service
Total cost linked to storage	7 000,00 €	/year	
Maintenance cost	10 000,00 €	/year	

7. Storage pellets	**17 000,00 €**	**/year**	
Loading activity from silo to silo	7000,00	ton/year	
Truck volume	25,00	ton/truck	
Amount of trucks	280,00	trucks	
Time for employee to load truck	0,50	hr/truck	
Hourly cost for loading truck (wage & other)	50,00 €	/hr	No need to multiply by 2,1 because external service
Total cost linked to storage	7 000,00 €	/year	
Maintenance cost	10 000,00 €	/year	
Operating expenses	**- €**	**/year**	Machines were quite old, so we assume that machines are fully depreciated
Depreciation costs			
Depreciation of transport system	- €	/year	
Depreciation of mixing machine	- €	/year	Machine is already 30 years old so fully depreciated
Depreciation of pelletiser	- €	/year	
Depreciation of cooling unit	- €	/year	
Depreciation of silo's	- €	/year	
Labour costs linked to sales activities of pellets			
Yearly wage of employee	100 000,00 €	/year	This number represents the actual employer cost
% of time spent on pellet sales	25,00	%	
Yearly wage of employee linked to pellet sales	25 000,00 €	/year	
Yearly wage of two employees linked to pellet sales	50 000,00 €	/year	

X

Part X – Project diary

PROJECT DIARY

MASTERS IN GENERAL MANAGEMENT GHENT 2021-2022

Name: Aurélie Coene, Laure Craeye, Cindy Braekman

Company: Boortmalt

Company supervisor: Gianluigi Cafiero

Vlerick promoter: Robin Kleer

Vlerick researcher: /

Meeting	Duration	Topic
9th of March	***1h***	*Ice break and introduction to each other.*
23rd of March	***1h***	*Analysis and introduction to project.*
13th of April	***1h***	*Official kick-off with Vlerick promotor and company supervisor.*
20th of April	***4h***	*Introduction on malting process: theory and first brainstorm about ICP together with Gianluigi.*
21st of April	***4h***	*Malting tour and brainstorm for actionplan.*
22nd of April	***2h***	*Visiting Boortmalt's innovation centre and making timeline for the ICP.*
26th of April	***1h***	*Meeting with Gianluigi and consultancy company Bundl that already performed a first market scouting to understand their screening methodology.*
26th of April	***1h***	*Meeting with Gianluigi to further discuss the project scope and what is expected from us.*

27th of April	***1h***	*Meeting with Gianluigi to recap the to do's for the first week.*
29th of April	***1h***	*Meeting with Gianluigi to wrap up our first week.*
29th of April	***1h***	*Meeting with Robin Kleer to go over and discuss our proposed methodology.*
12th of May	***3h***	*Meeting with Gianluigi to follow up on ICP, discuss data from market research, results of P&L, next steps to be done and to receive feedback.*
13th of May	***½h***	*Meeting with prof Dr. Mathieu Luypaert from Vlerick to discuss WACC calculation and investment analysis of Boortmalt and ask our questions.*
18th of May	***Whole day***	*Meeting at Boortmalt office with Gianluigi and the other members of Boortmalt's innovation team including the Chief commercial and innovation officer. During the meeting, a Swiss start-up pitched their products including meat alternatives made with Boortmalt's by-products.*
25th of May	***1h***	*Meeting with Robin Kleer to ask questions about methodology & discuss how to proceed with financial parts in collaboration with Swiss start-up.*
25th of May	***1h***	*Meeting with Gianluigi to ask questions and check on our progress.*
31st of May	***½h***	*Catch-up call with Kimberly Pauwels to check how the ICP is going.*
31st of May	***1h***	*Meeting with Gianluigi and Swiss start-up to discuss about the TVP production equipment and design for Boortmalt. During this meeting, the potential for making a financial analysis of the TVP process has also been discussed.*
1st of June	***3 ½h***	*Meeting with Gianluigi to go over all frameworks made for the market research and to discuss the outcome. Besides, a new plan is made on how to tackle the financial calculations for the TVP production.*
2nd of June	***1 ½h***	*Online meeting with Gianluigi to go over the frameworks that have been adjusted content-wise based on feedback received during the previous meeting.*
6th of June	***½h***	*Meeting with Gianluigi to ask questions.*
7th of June	***½h***	*Meeting with Carine Peeters, Strategy professor at Vlerick to get some feedback on the strategic frameworks that have been used as part of our market research.*

9th of June	***1h***	*Meeting with Gianluigi to go over our discussion and conclusion.*
13th of June	***1h***	*Meeting with Gianluigi Cafiero to receive feedback on our full written report.*