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Potential application areas for Fresenius Kabi's bonus products

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Abstract

Potential application areas for Fresenius Kabi's bonus products

Elina Annala, Jenny Karlsson, Matilda Brink

The main purpose of the project was to investigate existing markets within the food- and cosmetic industry in order to determine a strategy for market entrance with the bonus product of Fresenius Kabi. The original bonus product, P080, is a rest product from the process where phospholipids are extracted from egg yolk powder. P80 is a refined version of the P080 where egg yolk oil has been extracted, hence the protein content in P80 is higher. The extracted egg yolk oil is the final portion of the bonus product. Thereby, the original bonus product can be divided into two refined fractions. This project investigates the potential for each of these three substances to be a part of a fictive product.

By scanning the global protein market as well as the egg yolk protein- and egg oil market, seven potential product segments were discovered. These segments were further evaluated in order to bring out specific products that were potential candidates as products based on the bonus product.

The analysis resulted in two fictive products based on P080; high value nutrition bars and snacks for seniors, one based on P80; protein powder, and one based on egg yolk oil; dietary supplement. All presented in three business cases.

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Sammanfattning

I västvärlden idag äter vi väldigt mycket kött i form av fisk, fågel och biff. Detta medför att vi får i oss högkvalitativa proteiner som kroppen behöver för att fungera ordentligt.

Köttkonsumtionen ser olika ut beroende på vart i världen man befinner sig, i USA till exempel äter man ungefär lika mycket kött som i Australien medan befolkningen i vissa Afrikanska länder äter nästan en sjättedel så mycket. Det pågår dock en förändring i utvecklingsländerna; de industrialiseras och får därmed successivt en bättre ekonomi.

Detta medför att köttkonsumtionen har börjat öka markant i dessa delar av världen. Om vi i västvärlden fortsätter äta kött på samma sätt som vi gör idag, samtidigt som utvecklingsländerna ökar sin konsumtion, kommer vi år 2050 ha fördubblat den sammanlagda köttkonsumtionen. Vid ungefär samma tidpunkt kommer även världens befolkning ha ökat till ca 10 miljarder människor, vilket även betyder att det kommer vara 10 miljarder munnar att mätta. Vi blickar alltså fram emot en stor utmaning i att tillfredsställa det alltmer ökande proteinbehovet i världen, något som inte kommer vara möjligt om vi inte börjar konsumera bättre och mer hållbara proteinalternativ.

Ett exempel på sådant alternativ skulle kunna vara att öka användandet av fler hållbara proteinkällor, såsom ägg. Ägg innehåller väldigt många bra proteiner, precis på samma sätt som kött gör. Ett ägg innehåller nämligen alla essentiella aminosyror tillsammans med flertalet fleromättade fettsyror, exempelvis omega 3, 6, 9. Det är också en källa till vitaminer och mineraler och det är relativt billigt. Ägg har dock ett mindre klimatavtryck än kött, biff och fisk vilket gör det till ett mer miljövänligt alternativ.

Det är inte bara inom livsmedelsindustrin som vi behöver göra mer hållbara val i framtiden. Även inom kosmetikaindustrin används mycket kemikalier idag, vilket medför att denna industri också törstar efter fler hållbara alternativ. Det finns redan en del naturliga oljor på marknaden, som maroccanolja inom hårvård och mandelolja i hudvård, men användningen naturliga oljor förutspås att växa sig större i framtiden. Däremot är marknaden för just äggolja i hudvård och hårvård endast etablerad i asiatiska länder för tillfället.

I och med de rådande situationerna i världen idag, som nämndes ovan, är det väldigt viktigt att ta vara på ett företags resurser och eftersträva cyklisk ekonomi. Fresenius Kabi är ett läkemedelsföretag som bland annat ligger i Uppsala och Stockholm, de har produkter inom klinisk nutrition, infusionsterapi och medicinsk utrustning. I deras produktionsprocess av en påse för parenteral nutrition extraheras fosfolipider från äggulepulver, vilket resulterar i en restprodukt. Denna bonusprodukt härstammar från äggulepulver och innehåller därför alla aminosyror, vitaminer, fetter och mikronutrientier som vanlig äggula innehåller. Målet med det här projektet var därmed att undersöka existerande marknader inom livsmedels- och kosmetikaindustrin i syfte att finna en strategi för marknadspenetration med Fresenius Kabis bonusprodukt.

Genom att scanna den globala proteinmarknaden såväl som ägguleprotein- och äggoljemarknaden, identifierades sju potentiella produktsegment. Därefter utvärderades segmenten för att hitta produkter som visade potential att kunna baseras på bonusprodukten.

Analysen resulterade i fyra fiktiva produkter som alla härstammar från bonusprodukten.

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1. Introduction

1.1 Background of the study

The main purpose of the project was to investigate existing markets within the food industry and cosmetic industry in order to determine a strategy for market entrance with the bonus products of Fresenius Kabi. The original bonus product, P080, is a rest product from the process where phospholipids are extracted from egg yolk powder, see figure 1. The phospholipids are used in Fresenius Kabi's three chambered bag for intravenous feeding of patients (Fresenius Kabi, 2019). Since the good properties of P080 were identified, it contains egg oil and has a high concentration of egg yolk proteins, a process for further refinement of P080 was discovered during the master thesis of 2017, see figure 1. The refined bonus product P80 has a even higher protein content including all the essential amino acids (Bergman, Nilsson, 2017). The main purpose of this project was to find suitable application areas for the refined bonus product P80 and the egg oil as well as the original bonus product P080, within the food- and cosmetic industry.

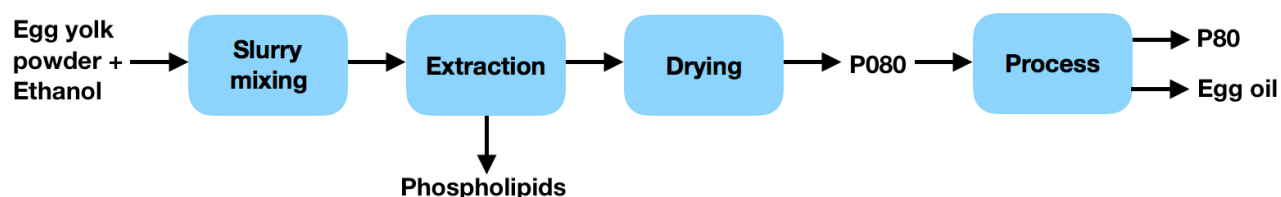


Figure 1. Overview of the process that ends up with the refined bonus products P80 and egg oil.

1.2 Expected impact

This project is formulated by Fresenius Kabi, a world leading company in clinical nutrition, infusion therapy and medical equipment. They offer products and services for care and therapy for humans, both inside and outside of hospitals. Fresenius Kabi is a part of the German Fresenius Group and has about 1000 employees in Sweden, where approximately 200 of them work in the site of Brunna and the rest in Uppsala. The production unit of intravenous nutritional solutions is located in Uppsala and the production unit of raw material, including phospholipids derived from egg yolk, is located in Brunna (Fresenius Kabi, 2019).

One of Fresenius Kabi's products is the three chambered bag. It is used in intravenous feeding for parenteral nutrition and consists of amino acids, glucose, carbohydrates, fat and electrolytes. In a situation where the patient can not eat properly, these solutions provide the body with energy intravenously. In the process of producing these bags, phospholipids are being used as emulsifiers in order to solve hydrophilic and hydrophobic content in the same bag. As mentioned earlier, the phospholipids are derived from yolk, by mixing it with ethanol.

After these lipids have been extracted, Fresenius Kabi ends up with a rest product containing a lot of nutrients from yolk such as egg oil and egg yolk proteins. Even though the phospholipids have been extracted, it is estimated that the egg oil contains around 1-3 % of phospholipids. This is however good due to that the favorable properties of the egg oil still remains. The rest product that contains egg yolk oil and egg yolk proteins is named P080 and serve today as animal feed. But since the company realized the potential of P080, considering its high protein content, they wanted to further increase the possibilities which gave rise to the master thesis of 2017. By extracting the egg oil from P080, the original bonus product generated P80, containing 80% highly qualitative protein including all of the essential amino acids. In addition to the protein, it also contains less than 5% fat and have more than 97% dry content (Bergman, Nilsson, 2017).

Next question for Fresenius to answer became; what shall we do with P080 and its components? That is where this project comes in - find the right application area for this tremendously great access. The character of this project is free and unrestricted where the company leave all doors open without interfering with their future plans or findings. Fresenius Kabi promotes sustainability and cyclic economy which is the underlying theme of this project.

Apart from the profit of the company, what makes this project so necessary for the rest of the world? As the population living on this planet continuously increase along with the general income, we all need to find a way of producing sustainable food. In 2050, the estimated world population will be 10 billion people. That is 3 billion people more than 2010, 3 billion more stomachs to feed with resource-intensive food. As the income rises, people will choose more animal-based alternatives which leads to increased consumption of foods that harm the environment (World Resources Institute, 2018).

This project contributes to the described challenge of food supply, the need of protein for human body and the difference in protein sources. Other animal-based proteins, such as dairy products or beef, generates a lot more greenhouse gas emissions from food industry. Between 2006 and 2050, the increase in population and income is expected to rise the demand for animal-based foods with 80% and specifically beef with an increase of 95%. Of course, some of the protein intake will lead to welfare gains but it is crucial to find a way of making protein supply sustainable. In order to do so, the protein supply should be derived from sources that generate smaller environmental footprint. In figure 2, different protein sources are listed by the amount of emission (World Resources Institute, 2016).

PER TON PROTEIN CONSUMED

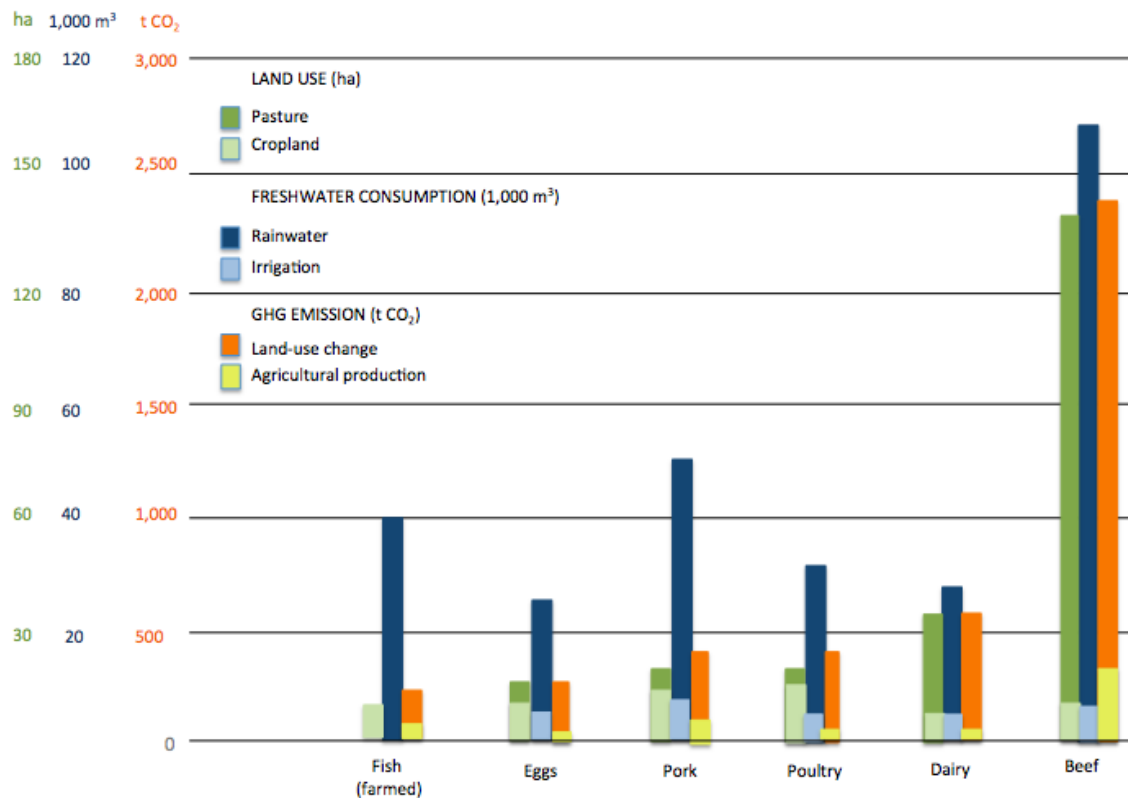


Figure 2. Difference in environmental footprint for the most common animal-based protein sources (World Resources Institute, 2016).

The production of eggs does not use as much land and does not emit as much greenhouse gases as the production of dairy, poultry or beef products. The similarities of eggs and dairy in protein content will later be described. From a sustainable point of view, choosing an egg-based alternative is a better choice for protein supply. Therefore, the bonus product could constitute such a sustainable alternative and change the pattern of consuming protein in the western world.

The egg oil on the other hand, also has potential to contribute to a more sustainable cosmetic industry. Today, many cosmetic products on the market are chemical intense and the consumers crave more natural and sustainable ingredients (Market Research Report, 2019).

1.3 Aim of the study

The aim of the study was to scan the existing markets for egg yolk within the food- and cosmetic industry in order to determine a strategy for market entrance of Fresenius Kabi's bonus products.

In order to reach the main goal, following milestones were accomplished:

- The different sources of protein on the global food market were mapped. The goal was to find social and cultural differences and to investigate if there had been historical changes, in order to predict future trends.
- The different product areas based on egg yolk protein and egg yolk oil on the global food and cosmetic markets, were mapped. The goal was to find social and cultural differences and to investigate if there had been historical changes, in order to predict future trends. Could any gaps be found on these markets, ready to be fulfilled by a product derived from the bonus products?
- Based on the previous mapping, a selection of product segments were chosen and presented where the bonus products were competitive alternatives.
- The product segments were evaluated and the three egg yolk protein-based products and the egg oil-based product that had the highest correlation with the properties of the bonus products, were chosen.
- Business cases for the chosen products were constructed based on earlier mentioned studies. Conclusions were taken based on these studies together with the current position of Fresenius Kabi in mind.

2. Research strategy

2.1 Study Design

There are three guidelines available to orientate a study. These are exploratory, descriptive and causal. For a more detailed description, read Appendix chapter 1.

2.1.1 Selection of marketing model

Throughout the study, it was intended to use an explorative market model with descriptive elements. A descriptive model is applied when the investigator wants to describe a certain situation and thereafter explain it to the reader. An explorative model creates underlying knowledge of a situation and thereafter, the investigator uses it in order to explore possibilities and as support for further decisions. Additionally, an explorative model creates a bigger picture instead of generating the most accurate data (Lekvall, Wahlbin, 2001). In this project, the descriptive elements took part in the beginning of the study where a collection of information about the global protein market and egg based market was presented. Thereafter, the following analysis went further into a more narrow range of product segments where the explorative model took part. In order to investigate where the bonus products had their best application areas, explorative studies were used to identify promising market possibilities. A combination between explorative and descriptive studies offer the possibility to create a big picture of the protein market and its needs, as well as deeper knowledge about chosen market components.

2.2 Methods being used

A wide range of qualitative data was collected in order to scan the global protein-, egg yolk protein- and egg oil market. Qualitative data can be used to characterize and approximate certain facts. It is not quantifiable data, meaning that it does not include numbers in its definition (Lekvall, Wahlbin, 2001). By collecting a large amount of information from published scientific papers, literature and published market analysis, a picture of the current and past appearance of these markets could be build up. The published scientific papers were found on databases such as PubMed and NCBI which the authors got access to through the online library of Uppsala university. The published market analysis were found by searching at Google with proper words such as “egg yolk protein market analysis” and likewise. To gather deeper knowledge and to understand details of these reports, further analysis of the references was made.

To conclude whether the found information was reliable, data was gathered from various sources, at a certain time, all of which strengthen the facts or arguments related to the current market. Hence, the method for collecting information was partly done through cross sectional survey study, meaning that we have observed or described the states of the current protein markets and product segments, without trying to actively influence the results or outcomes (Lekvall, Wahlbin., 2001). There is however always a person behind the glasses when reading and collecting information. Even if data was carefully picked from reliable sources and confirmed by other sources, there is always the question about how the author interpret the collected information. At certain chapters in this report, conclusions based on gathered information are made, which naturally are influenced by the interpretation of the authors. The authors of this report have a background within biotechnology and if this study was made by authors with other competence and background, the conclusions based on interpreted data may be different. In conclusion, it is vital to have in mind that all results are in some extent influenced by the background of the authors.

This study is based on secondary data, meaning data that is already collected and compiled in some other context. Hence, it is very much a *desk research* where the gathered and analyzed information has been published online or is available on print (Lekvall, Wahlbin, 2001). To collect information regarding markets and product segments, published scientific papers online as well as published market analyzes were used. In order to collect specific data about certain existing products, websites of manufacturers and suppliers were visited. To gain a deeper understanding of the preferences of customers, information regarding product type and product price, reviews and articles were gathered and read. Facts and insight about methods, models and frameworks were gathered from physical, educational literature.

2.3 The project step by step

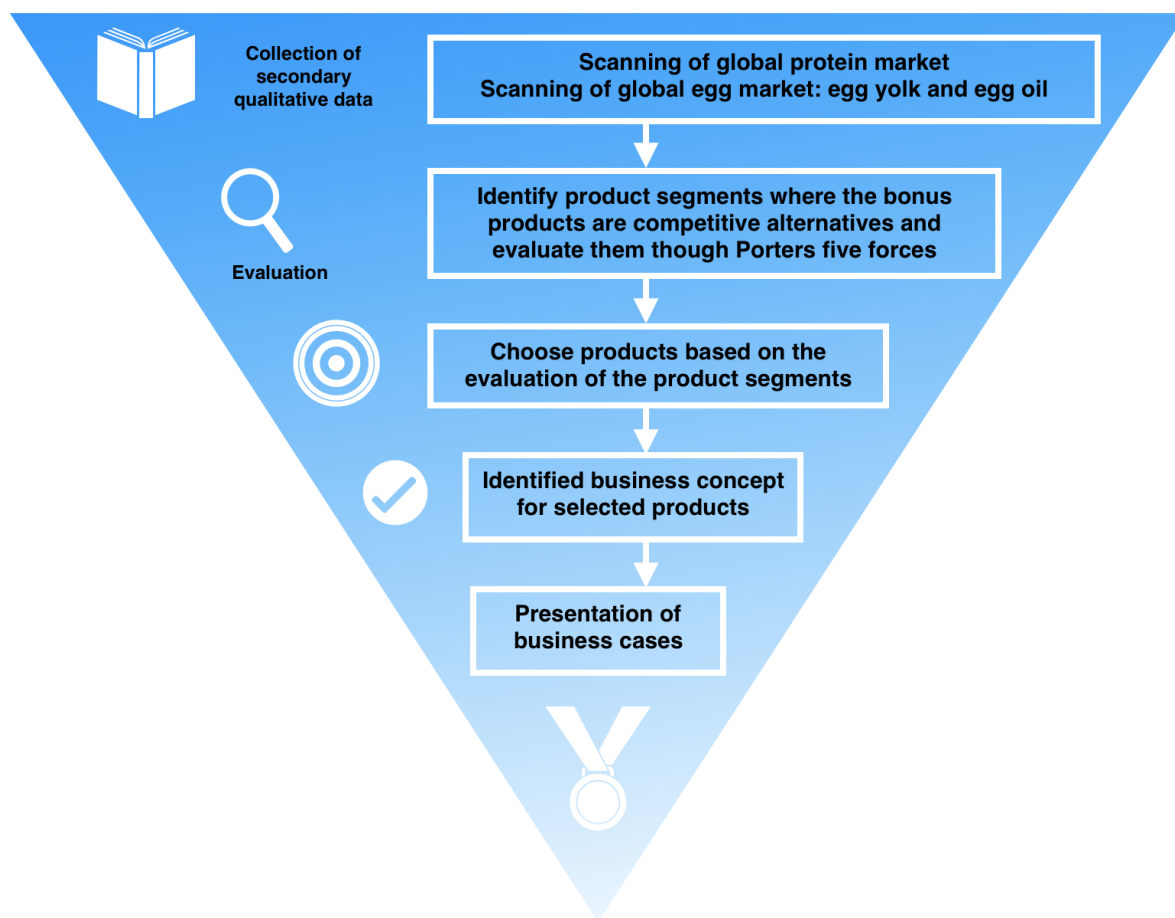


Figure 3. A visualised sequence of actions throughout the project.

The project was initiated with a wide ranged literature study in order to scan the global protein market. To read about the global protein market, see Appendix chapter 3.1. The aim of that part was to identify the distribution of different protein sources on the food market, today as well as the historical development for the last five decades. This was done to identify social and cultural trends, and to predict future trends. The initial phase also included scanning of the global egg oil and egg yolk protein markets with a similar approach in order to identify product segments within these markets. Most of the material derived from these scannings can be read later in this report, see chapter 4, but some parts can be found in Appendix, chapter 3.2. An visualisation of all sequence of actions during this project can be seen in figure 3.

Further literature studies were carried out in order to evaluate certain product segments where Fresenius Kabi's bonus products had potential to be a competitive alternative. The evaluation was done with the Porter's five forces framework and the goal was to evaluate the possibilities for the bonus products within the different product segments. The whole evaluation of Porter's five forces can be read in Appendix, chapter 4. Porter's five forces generated three protein products and one egg oil product that had potential to be competitive in each product segment respectively.

Thereafter, the phase of identifying the business cases for the specific products within the product segments was initiated. The business cases presents an overview of the possible directions Fresenius Kabi can take for each product respectively. The scenarios differ in terms of demand for external expertise and production capability, depending on which market strategy the company chose. These scenarios along with pros and cons are summarized in this chapter in order to pinpoint each products potential.

3. Frame of reference

3.1 Strategy for growth

In order to identify the real implementation area for this project, the Ansoff matrix was used. It is a tool used to analyze the alternative directions for further growth of a business or a corporation, while also considering the potential risks associated with every direction. The Matrix consists of four blocks; market penetration, product development, market development and diversification, see figure 4 (Ansoff, 1965). On the X-axis, there are two variables; existing- and new products and on the Y-axis, existing- and new markets. This tool was used to determine Fresenius Kabi's current position in relation to the investigated markets and products.

- Market Penetration: This is the strategic direction for a company where they increase their market share on existing markets with existing products.
- Product Development: This is the approach where the company deliver new products to their existing markets.
- Market Development: This is the option where the company offers existing products to completely new markets which involves new users.
- Diversification: This is the approach a company take to enter new markets with new products. It can either be a related or unrelated diversification. Related diversification refers to when a company enter markets that they are somewhat familiar with, while unrelated diversification means that the company moves towards a completely new market which they do not have any experience of (Ansoff, 1965).

Based on the gathered information about the company, its markets and existing products, it is concluded that this project will take the direction of either a related or unrelated diversification, see figure 4. This was concluded by determining the current position of Fresenius Kabi, which is described down below.

Fresenius Kabi offers products and services for clinically and chronically ill patients. They have products within infusion therapy, clinical nutrition and transfusion technology. In order to get a deeper description of the three areas, see Appendix, chapter 2. As mentioned in previous chapter, the purpose of the project was to find potential application areas for Fresenius Kabis bonus products; egg yolk protein and egg oil. These are not the main components in any existing products in their portfolio. Hence, we were looking at a new product for the company Fresenius Kabi.

In terms of market, we looked into a wide range of egg protein-based products within the food market that had similar characteristics as the protein-high bonus product. We also look into a wide range of egg oil-based products within the food and cosmetic markets. These markets were specifically assigned to us by the representatives of Fresenius Kabi. This led in to new customer segments and a diverse selection of markets that are foreign for Fresenius Kabi. It was therefore concluded that this project take the direction of either a related or unrelated diversification, see figure 4.

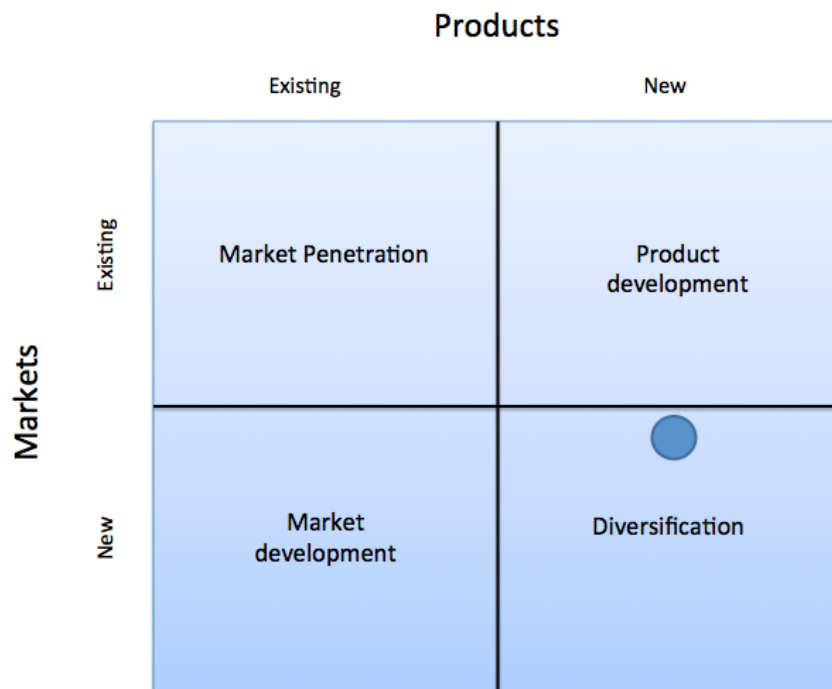


Figure 4. The Ansoff matrix with four different approaches for business growth; Market penetration, Product development, Market development and Diversification. X-axis represent new and existing products while Y-axis represent new and existing markets. Approach for the project is marked in the area for Diversification.

3.2 Industry competition

In order to investigate which one of the product segments that Fresenius Kabis bonus products had their best application possibilities within, the framework of Porter's five forces was used. This is a framework tool that can be used to investigate the attractiveness and competition on a certain market. The strategy was developed by Michael E. Porter in 1979 and has been used by business organisations worldwide. The idea behind the framework is that there are five forces that determine the intensity of competition on a market. These forces are the power of buyers, threat of new substitutes, power of suppliers, threats of new entrants and rivalry of existing competitors (Porter, 1979). From the evaluated product segments, three protein based products and one oil based product were chosen to build up business cases upon.

The forces were defined by investigating a number of factors, see figure 5. The number of factors linked to each force were restricted due to the limited level of information that could be found regarding each product segment and the bonus product P080 itself; it is important to not base conclusions on insufficient data or facts.

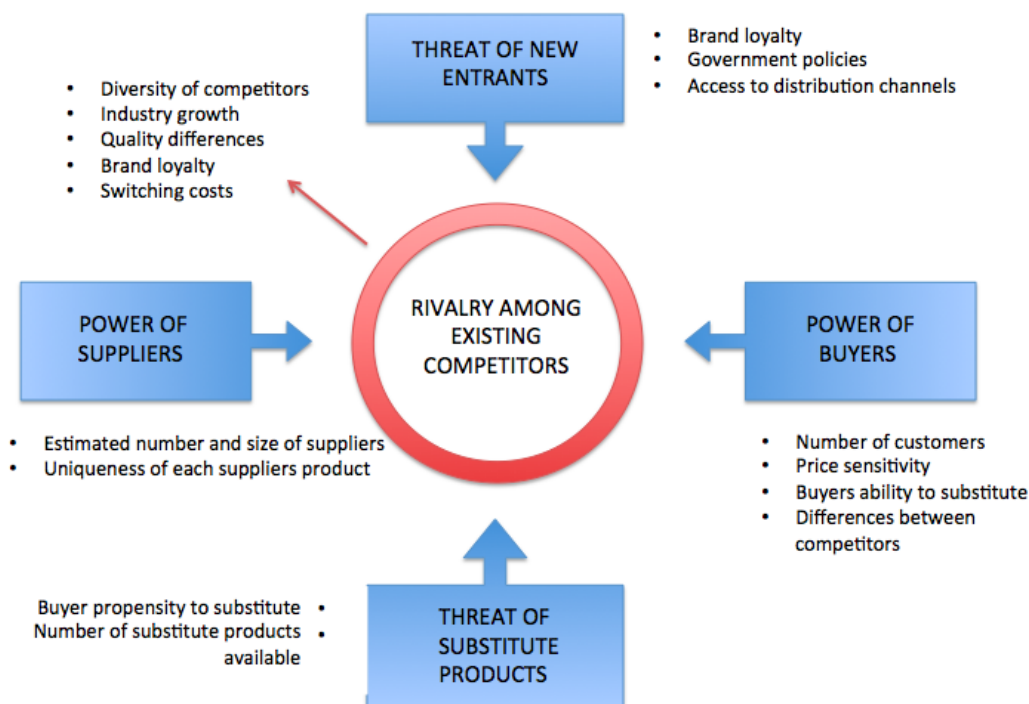


Figure 5. The porter's five forces framework.

3.3 Constraints

Constraints of a study can either be considered to be from a certain part of area or to a certain part of area. Furthermore, this study was described by defining the “triangle of the project” which is structured by the variables time, resources and quality. These variables can in some cases fluctuate throughout the process but it is completely necessary that all participants in the project are aware of the importance and priority of every variable when the project initiates. The triangle symbolise how every variable influence the other. For instance, if the resources of the project are extensive- the time and/or quality change as well. Or if the time decrease, so would also the requirements of the quality unless the resources expand (Fors-Andrée, 2011). The two models are visualised in figure 6 and 7.

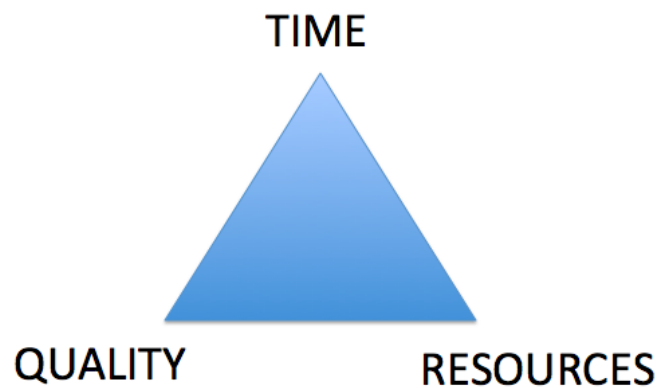


Figure 6. Triangle of the project with chosen variables; time, quality and resources.

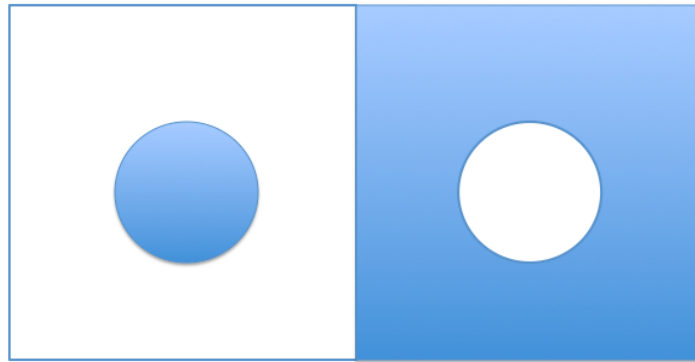


Figure 7. Visualization of constraints from or to.

In this case, the definition of the “triangle of the project” includes time, quality and resources, see figure 6. The time was definite, it was predetermined that the project should run for 17 weeks. The resources in this project were the number of workers, money and accessibility of information. Since the project was assigned to three students, it was not an option to increase the resources by adding another worker. According to money and information accessibility, the available information was limited to course literature, published scientific papers and parts of published market analyses. This leaves us to the only changeable variable, quality. The quality was therefore controlled and constrained by the set variables; time and resources.

When it comes to constraints from or to, it was reasoned, due the character of this project, to choose constraints to a certain area, see figure 7. From a broad range of possible options, only a few selected segments and specific products were further evaluated.

4. The Global Egg Market

The importance of achieving right amount of every nutrient from food, on daily basis, is widely known today. Therefore, the consumption of eggs and egg derived products have increased over the last couple of years. In 1984, 15% of the total number of eggs were further processed into new products. This means that 25.6 million counts of shell eggs were broken to produce other egg products. In 2012, that number had increased to 70.4 million (American Egg Board, 2019). It may sound a lot, but it is understandable since eggs are the perfect source of both protein, fats and micronutrients (Miranda et al., 2015). It was earlier been believed that egg yolk was unhealthy because of the high amount of cholesterol, the high density lipids (HDL) and low density lipids (LDL). However, today researchers have clarified that the response in human body is not depending on intake of cholesterol from food but from other factors such as ethnicity, genetics, hormonal- and nutritional status (Miranda et al., 2015). Fat, which most people thought was something to avoid, is now considered completely necessary.

Egg is also investigated to be introduced as functional food, which refers to foods that supply the body with greater health benefits and is expected to decrease diseases and socio demographic factors (World Intellectual Property Organization, 2009). Together with all the desirable nutrients and other essential components in egg, the label of functional food will most probably increase the egg consumption even more. A more detailed description of the composition of egg is described in table 1.

Table 1. Total amount of all nutrients in egg per 100 g (Miranda et al., 2015).

Component (Unit)	Amount	Component (Unit)	Amount
Egg shell (%)	10.5	Calcium (mg)	56.0
Egg yolk (%)	31	Magnesium	12.0
Egg white (%)	58.5	Iron (mg)	2.1
Water (g)	74.5	Phosphorus (µg)	180.0
Energy (Kcal)	162	Zinc (mg)	1.44
Protein (g)	12.1	Thiamine (mg)	0.09
Carbohydrates (g)	0.68	Riboflavin (mg)	0.3
Lipids (g)	12.1	Niacin (mg)	0.1
Saturated fatty acids (g)	3.3	Folic acid (µg)	65.0
Monounsaturated fatty acids	4.9	Cyanocobalamin (µg)	66.0
Polyunsaturated fatty acids (g)	1.8	Pyridoxine (mg)	0.12
Cholesterol (mg)	410	Retinol equivalents (µg)	227.0
Iodine (µg)	12.7	Potassium (mg)	147
Tocopherols (µg)	1.93	Carotenoids (µg)	10
Selenium (µg)	10	Cholecalciferol (µg)	1.8

The bonus product of Fresenius Kabi is derived from egg yolk powder and therefore, the egg yolk, its proteins and oil, is the main focus of this report.

4.1 The global egg yolk market

Usage of egg yolk shows the same patterns as for whole eggs, it continues to increase and that is mainly because of three significant properties; the ability to manufacture and stabilize emulsions, stability in foaming and the ability to form a gel by heating (Rossi et al., 2010). In Appendix chapter 3.2, the history of egg, the differences in egg production and egg consumption between countries, historically, are presented. Later in this chapter, the most common application areas for egg yolk are presented. Table 2 shows the content of a raw egg yolk.

Table 2. Content of one raw egg yolk from a standard large egg (17 g) in the US (Huizen, 2017).

Component (Unit)	Amount	Component (Unit)	Amount
Protein (g)	2.7	Sodium (mg)	8
Energy (Kcal)	55	Zinc (mg)	0.39
Saturated fatty acids (g)	1.624	Thiamin (mg)	0.03
Monounsaturated fatty acids (g)	1.995 g	Riboflavin (mg)	0.09
Polyunsaturated fatty acids (g)	0.715	Niacin (mg)	0.004
Cholesterol (mg)	184	Vitamin B-6 (mg)	0.059
Carbohydrates (g)	0.61	Vitamin B-9 (µg)	25
Sugar (g)	0.10	Vitamin B-12 (µg)	0.33

Calcium (mg)	22	Vitamin A (µg)	65
Iron (mg)	0.46	Vitamin E (mg)	0.44
Magnesium (g)	1	Vitamin D (µg)	0.9
Phosphorus (mg)	66	Vitamin K (µg)	0.1
Potassium (mg)	19	Dietary fiber (g)	0

4.1.1 Social and cultural differences; egg yolk utilization

In 2013, China and the US were the head producers of egg and the amount produced eggs have increased ever more since the 1990s (see Appendix chapter 3.2.2). China produced 29.13 million tonnes egg during 2013 and the US produced 5.78 million tonnes eggs, see figure 8 (Ritchie, Roser, 2017).

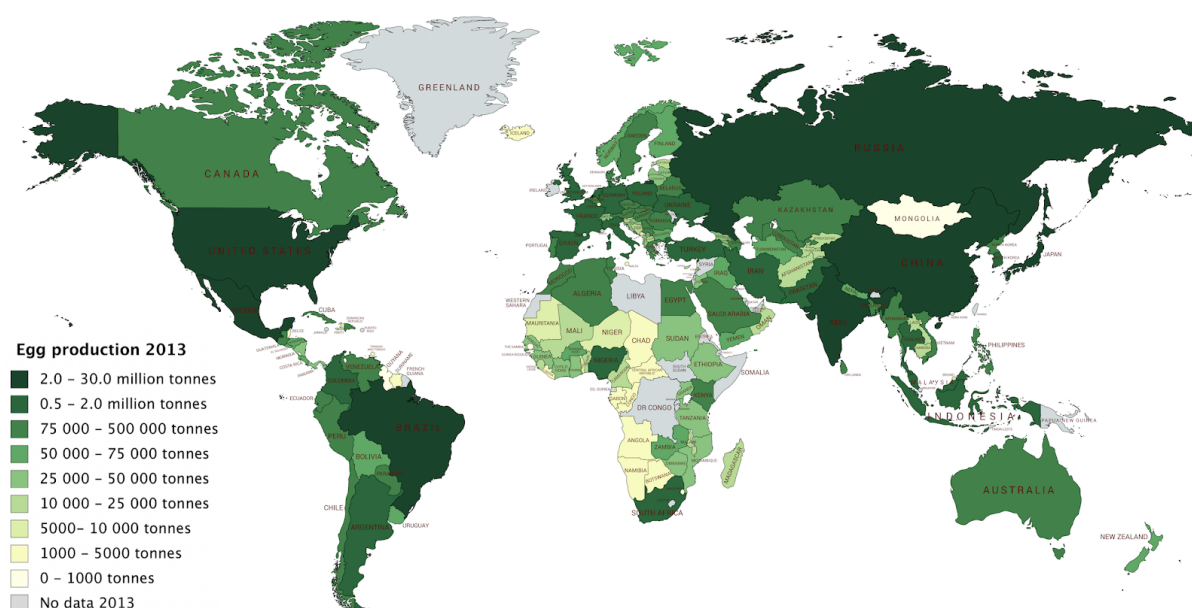


Figure 8. An overview of the egg production in the world 2013.

However, the largest consumers of eggs per capita 2013 were China, Japan, Paraguay, Mexico and Ukraine, see figure 9 (Ritchie, Roser, 2017).

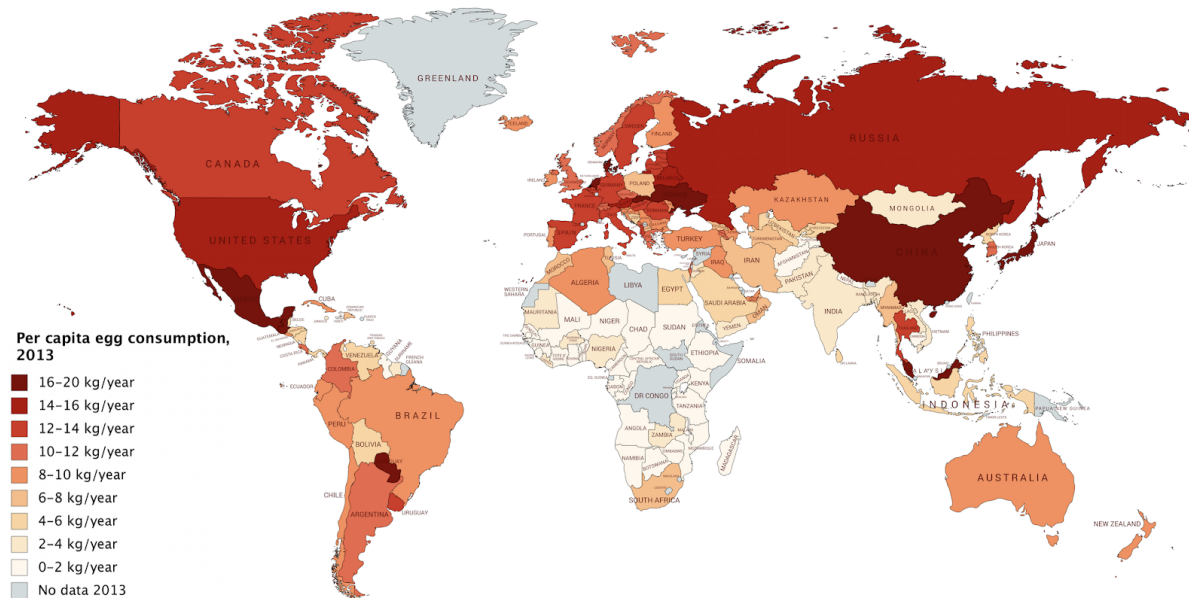


Figure 9. An overview of the egg consumption per capita in the world 2013.

As illustrated in the figures above, both the production and the consumption of egg are generally very high, and have also amplified during the last decades. This is due to the increased demand of eggs. Yet, the demand of egg is expected to continue to grow in the future since its usage increases constantly, for instance in the food industry (Transparency market research, 2017).

For further information about the historical development of egg production and consumption worldwide, see Appendix chapter 3.2.2.

4.1.2 Applications of egg yolk today

It is believed that the demand of egg yolk powder will increase rapidly in the future, especially in the food processing sector, due to its high nutritional content of protein, vitamins and minerals. Whole eggs have been used in the food industry for a long time, but egg yolk powder is starting to replace the whole eggs.

This is because of its beneficial properties such as longer shelf life and therefore more favourable shipping and transportation. Also, it has become very trendy to have a high-protein lifestyle and egg yolk powder is one of the the most available nutritional protein sources on the market (Transparency market research, 2017).

Today, egg yolk powder comes in different shapes and variants in order to adapt it to various food products. High gel egg yolk powder and high whip egg yolk powder are two usual variants that you can find on the market today. Listed down below, one can read the different market segments in which egg yolk powder are used in. You can find egg yolk powder on supermarkets, stores and online (Transparency market research, 2017).

- Food industry; bakery, confectionery, snacks and ready-to-cook, ready meals, meat and fish products, dairy products, salads, sauces and dressings.
- Nutraceuticals and pharmaceuticals
- Hotel/restaurants/café
- Households

Looking in to specific products that are based on egg yolk, different ice creams (Brown Butter Sugar Cookie, 2019), smoothies e.g “Health aging” which is a clinically proven smoothie for cognition and eye health (Healthy Aging, 2019), snacks (Valverde et al., 2016) and bakery mixes are found. Egg yolk powder is also used as a protein powder which is consumed as a shake or added in sauces, soups, bakery mixes, or other dishes (MyProtein, 2019). This is because egg yolk powder has great emulsifying properties.

The market for egg yolk powder is not as developed as it is for milk based powders, such as casein. However, the properties of milk casein powder and egg yolk powder are very similar (Bergman, Nilsson, 2017). Thus, the bonus product P080 that originates from egg yolk powder also has many similar properties to milk casein powder. Therefore, the current applications for milk casein also have been examined.

4.1.3 Casein

One discovery from 2017 Master Thesis was that egg yolk proteins, and therefore the bonus product of Fresenius Kabi, has great similarities with milk casein. According to Nilsson and Bergman, milk casein and P080 appear to have resembling amino acid profiles including all of the essential ones. Table 3 reveals egg yolk protein, P080 and milk casein in amount of each amino acid presented in mg per g protein.

Table 3. Comparison of EYP, P080 and milk casein with respect to the essential amino acids. The unit is milligram amino acid per gram protein.

Essential amino acid	Egg Yolk Protein	P080	Milk casein
Thr	48	52	48
Phe + Tyr	85	97	112
Met + Cys	46	28 + N/A	32
Val	56	63	69
Ile	50	57	55
Leu	80	92	97
Lys	71	47	83
Trp	15	10	16
His	25	26	30

Additionally, all the amino acids are preserved in some extent in the process where P080 becomes P80. This mean that the potential application area for P80 could be compared to current application areas for milk casein.

Casein is a protein natively found in cow milk. The extraction of casein from whole cow milk is quite straightforward. First of all, whole milk is separated into skim milk and cream, which is later used in production of e.g butter. Skim milk is then used as the raw material of which casein is produced (NZIC, 2017). In the last 30 years the usage of casein has gone from technical to food- application, both according to its functional and nutritious properties. Water binding, thickening or emulsification and texture are some of the functions that are enhanced by adding casein. Products where casein is used for nutritious properties are infant foods, pharmaceuticals, sports drinks, instant breakfast and beverages (NZIC, 2017). Nowadays most people recognize casein as a protein supplement in sports nutrition.

In food industry, casein is marketed as the supplement with the slowest digesting capacity. When the protein reaches the stomach, it forms a kind of gel due to its thickening properties which leads to a slow absorption of the amino acids. Casein intake is therefore preferable at night or when dieting since the powder provides the body with protein during a longer period of time and prevents degradation of muscles. It is also a popular ingredient in baking or to use in puddings. The marketing price for 750 g casein at a regular distribution channel is EU€ 18 (ProteinPRO, 2019). Moreover, lactate dehydrogenase, an enzyme that breaks down lactate naturally in body, is added to some casein powders in order to make it accessible for people extra sensitive to lactose (Kosttillskott, 2019). This is however a synthetic addition to the protein powder. An egg yolk-based powder, such addition of enzymes is not necessary since it does not contain lactose, and the product could stay totally natural.

Protein powder that is totally free from lactose is a bit harder to find. According to Bulk Powders (2019), the lactose free protein powders are derived from beef, egg white, brown rice, peanut butter, peas or other vegan sources. Protein powder with the same amino acid profile as milk casein does not exist amongst the most common lactose free options. Last but not least, there is an environmental aspect to consider. Milk casein and whey are protein supplements derived from milk and therefore, from cows. As described earlier in this report, and visualised in figure 2, beef and egg production differs a lot in greenhouse gas emissions and environmental impact. A protein source from egg is much more sustainable for the planet than one from cattle.

4.1.4 The proteins in egg yolk

Egg yolk can in simplified sentence be said to consist of two things, granules and plasma. Plasma accounts for 78% and granules accounts for 22% and the separation of yolk into these compartments is done by centrifugation (Huang, Ahn, 2019). Furthermore, many of the proteins in yolk have formed a complex with lipids, forming low density lipoproteins and high density lipoproteins (Nys, Guyot, 2011). Egg yolk plasma is composed by 85% low density lipoproteins and 15% livetins and the granules consists of 60% protein and 34% lipids (Huang, Ahn, 2019). The protein profile of egg yolk, without the minor proteins, is visualised in table 4.

Table 4. Protein profile of egg yolk (Huang, Ahn, 2019; Nys, Guyot, 2011)

Protein	Percentage of total yolk protein
α-livetin	5%
β-livetin	16%
γ-livetin	17%
Lipovitillin (α- and β-forms)	36%
Phosvitin	8-9%
Low density lipoproteins	17%

Much research has been done about the different proteins in egg yolk protein. In a later section, some of the discovered application areas of these proteins are presented together with discussions of how promising and relevant they are for the bonus products.

4.2 The global egg oil market

Even if egg whites generally have been appreciated for their high amount of high quality protein with a low calorie content, the majority of the nutrients are located in the yolk. The main components of yolk are lipids, such as unsaturated fatty acids, phospholipids, carotenoids and choline. It does however also facilitate several essential minerals such as calcium, magnesium, phosphorus, sodium, zinc, potassium and iron. The egg yolk is also a rich source of vitamins, in particular fat and water soluble vitamins as well as natural pigments such as carotene and xanthophylls. The collection of these important components makes yolk a fantastic food for humans, which one can understand since its basically designed for being the primary source of nutrients for an embryo during growth (Kuang et al., 2018).

Egg yolk offers a good source of omega 3 fatty acids as well as other important micronutrients. Hence, the oil derived from yolk include several beneficial lipids and other components that can be used for a variety of purposes. The most common methods for obtaining yolk oil include heating- and chemical solvent extraction. For medical purposes, the yolk oil made from heating methods is suggested to be better than yolk oil made through chemical extraction in a laboratories where there is a risk for loss of cholesterol and carotenoids (Hu, Lan, Loh, 2012; Madan, Nanda, 2017). There is however very little scientific material about the health and disease preventing effects of heat-extracted yolk oil since most research is related to yolk oil obtained through chemical extraction.

4.2.1 Social and cultural differences; egg oil utilization

Today, yolk oil is commonly used in Asian countries as a multipurpose medicine. Yolk oil products with trademark are sold in pharmacies in Japan while such products can be bought from general homemade markets in China and Taiwan. There are several studies showing indications of yolk oil's dermatological and anti-microbial functionalities and the oil is therefore seen as a multipurpose remedy for all diseases amongst the people in these countries. There are even cases where yolk oil is used as a complementary agent for preventing heart diseases (Hu, Lan, Loh, 2012).

In India on the other hand, egg yolk oil is a very popular ingredient in different hair care treatments since it offers a relatively cheap and natural alternative, full of nourishing fats. In the western world, yolk oil are mainly used as ingredient in products for hair care as well as a multifunctional agent in several skin care products. The most common applications in such skin care cosmetics are as sun and skin protective agent, burns and wound healing agent and analgesic- and anti-inflammatory agent (Madan, Nanda, 2017).

4.2.2 Applications of egg oil

Burns and wound healing

Due to the rich content of multifunctional components such as cholesterol, phospholipids and carotenoids, egg oil is suggested to have wound-healing and emollient effects on skin. Much research in this area have been conducted and there are studies that prove that yolk oil-treatment show re-epithelialization effects on the skin of burned animals, without leaving any tissue scar (Rastegar et al., 2011). Hence, egg oil show promising characteristics to be used as a natural treatment against burn wounds. People in Asia actually already use the egg oil for various skin-related diseases or wounds and the popularity of egg oil as a multi-remedying substrate is spreading to other parts of the world (Hu, Lan , Loh, 2012; Rastegar et al., 2011).

Sun protective

It is common knowledge that sunburns are dangerous for humans and can cause cell inflammation. This is primarily due to the production of reactive oxygen species (ROS) within the cells after the skin have been exposed to high levels of UV radiation. ROS, in turn lead to apoptosis, DNA damage or necrosis, hence cell death. The photosensitivity of egg oil has been investigated in a study made by Hahn et al.. According to their observations, cell sections that had been treated with egg oil showed less damage and intact nuclei after UV-irradiation as opposed to cells without egg oil treatment. Hence, egg-oil is suggested to lead to reduced production of ROS and can offer a protection against UV-irradiation (Bereiter-Hahn et al., 2014). Many sunscreens on the market today contain chemicals that could be harmful when absorbed into the body. Therefore egg oil have potential to serve as a natural and safe sun protective agent and hence a competitive alternative on the future market of sunscreens.

Emollient agent

Egg yolk has been used in traditional cosmetics for centuries since its oil have a moisturizing effect on hair and skin, much due to the high cholesterol content. The natural cholesterol in eggs has the ability to nourish the skin and restore the health of damaged hair. Since egg oil can be obtained more or less protein free, the cholesterol can be absorbed directly into the skin and still be safe to use for people with egg protein allergy (Madan, Nanda, 2017).

Emulsifier

Since egg yolk contain many surface active compounds such as phospholipids and lipoproteins, the oil from yolk can be used as an emulsifying agent in cosmetics as well as foods. The active components have the ability to form an interface between water- and an-oil phase, hence making a stable emulsion. Both the low density lipoproteins and high density lipoproteins in yolk are important for the emulsifying properties as well as pH and ionic strength (Magnusson, Nilsson, 2013). These characteristics makes egg oil a promising ingredient in different types of firm creams.

Dietary supplement

Last but not least, yolk oil offers a rich source of omega 3 and vitamins such as vitamin D and E, hence it have potential to work as a supplement in countries where there is a lack of these important nutrients in the daily diet. In some countries of the western world such as Sweden and Finland, there is a suggested deficiency of vitamin D due to a deficit exposure to sun during the winter season (Kuang et al., 2018). Here egg oil might show potential as a good alternative for a multi-source dietary supplement which contains both vitamin D and omega-3 as well as other important micronutrients such as zinc, β -carotene and vitamin B12.

Other possible application areas for egg yolk oil can be read in Appendix chapter 3.2.3.

4.2.3 Future prospects of egg oil

Some of the largest market opportunity for egg yolk oil in the future is predicted to continue to lie in the cosmetic space. The increasing demand for hair care treatments and the growing demand for natural ingredients is what will raise the sales of egg yolk oil.

There is also a predicted increase in the sales of egg yolk oil for dietary supplements and infant nutrition. The sales of egg yolk oil for dietary supplements reached US\$ 22 million in the year of 2017 which indicates that such egg oil-based products already state a big market share (FACT.MR, 2018).

In terms of new product launches and sales, China and India is foreseen to be the main contributors to the growth of the egg yolk oil market. Therefore, the biggest market of egg yolk oil will be concentrated in emerging economies of Asia-Pacific. However, such markets are not the main focus of Fresenius Kabi since it requires long transportations. There is on the other hand indications of an increasing request for egg yolk oil in North America and Europe as well. Mainly due to new insights regarding the benefits that egg yolk oil can provide (FACT.MR, 2018).

The egg yolk oil sales are evolving towards e-commerce (online selling directly to customers). This means that manufacturers can broaden their bank of customers in terms of demographics and reach out both to people in suburban areas and bigger cities. In a report made by Fact.MR in 2018, they estimate that the global demand for egg yolk oil will exceed 1 million liters by the year of 2028 (FACT.MR, 2018). In conclusion, the prospects of the egg yolk oil market are very positive.

4.3 Choice of product segments

During the extensive qualitative literature study of the global market, with focus on egg yolk protein and egg oil, there have been seven product segments that continuously display as application areas for egg yolk. Four of them are in the section of yolk protein and three of them in yolk oil, all are listed below in table 5:

Table 5. All product segments identified for egg yolk.

Yolk Protein	Yolk oil
Casein Substitute	Dietary Supplement
High Value Nutrition Bars For Old Adults	Hair Care
Specific Proteins	Skin Care
Protein Enriched Products	

Casein substitute

The choice of the product segment of casein substitute is due to the obvious similarities in powder structure and amino acid profiles between the bonus product of Fresenius Kabi and milk casein, (see table 3 in section 4.1.3 Casein). It is therefore a possibility to exchange casein to P080 or P80 within its current application areas.

High-value nutrition product for seniors

The average age of the world's population are increasing and it is an ongoing challenge to provide them with nutritious food. We are in need of highly nutritious, convenient and affordable alternatives of foods enriched with qualitative protein. This is because of the importance of sufficient protein intake, especially for adults over 70 years since they show lower rates of protein synthesis in their body (Nowson, O'Connell, 2015). Due to this, it is believed that the bonus product of Fresenius Kabi would be suitable in production of nutritious bars aimed for seniors. Partly because of its high content of qualitative protein and partly because of the great importance to supply a good balance between protein, micronutrients, carbohydrates and fat for people over 70. In addition, egg yolk include, as mentioned in the report, all essential amino acids in addition to other important vitamins and minerals. It is e. g. a natural source of calcium, iron, potassium, vitamin A, E, D and K.

Specific proteins

Egg yolk consists of a number of useful single proteins that operates on their own. Since there has been an imbalance in consumption of egg white and yolk for a long time, researchers have found new application areas for the accumulating yolk.

Two of them are; taking care of fractions and expand them into new base materials, and extract functional proteins and lipids to either use them directly or process them further into bioactive peptides or lipids. The most promising proteins in yolk are phosvitin, which also can be further processed into bioactive peptides, and immunoglobulin γ (Huang, Ahn, 2019). Specific proteins is a product segment with some constraints due to the fact that the egg yolk has been through a phospholipid elimination and, most probably, are all proteins denatured after the process. However, the peptides can not lose their activity through protein denaturation because they do not have a three dimensional structure. Bioactive peptides and fractions of yolk, proteins that are not depending on activity, are therefore products of interest.

Protein-enriched product

A protein-rich diet is a trend that have grown significantly in the past decades. The increased awareness about the health benefits proteins offer has increased the sales of protein-rich products worldwide. Therefore, this product segment is of interest. Later in this report, the possibilities within three different kinds of protein-enriched products are investigated; chips, candy and ice cream. This is due to the fact that all of them has been enriched with protein before meaning that they for sure lie on established markets.

Dietary supplements

The egg yolk oil is highly nutritious and consists of i.a. saturated, unsaturated and polyunsaturated fatty acids along with other minerals and vitamins (see table 2 in the section 4.1). Some products does therefore simply use the yolk oil as it is and make capsules out of it. Dietary supplements in shape of oil capsules, exists in Europe but are mostly derived from fish. The fish oil market is big and was valued at US\$0.69 in 2014 for the european countries. The market is believed to further increase due to improved aquaculture activity in i.a. UK and Norway (Grand View Research, 2016). The egg yolk oil as supplements has not yet reached this part of the world but do exist on the market in, for instance, Asian countries such as Japan. Yolk oil capsules in Europe can therefore be considered as a “weak signal”, completely up-to-date with the occuring health trend but not yet fully discovered.

Hair care

This product segment is one of the largest application areas for egg yolk today. Yolk oil has been used as a home made treatment against dry hair for centuries, especially in Asia-Pacific (FACT. MR, 2018). It has also proven to be useful when treating damaged hair because of the polyunsaturated fatty acids and specific micronutrients it offers (Healthline, 2017). There are some existing companies on the market that has been using egg oil in their products, for example Eyova® from India who marketed their product as a multi-purpose remedy for damaged hair, dandruff, hair loss and dry scalps (Eyova, 2019). There are also companies, such as Swiss Rausch, that adds egg oil into their shampoo in order to make “a smoothing vitalizing formula for brittle hair and stressed scalps” (Rausch, 2019). Depending on the application area, there are different requirements on the purity of the yolk oil which is an aspect that has to be further investigated in order to know if the bonus product is a suitable option in hair care products.

Skin care

Egg oil can also be used in skin care products due to its wound healing, anti-inflammatory, emollient, anti-aging and antimicrobial properties. These properties are partly due to the phospholipids in yolk oil (Madan, Nanda, 2017). Even though the bonus product of Fresenius Kabi has experienced a phospholipid extraction, it is estimated that it still got 1-3% of them left. This is very advantageous due to the fact that the phospholipids contributes to emulsifying properties which is admirable within skin care (Magnusson, Nilsson, 2013). Other than that, egg oil includes compounds like triglycerides, carotenoids, cholesterol and tocopherols which are also compounds favourable in skin treatment (Madan, Nanda, 2017). There is a lot of accessible information about the benefits of egg oil in skin care, but not many products existing on the market. Therefore we see a great potential for the egg oil in Fresenius Kabis bonus product to enter the market as a competitive alternative.

5. The different product segments

5.1 Casein substitute

As mentioned earlier, we have a theory that the potential application areas for Fresenius Kabis bonus products can be applied to the current food application areas of milk casein due to their similarities in amino acid profiles and their powdered structures. Therefore we chose to look more into the application areas of casein.

Casein is known for its preferable properties; solubility, viscosity, water absorption and its nutritional value and is used within many different areas (NZIC, 2017). As mentioned earlier, casein is produced from skim milk and contains 80% of the total amount of milk proteins. In order to take advantage of the beneficial and useful properties of casein, it is usually produced in two different forms. The difference between them is that they are employed with different clotting agents and they are thus named after the used coagulating agents: acid casein and rennet casein. In addition to these two main types of casein there are two other types of caseins so-called caseinates and co-precipitates (Badem, Uçra, 2017). Caseintes are produced by reaction with alkalis such as sodium, potassium or calcium and are water-soluble derivatives of acid caseins (NZIC, 2017). Co-precipitates are produced by heating or by precipitating treatment with rennet and as a result casein and whey protein complexes are formed (Badem, Uçra, 2017). However, one of the main types, acid casein, can be produced in three different ways depending on which acid that are added in order to precipitate the casein. The precipitate acids that are used are sulfuric, hydrochloric or lactic acid. The most commonly used precipitate acid in Europe is hydrochloric acid because it is a common by-product in chemical industries and therefore is quite cheap. However, the differences in properties of the different acid caseins are very small and therefore they can be used alternately. Nonetheless, the differences between acid casein and rennet casein are bigger. The coagulating agents that are used to produce rennet caseins are chymosin, also known as rennet, and different microbial rennets which are enzymes originated by different microbial fermentation techniques (NZIC, 2017).

The properties of the different types of caseins differ a bit and therefore the application areas alter. However, both rennet and acid casein are insoluble in water and many applications of casein products requires a solved form of casein. Therefore, caseintes; acid casein treated with alkali are used within these application areas due to that they are water-soluble. In order to visualise the differences between the different casein types compared to Fresenius Kabis bonus product P080 table 6 was constructed (NZIC, 2017; Appendix B).

Table 6. Composition of acid casein, rennet casein and two types of caseinates (NZIC, 2017; Appendix chapter 5).

Compound	Acid Casein	Rennet Casein	Sodium caseinate	Calcium caseinate	P080
Protein (%)	85.4	79.9	91.4	91.2	43.2
Fat (%)	1.3	0.8	1.1	1.1	45.8
Lactose (%)	0.1	0.1	0.1	0.1	<0.1
Ash (%)	1.8	7.8	3.6	3.8	2.0
Moisture (%)	11.4	11.4	3.8	3.8	9.0
pH	4.6-5.4	7.3-7.7	6.5-6.9	6.8-7.0	-

According to table 6, we can see that the composition of the different caseins and P080 are pretty similar. The biggest difference is that P080 contains more fat, so it has a greater balance of the nutritions. The altered application areas for the different casein types are illustrated in table 7 (Badem, Uçra, 2017).

Table 7. Function of casein in different application areas and products (Badem, Uçra, 2017).

Food Category	Casein product	Function
Baked products	Casein, caseinates	Nutrition, water binding
Cheese products	Rennet casein, acid casein, caseinates	Fat and water binding, texture, matrix formation
Fermented milk products	Caseinate, co-precipitate	Emulsifier, stabilizer, water binding, viscosity building
Coffee whiteners	Sodium caseinate	Fat emulsification
Beverage	Caseinate	Nutrition, emulsifier
Confectionary	Caseinates, co-precipitate, acid casein	Texture, foam stabilizer
Dietary preparation	Caseinate	Nutritive value
Cultured products	Sodium caseinate	Fat emulsifier, stabilizer
High fat powder	Sodium caseinate	Fat emulsifier
Ice cream	Sodium caseinate	Texture, stabilizer
Infant food	Rennet casein, acid casein	Nutrition
Instants breakfasts	Sodium caseinate	Nutrition
Meat products	Sodium caseinate, co-precipitate	Nutrition, fat emulsifier, water binding, texture, structure formation
Nutritional food bars	Casein, caseinates	Nutrition, texture
Pasta and snacks	Casein, caseinates	Nutrition, texture
Soups and gravies	Sodium caseinate	Nutrition, thickener
Sport drinks	Sodium caseinate	Nutrition
Whipped toppings	Sodium caseinate	Film former, fat emulsifier
Desserts	Caseinate	Emulsifier, foam stabilizer,
Extruded foods	Caseinate, rennet casein, acid casein	Texture, nutritive value, emulsifier

As visualised in table 7 above, we can see that casein has very many different food application areas. As illustrated in table 3 and table 6 the similarities between casein and the bonus product of Fresenius Kabi are the amino acid profiles, the compositions of the two substances and the similar powder structures. In other words, the nutritional compositions and appearances are the similarities between them. Therefore, the conclusion is that the food application areas where casein is used as a nutrient are promising application areas for the bonus product. According to table 7 above, these are: baked products, beverage, dietary preparation, infant food, instant breakfasts, meat products, nutritional food bars, pasta and snacks, soups and gravies and last sport drinks. However, due to that the properties of the bonus product are relatively unknown, some casein application areas are not as suitable as others. Within the food application areas where casein is used as a stabilizer, it is unknown if the bonus product could work in the same manner. Therefore, a decision has been made to disregard these application areas even though the bonus product could work as a nutritional agent. This leaves us with the following possible areas of application for the bonus product: dietary preparation, infant food, instant breakfasts and sport drinks.

However, it is hard to find information about the dietary preparation market. It is even hard to find data on what kind of substances that are used as dietary preparation agents. This makes it difficult to define this application area. Therefore, a decision has been made to exclude dietary preparation as a possible application area for Fresenius Kabi's bonus product. It is hard to do a complete analysis of this area if there is insufficient information available. Furthermore, the consequence of this is that it would be difficult to estimate the suitability of the bonus product within this area.

In addition, protein powder is also a popular application area of casein. This is therefore a possible application area for the bonus products due to its similarities in structure and appearance. In summary, the possible application areas for the bonus product within the product segment casein substitute are infant food, instant breakfasts, sport drinks and protein powder.

5.2 High value nutrition bars

Populations in western countries are extending their life time as a result of better living standards and improved healthcare. In 2011, the first so called “baby boomers” reached the age of 65. The baby boom generation refers to the population that was born after World War II, between 1946 and 1964, when there was an extreme increase of births worldwide (Baby Boom Generation, 2019). As a result of the massive amount of newborns between these years, the amount of people over 65 could grow to be 69 million by the year of 2030. That means that the number of individuals over 65 will outnumber the population of young people under 18.

This indicates a risk of insufficient amount of caretakers in the future. The number of people that needs to be taken care of will probably be too many to manage for today’s social security, elderly care and medical care (Mechanic, 1999). In addition, the risk of malnutrition and subclinical deficiencies amongst elderly people is increasing. This is mainly because of diminishing appetites due to psychological, economical and social changes that comes with aging (Blumberg, 1997).

In a presentation held by Kateria Tucker at Tufts university in Boston MA, the change of dietary needs when aging was discussed. Tucker presented reasons why elderly require a nutrient-dense diet in order to maintain health. One reason is that older adults show less efficient absorption of nutrients which mean that they need an increased intake of such foods. The utilization of medicines amongst elderly also have an impact on their overall food intake. Some medications can in fact affect the uptake of nutrients such as B-vitamin and hence have a negative effect on the metabolism of these micro nutrients. In addition, elderly people tend to do less physical activity and have a slower metabolism. This leads to a lower energy requirement which contributes to a decreased appetite. Less hunger in combination with the fact that many elderly experience changes in smell and taste, has led to a pattern of less varying diets amongst seniors (Institute of Medicine (US) Food Forum, 2010).

Mobility constraints and reduced ability to swallow are also factors contributing to the deficient energy intake amongst elderly (Institute of Medicine (US) Food Forum, 2010).

Foods like meat and hard vegetables can be very problematic to chew and digest which limits their choice of foods. Another aspect that is worth mentioning is the social factors involved. Many seniors explain their lost interest of food as a consequence of not having anyone to share their meals with (Birkett, 2016). While the populations of elderly people is increasing, the task of providing all these people with sufficient nutrients become even more challenging. Highly nutritious, convenient and affordable alternatives of foods is therefore needed to solve this future problem.

A big contributor to morbidity and reduced life quality of older people is a deficiency of protein. Proteins are essential building blocks and are especially important for adults over 70 years since they show lower rates of protein synthesis in their body. Weak muscles are common amongst elderly due to age related muscle loss which in turn increase the risk of fractures from falls (Nowson, O'Connell, 2015). Foods with sufficient protein content is therefore of highest importance for this group of people.

5.2.1 Existing products for elderly

Currently, there are a wide range of existing products that elderly people can use as a convenient alternative for food. There are many balanced supplements which can be bought from general stores. Such products does often come as powders which one can mix with liquid into soups, shakes or hot drinks to raise the protein level or energy intake. They are commonly used as supplements which one can take between, or aside of meals in order to keep up the calorie or protein intake throughout the day. Such products does normally not fill the full dietary requirement to work as a whole meal (Cancer Research UK, 2017). There are however also complete meal replacements for elderly which can be prescribed by a doctor or dietitian. Such products contain enough nutrients to theoretically replace a meal. These products most often come as a liquid in bottles either as fruit juices or milkshakes and are intended to be used by people that have issues with digesting or chewing normal foods (Cancer Research UK, 2017). If it is possible to to eat regular food in some extent however, that is recommended instead of only drinking meal replacements. The above mentioned products are very convenient for people that experience chewing- and digestion problems. But the reason why elderly do not eat sufficient nutrients are not always due to such problems.

As earlier mentioned many elderly do not sense the taste of certain foods, do not like to eat without company or simply do not have the strength to shop and make themselves a proper meal. For these people, shakes and drinks might strike as a monotonous and less appetizing alternative. Bars containing the same nutritious content could replace such products for people seeking for non-liquid alternatives.

Most bars on the market today are directed towards a younger customer segment who are looking for supplements to enhance physical performance or to control their weight. They are most often high in protein derived from milk or soy and have a low calorie content. Such bars meet the customer demands for foods that promote lean muscle mass without sugars or fat that might affect weight and physical attributions. There are however also energy-rich bars on the market, intended to be taken before physical activity or as a snack between meals. Out of many options to choose from, few are intended and marketed as a product directed towards older adults. Nestlé did however develop a nutrition bar that was launched in stores in 2013 with the purpose to provide older adults with the specific nutrients they may be lacking. The product is called BOOST® Nutrition Bars and are meant as a complement in a healthy senior diet (New Boost Nutrition Bar Provides Nutrition On-The-Go, 2013). The bars contain proteins and 21 different vitamins and minerals. Several similar bars exist but they are very rarely launched as a bar directed towards seniors. Nutrition facts of BOOST® Nutrition Bar and some other similar bars are listed in table 8.

Table 8. Nutrition facts of common nutrition bars (Protein & Meal Replacements at Kroger, 2019; NutriBar Chocolate Peanut Butter Protein Bars, 2019).

Nutrients	BOOST® Peanut Butter Chocolate Nutrition Bars (50.0g)	Balance Bar® Peanut Butter Nutrition Bar (50.0g)	NutriBar® Original Chocolate Peanut Butter Bar (65.0g)
Energy (Kcal)	200	200	270
Tot. Fats (g)	7	7	9
Saturated Fat (g)	3	3	4.5
Trans Fat (g)	0	0	0
Sodium (mg)	170	170	250
Tot. Carbohydrate (g)	22	21	33
Dietary Fiber (g)	1	0	3
Sugars (g)	12	17	19
Protein (g)	11	15	13

Apart from the nutrients mentioned in table 9, these bars also contain important micronutrients. BOOST® Nutrition Bar, which is the bar that is specifically formulated to meet the nutritional needs of seniors, contain 50% of the daily recommended intake of calcium, which is known for maintaining strong bones. It also contain several other minerals and vitamins that may be deficient in the diet of seniors, such as magnesium, potassium, choline and Vitamin E, K and A (New Boost Nutrition Bar Provides Nutrition On-The-Go, 2013). The protein content in these bars are based on soy protein isolate which is one of the most common protein ingredients in bars along with whey protein derived from milk (Brown et al., 2004).

Egg yolk does, as earlier mentioned, include all essential amino acids in addition to other important vitamins and minerals, many of which are included in common nutrition bars. Egg yolk work as a natural source of calcium, iron, potassium, vitamin A, E, D and K, all of which is required for a healthy diet amongst older adults. As a source of protein, it is a cost-effective alternative which offers a wide range of nutrients that needs to be added as a separate ingredient in bars based on soy- and whey protein. In table 9, some nutrition facts of Fresenius Kabi's bonus product P080 are listed.

Table 9. Nutrition facts of Fresenius Kabi's bonus product P080 (Appendix, chapter 5).

Nutrients	P080 (100g)
Energy (Kcal)	579
Tot. Fats (g)	45.5
Saturated Fat (g)	13.4
Trans Fat (g)	<0.1
Sodium (mg)	-
Tot. Carbohydrate (g)	<0.3
Dietary Fiber (g)	<0.3
Sugars (g)	<0.25
Protein (g)	43.5

Since it's extremely important for people over 70 to get a good balance between protein, micronutrients, carbohydrates and fats, egg yolk protein show great potential as a main ingredient in nutritious bars aimed for older adults. The bonus product of Fresenius Kabi, P080, contain the range of amino acids that soy protein isolate offers along with many other important micronutrients (Soy protein isolate: nutritional value and analysis, 2019). It is also a more environmental friendly alternative than soybeans. We therefore see great potential for the bonus product from Fresenius Kabi to have applications within this product segment.

5.3 Specific egg yolk proteins

In 2019, Huang and Ahn wrote the article "How can the value and use of egg yolk be increased?" where they described the reason and possible solutions to the fact that the consumption of processed egg in the US has stagnated during the past years. They believe that it is due to the imbalance in request of egg white and egg yolk. It is commonly known that egg white is rich of protein and low in calories which leads to a great desire from consumers and increased sales. However, this also leads to an accumulation of the rest products from egg white consumption which is egg yolk. The benefits of egg yolk are not as widely spread as they are for white and it has been several, unjustified, accusations on yolk saying that it is unhealthy due to e.g. high cholesterol content (Huang, Ahn, 2019).

Moreover, there are plural application areas for the yolk and two of them are:

- Take care of fractions of egg yolk and expand them into new base materials to use in, for instance, foods or food processing.
- Extract different functional proteins and lipids and either use them directly, or process them further into bioactive peptides which can be used in pharmaceuticals, nutraceutical and cosmeceutical agents (Huang, Ahn, 2019).

These two application areas together confirms the chosen product segment of “specific proteins in egg yolk”. The bonus product of Fresenius Kabi contains all proteins from egg yolk but in smaller amount, since it has experienced an extraction of phospholipids. We also believe that all proteins are denatured due to the extraction and therefore bioactive protein may not be a suitable application. However, the peptides can not lose their activity through protein denaturation because they do not have a three dimensional structure. Bioactive peptides and fractions of yolk, proteins that are not depending on activity, are therefore products of interest.

One example of protein extraction from egg yolk is visualised in figure 10.

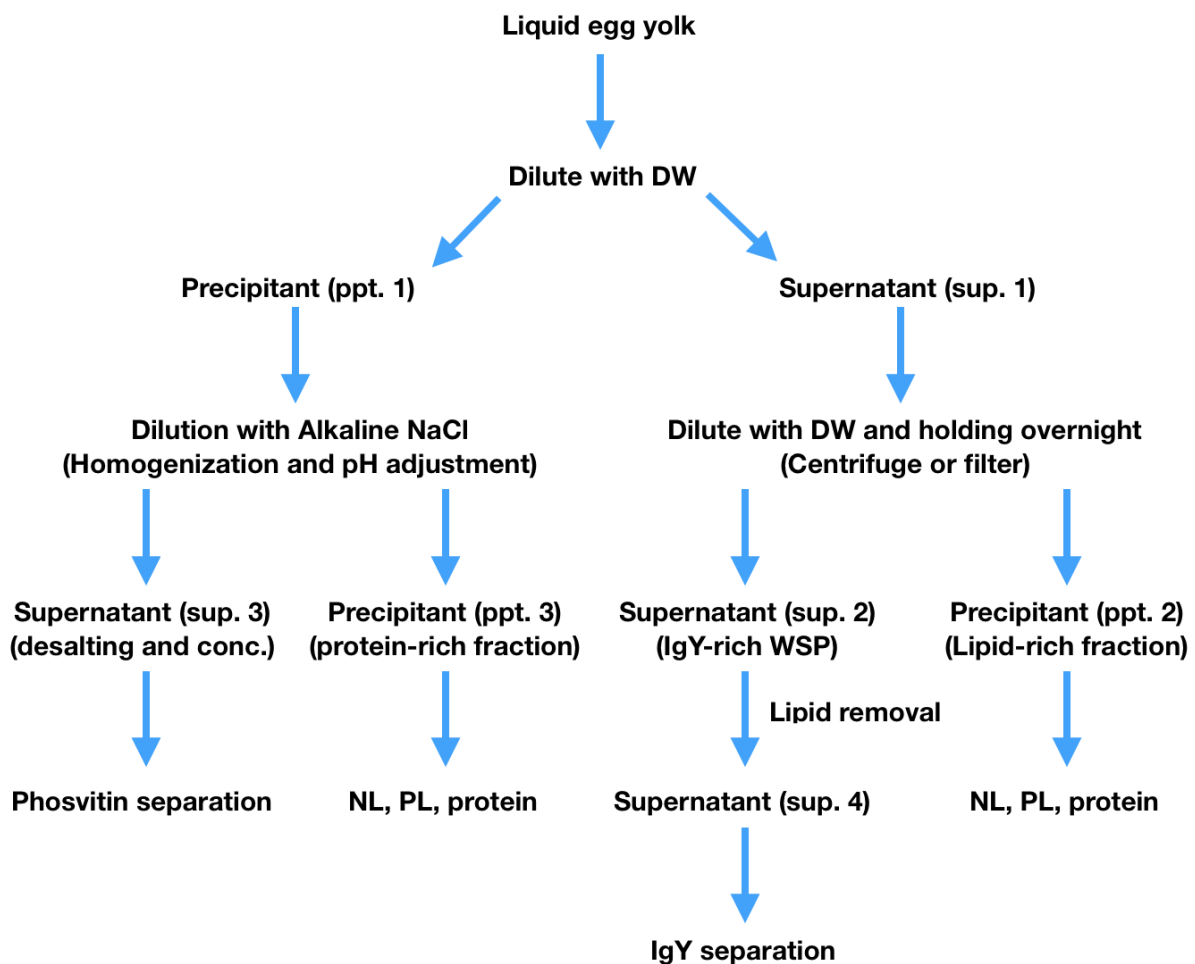


Figure 10. Assuming the start material is liquid egg yolk, this figure represents a possible extraction method for different proteins (Huang, Ahn, 2019).

Another name for γ -livetini is γ -immunoglobulin, the antibody IgY. Phosvitin and γ -immunoglobulin are the most important, valuable proteins from yolk (Huang, Ahn, 2019).

Phosvitin

Phosvitin is a highly phosphorylated protein that, in its native form, is inaccessible for human body and has to be digested to minor peptides. These peptides can thereafter bind to other molecules to form complexes, where they become reachable to us. Of all the amino acids in phosvitin, more than half of them are serine and out of all the serines, about 90% of them are phosphorylated. This means that phosvitin is a protein with a lot of negative charges and has therefore a strong metal chelating, antioxidant, emulsifying and antimicrobial activity. If phosvitin stays in a three dimensional structure as a protein, it forms insoluble complex with metal ions and the body can not utilize i.e. calcium and magnesium from food in presence of phosvitin. However, these negative attributes disappear if phosvitin is fragmented into peptides (Samaraweera, 2012). These peptides are called phosphopeptides and are considered as one of the most interesting biomolecules. In contrast to the original phosvitin, they increase calcium or iron bioavailability due to prevention of insoluble calcium phosphates or complexes with iron (Samaraweera et al., 2012).

In 1947, Mellander discovered that phosphopeptides (derived from casein at that time) increased the calcification of bones. He showed that phosphopeptides are able to enhance the absorption of calcium in the gastrointestinal system even though Vitamin D is not present. It was later discovered in 1977 that phosphopeptides also enhance iron absorption in the gastrointestinal system and therefore the iron availability. Naturally iron absorption is low in that area due to the heavy ferric hydroxide complexes that iron creates (Derman et al., 1977). Furthermore, these properties make phosphopeptides useful as metal carriers and of metal ions and possible as nutraceuticals. There have already been an approval of casein phosphopeptides as nutraceuticals in Japan before year 2000 (Samaraweera et al., 2012). According to Huang and Ahn (2019), phosvitin itself enhanced the immune system significantly due to stimulation of pro-inflammatory mediators.

IgY

IgY is an antibody that is mainly derived from serum IgG by immunized chicken. Antibodies produced from an immunized method have the ability to modulate immune response and have the possibility to treat diseases, both human and animal. However, the IgY in chicken egg yolk holds for 5-7 mg/mL, where about 10% is antigen-specific, which is a bigger amount than from mammalian sources. This means that the productivity is better from laying hens than from invasive blood method in mammals, and at the same time a lot more animal friendly. Additionally, egg yolk has great possibilities for production of antibodies and those from chicken have more potential than from mammals. Known application areas for IgY are to monitor enteric infections, whether it is from bacteria or viral, to use in immunodiagnostics and to analyse food in order to find pathogens (Huang, Ahn, 2019).

5.3.1 In summary

There is no doubt that egg yolk and its proteins offers great possibilities as value-added components to be used in food as well as in nutraceutical, pharmaceutical and cosmeceutical. However, further research on bioactive peptides should not be specified to single, individual peptides but to everyone in hydrolysate. Only the sky, time and money is the limit. When it comes to bioactive lipids, it is a big challenge of separating them from sphingomyelin. They have been studied since before 1979 and still, nobody has managed to create a bioactive lipid (Huang, Ahn, 2019).

To summarize these facts above, it is believed that specific proteins are a fantastic application areas for Fresenius Kabi's bonus product since it contains all components except for phospholipids from egg yolk. However, the process of extraction is difficult, time- and resource consuming which leads to the conclusion of:

- If Fresenius Kabi wants to invest in the product segment of specific proteins, they should outsource the extraction to another company. Perhaps, it would be possible to refine the product in some extent in-house in order to raise the value of the product.

5.4 Protein-enriched products

A protein-rich diet is a trend that have grown significantly in the past decades. The increased awareness about the health benefits proteins offer has increased the sales of protein-rich products worldwide. The bodily norms and idealised appearances encourage all sorts of diets, without sugars, fats and a decreased carbohydrate intake. This is something that the snacks producers in western countries have used as a opening for new product launches.

Protein chips and snacks

On the shelves in general supermarkets you can find several protein enriched alternatives for snacks. In scandinavia for example, chips based on lentils, quinoa and chickpeas are getting more popular. Some of the biggest snacks-brands in sweden such as OLW and Estrella currently offer these chips in a broad assortment of different flavours.

Such chips has grown its popularity over the past three years and are marketed as an alternative with less fat and a higher percentage of protein than regular potato chips. The protein in these products comes from the fluor which is either based on lentils, chickpeas or quinoa as a substitute against the potatoes (Estrella, 2019; OLW, 2019).

Another brand that also have adopted their assortment of products after the occurring protein-rich diets, is the american lifestyle nutrition brand QUEST nutrition®. In 2014, they launched Protein Chips which is based on a blend of milk protein isolate and whey protein isolate, which is similar to the protein content that is normally found in bars or protein powder (Quest nutrition, 2019). These Protein Chips also come in different flavours and textures, imitating both nachos and regular potato chips.

The ingredients and protein content of these alternative protein-enriched snacks differ between brands. Some nutrition facts of four products are described in Table 10.

Table 10. Nutrition facts of some popular protein snacks on the market (Estrella 2019; OLW 2019; Quest nutrition, 2019; Gårdschips, 2019).

Product	Estrella Linschips Sour cream & Ranch (100g)	QUEST nutrition® Protein Chips Cheddar & Sour cream (100g)	OLW Kikärtsschips Chili & Mild vitlök (100g)	Gårdschips Quinoa Snacks Jalapeno & creme fraiche (100g)
Energy (Kcal)	447	437	470	487
Fat (g)	16	14	20	22.4
Total Carbohydrate (g)	60	15.6	55	66
Sugar (g)	3.4	0	3.6	2.4
Protein (g)	13	65.6	14	4.1
Salt (g)	2.3	0.69	2.5	1.8

These and similar products generally contain acidity regulators, synthetic flavours and starch of different kinds. Hence, an all natural alternative of protein rich snack is yet to be created. In addition, both the chips from Estrella and QUEST nutrition® contain traces of milk and are therefore not suitable for people with severe milk allergies (Estrella, 2019; Quest nutrition, 2019).

More new products based on different protein sources or protein-rich flours are emerging and the assortment of protein chips are rapidly increasing. Now there are, in addition to previously mentioned alternatives, also hummus-based snacks and oat-based snacks. The occurring trend of substituting potatoes towards richer sources of proteins creates yet another alternative for Fresenius Kabis bonus product.

P080 does not only serve as a good source of essential amino acids, it also have some emulsifying properties which could be beneficial when producing a product with the same texture as chips. Even though vegan alternatives of snacks or candy are getting more popular, there is still a demand from non-vegan people for a healthier, more natural snack alternative. These people make up the customer segment where egg yolk protein-based snacks could have a shot at being a competitive alternative. However, to have a chance of competing against existing alternatives, one should try to make these snacks as natural as possible, without synthetic compounds and flavours.

Protein ice cream

Egg yolk has many applications in food industry, both due to its physical properties and to other characteristics. In the process of producing ice cream, it has been known for decades that yolk is an essential ingredient. In journal of Dairy Science (1929), the qualities of whipping were investigated depending on the relation between concentration egg yolk and the ice cream mixes. They found out that “the improvement in whipping qualities noted is in most cases in direct proportion to the concentration egg yolk present” (Martin, Caulfield, 1929).

One part of the segment of “protein enriched products” in this report is therefore “protein enriched ice cream”, due to the fact that egg yolk and its characteristics already correlates with the popular summer sweet. The idea is to enrich regular ice cream with the refined bonus product of Fresenius Kabi, P80. The possible competitors to such product are the “new” kind of ice creams that differentiates from the ones we all have seen in the store-freezers for years, those who turns to customers of the big trend of fitness. Moreover, it is a long shot trying to create a vegan-alternative due to the importance of egg in ice cream to get proper texture. Therefore, the customer segment of existing protein-enriched ice creams would be the same as for the potential product derived from Fresenius Kabi’s bonus product. These people have already chosen non-vegan and are looking for a bigger protein intake while eating something luxurious.

Here is a list with some of these products:

- ProPud
- Add ice cream
- Häagen Dazs
- Barebell
- Oatly
- Lohilo

All of them are marketed as a healthier option than regular ice cream with lower amount of calories and carbohydrates and a higher amount of protein. One of them, Barebell, even state that their products are a “guilt free pleasure” which refers to a healthy snack with as good taste as the original (Svenskt kosttillskott, 2019). However, there are a lot of opponents that says that the difference between the healthy and regular ice cream is not that big. A licensed diet- and nutritional advisor, Annika Malm, compared Barebell’s Strawberry Vanilla and Magnum’s Strawberry White. She found out that it only differed 30 calories between them; 28 gram carbohydrates and 2 grams of fat more in Strawberry White while Strawberry Vanilla had 6.5 gram more protein (Clean eating by Annika, 2018).

Protein candy

Over the past decade, the awareness in the world about nutritious food has increased. As mentioned earlier, as a result, has it become very trendy to have a diet consisting mainly of proteins. Therefore, the production and selling of protein-enriched products have increased. On the market today we can see several low calorie protein-enriched bars but also protein-enriched snacks such as ice cream, chips and candy bars. Here we can see an application area for the bonus product of Fresenius Kabi due to its high nutritional value och texture properties. However, the chosen focus is on the protein-enriched candy and not the low calorie protein-enriched products, such as sport bars. This is because the bonus product does not only contain proteins but also other good nutritions with a calorie value. In addition, it is desirable to use as much as possible of the bonus product in the future product. The market of sport bars is also very well established and there is a high level of customer loyalty towards the brands on the market today.

If we look into the current market among protein-enriched candy we can see several examples. In table 11 some companies and their products are listed.

Table 11. An overview of protein-enriched candy that exist on the market today (Bodyfirst Nutrition, 2017; Herbaland, 2019; Pandy Protein, 2019; My protein Sweden, 2019; Trendhunter, 2019; Protein Outlet, 2019).

Company	Type of product	Protein source	Characteristic
Fulfil Nutrition	Candy bars	Soy and milk protein	Vitamin and protein-enriched candy alternative
Herbaland	Jellies	Pea protein	Plant-based protein-enriched gummies
Pandy protein	Candy bars, chocolate and jellies	Mix of milk proteins, hydrolysed gelatine combining with amino acids	The protein candy
Myprotein	Candy bars, chocolate and more	Mix of milk proteins	Snacks with high protein content
Mars Inc	Candy bars	Mix of milk proteins	Protein-rich candy bars

As written in table 11, a common protein source in protein-enriched sweets is milk proteins. Milk- and egg proteins have similar content, are not plant-based although vegetarian. Therefore these types of protein sources attracts the same customers. Protein-enriched sweets could hence be a promising application area for the bonus product of Fresenius Kabi.

5.5 Egg oil as dietary supplements

Earlier in the report, in the section of “global egg oil market”, one can read of different application areas of yolk oil used today. One of the chosen product segments of this study is the use of egg oil as food supplements due to the highly nutritious fatty acids, vitamins and minerals present in yolk oil.

In may 2018, Globe News Wire, wrote that using egg yolk oil as dietary supplements and infant nutrition covers a significant part of the total consumption of egg oil (FACT.MR, 2018). It is for example a company in Japan, Orihiro, that has made a product named Orihiro Garlic Extract & Egg yolk & Vegetable Oil which are capsules that should be eaten daily. The capsules are composed by a combination of oil from garlic, yolk and vegetables and says to provide the body with all nutrients and microelements needed. The characteristics wanted from garlic oil are disinfection of bacteria and infections, improved immune system and prohibition of diseases such as a cold or flu. Egg yolk oil contributes with increased brain function such as better memory and therefore decrease the emergence of senile dementia. Continuously intake over time may also have positive effects on reaction rate and other cognitive capacities. Moreover, there are components in egg oil that are essential for eye health which means that regular usage of these capsules helps to preserve good visual acuity. It also contains vitamin E which is one of the reasons why yolk oil is so popular in skin care, a subject that is further investigated in the product segment of “Egg oil in skin care” (Japanesebeauty, 2019).

There are some other egg oil based products as dietary supplements in Japan but yolk oil market is in general dominated by hair- and skin care products. However, supplements derived from yolk oil seems not to have reached Europe and the western countries yet, or are consumed in low quantities. Fish oil on the other hand, is a product highly consumed by people in the european countries. In 2014, the European fish oil market was valued at 0.69 billion USD and was believed to further increase due to improved aquaculture activity in i.a. UK and Norway (Grand View Research, 2016). Therefore, dietary supplements derived from egg yolk oil would be a potential application area for the bonus product of Fresenius Kabi.

There are some existing competitors on the market, operating far away on another continent or producing products with other properties. Perhaps, yolk oil capsules are today what we would call- a weak signal and maybe a crazy idea. But the demand of oil supplements do exist and the occurring health trend eventuate in people conscious of the benefits of nutrients and vitamins, especially when they originate from natural material.

5.6 Egg oil in hair care products

One of the largest application areas for egg yolk oil today is in hair treatments. Yolk oil have been used as a home made treatment for dry hair for centuries, especially in Asia Pacific. On some regional markets however, especially in China and India, there are commercialized yolk based hair products. According to the research report made by Fact.MR, egg yolk based hair treatments for commercial use are also expected to hit Europe and North America in a near future. This will give egg yolk oil new customer demographics and potentially increase the manufacturing and consumption of yolk oil worldwide (FACT. MR, 2018).

The yolk oil has proven to be especially useful when treating damaged or dry hair. This is due to its content of polyunsaturated essential fatty acids and specific micronutrients, that can be linked to healthy hair as well as proper hair growth (Healthline, 2017). Such micronutrients are Vitamin D, biotin and iron which all exist in a significant amount in egg yolk. Even though much focus lies on the actual hair, yolk oil can also be used in treatments against dry scalps (Healthline, 2017). Longer exposure of sun in combination with saltwater can cause dry and damaged scalp which in turn can affect the hair roots. Hence, egg yolk can provide a source of nourishing fats and vitamins to the capillary matrix. There are however limited research regarding what range and amount of these vitamins and minerals one should use to prevent hair loss (Guo, Katta, 2017).

Still, many people seek to improve their quality of hair and hair growth by taking supplements containing i.a the previously mentioned nutrients. Such supplements or formulas are easy accessible for purchase but are often quite expensive. What the products or supplements that we use to improve our quality of hair contain are often neglected. We are generally far more careful when it comes to pharmaceuticals and foods. Vitamin A, and E and selenium are for example common ingredients in popular hair growth supplements even though these nutrients have been coupled to hair loss when they are over-supplemented (Guo, Katta, 2017).

Existing products

One hair care product based on egg oil which is sold on i. a. Amazon is Eyova®'s Hair Nutrient with egg oil. Eyova® is a company located in Mumbai, India, focusing only on this product which is marketed as a multi-purpose remedy for damaged hair, dandruff, hair loss and dry scalps. In other words, an organic and effective treatment against all kinds of hair problems (Eyova, 2019). It contains OLEOVA (egg oil), canola oil and fragrance and has grown interest amongst customers worldwide, but mainly in the US, for its short list of ingredients and its organic content.

There are not only whole oil treatments based on egg oil, there are also shampoos with egg yolk oil as a “selling” ingredient. Rausch, a herbal cosmetics brand from Switzerland launched a nourishing shampoo containing egg oil. The product is marketed as a smoothing vitalizing formula for brittle hair and stressed scalps and contain fresh egg yolk along with wheat germ extract. This product does however also include some proteins like lecithin from egg yolk, hence are not only containing the oil from yolk specifically (Rausch. 2019).

On the market of hair care, formulas without alcohols, silicones and parabens are increasing in popularity. This is something that big hair care companies have caught up on and many are substituting synthetic or chemical ingredients to organic and natural ones. Pure egg yolk oil might be a bit too “natural” for some to put in their hair, but it seems to have a selling effect when it is mentioned as a nourishing ingredient i common daily hair care products. The purity and content of the egg yolk oil differ depending on its purpose as an ingredient, and one would have to look into such product requirements further in order to know if Fresenius Kabis egg yolk oil is a suitable option in hair care products.

5.7 Egg oil in skin care products

As mentioned in the section about the global egg oil market, there are various application areas for egg oil. The usage of egg oil is mostly wide spread in Asia, where it is used within many markets. One of the markets is skin care due to its wound healing, anti-inflammatory, emollient, anti-aging and antimicrobial properties. This is because egg oil contains compounds like triglycerides, carotenoids, cholesterol, tocopherols and phospholipids which contributes to the mentioned properties (Madan, Nanda, 2017). Fresenius Kabi's original bonus product, P080, is the rest product after the earlier specified phospholipid extraction. However, after the phospholipid extraction, Fresenius Kabi have estimated that there are still around 1-3 % of phospholipids left in the bonus product P080. This is very advantageous due to the fact that the phospholipids, among others, contributes to emulsifying properties which is favorable within skin care formulas (Magnusson, Nilsson, 2013). Another favorable property among skincare products are an emollient characteristic which the cholesterol in the egg oil contributes to. The cholesterol has an ability to nourish and moisturize the skin due to that the oil is protein-free and therefore it can fastly be absorbed by the skin. The protein-free feature of the egg oil is also profitable due to that it can be used by those who are allergic to egg proteins (Madan, Nanda, 2017). Therefore, we have chosen to look into the product segment skin care as a possible application area for the egg oil of Fresenius Kabi.

In order to specify the current egg oil-based skincare market, different products within this product segment as been examined. In table 12 some facial skin care products containing egg oil are listed.

Table 12. An overview of facial skin care products containing egg oil (McDougall, Andrew, 2013; Charismon®, 2019; Ecovatec Solutions inc., 2015; Vitellus, 2018).

Company	Product name	Amount of egg oil	Characteristics
Natural Sourcing	Natural Sourcing Egg oil	100 %	Healing dry skin, reducing wrinkles
Charismon®	Crème du CIEL	4.5%	Prevention of premature aging and increased elasticity and firmness of the skin
Ecovatec Solution INC	Ecovatec's Egg Oil	100 %	Moisturizer, anti-oxidant, skin penetration enhancer and skin conditioner
Vitellus	Pure Extra Virgin Egg Oil	100 %	Moisturizer, anti-oxidant, skin penetration enhancer and skin conditioner
Vitellus	Nourishing Egg Oil Face Oil	It contains Egg Oil, Coconut Oil, Camellia Oil, Lavender Oil, Patchouli Oil and Ylang Ylang. The amount of egg oil is unclear	Reinforces skin barrier, anti-inflammatory, clears pores, anti-bacterial, treats atopic eczema, promotes wound healing

As can be visualised in table 12, there are several skin care products containing egg oil on the market. However, there are a lot of accessible information about how good the egg oil is for the skin, but there are not as many products on the market as you think. Therefore we see potential for the egg oil of Fresenius Kabis bonus product to enter the market.

6. Evaluation of product segments

In order to investigate which of the above mentioned product segments that Fresenius Kabi's bonus products had their best application possibilities within, the framework of Porter's five forces was used. Every evaluation was made by the supposition that the bonus products have been processed into a potential, fictive product. This can either be done in-house by the Fresenius Concern, in an alliance with an external partner or the bonus product can be sold as raw material. However, this is not something that has been taken into account when doing the evaluations, since it is a decision to be made by Fresenius Kabi. The number of factors linked to each force was restricted due to the limited level of information available regarding each product segment and it is important to not base conclusions on insufficient data or facts. Furthermore, these evaluations include reflections and conclusions made by the authors of this project which should not be taken as scientific facts but rather discussions and assumptions based on gathered material.

To investigate the bargaining power of buyers today, it was decided to focus on four factors. The number of customers were estimated, as well as the price sensitivity within each product segment respectively. The buyer's ability to substitute products were later investigated and the differences between existing products within the segments were identified. A similar approach was used when defining the other forces and evaluating the other factors that were linked to each force respectively. The chosen factors for investigating each force can be visualised in figure 5 and the overall competitive intensity of each segment is summarized in table 13 and 14 in the end of this chapter, in order to compare the strength and weaknesses between each segment. Based on this comparison, it was decided which products within the evaluated product segments that were the most promising. This was done by ranking the different forces as high, medium or low for each segment to get a clear overview of the evaluations.

The entire evaluations of the product segments can be found in Appendix, chapter 4.

6.1 Summary of Product Segment Evaluation

In this section, a summary of the conclusions from Porter's five forces is presented. The complete evaluation of each product segment and its associated references can be read in Appendix chapter 4.

6.1.1 Casein substitute

Whole evaluation of this product segment can be read in section 4.1 in Appendix.

Power of buyers

Infant food - High

Due to the large amount of manufactures and products on the infant food market, the customers have a lot of options to choose from (see factors; *number of customers* and *difference between competitors*). However, many of the supplier's casein-based products are very similar to each other in terms of price, content and appearance, making the competition strong (see factor; *difference between competitors*). This also makes it harder for the customers to obtain a brand loyalty towards a specific brand (see factor; *buyers propensity to substitute*). In addition, there are always new first time parents on this market, meaning that all brands are new for these customers which affect the long term brand loyalty (see factor; *brand loyalty*). However, some brand loyalty exist among customers that have infants with specific needs, for instance tummy troubles, who probably stick to products they know work for their infant (see factor; *difference between competitors*). In summary, the power of buyers among infant food can be considered as pretty high.

Instant breakfast - High

Within this area there are also many manufacturers providing both liquid- and powder-based instant breakfast, and the number of customers are many (see factor; *Number of customers*). The casein-based products provided by different brands are very similar to each other in terms of price, offered flavours and appearance, indicating that there is competition between the suppliers (see factor; *difference between competitors*). The similar options on the market makes it harder for the customers to obtain a brand loyalty towards one single brand (see factor; *brand loyalty*).

However, the products are often bought by people on the go, meaning that they are stressed and have less time to investigate what is new in the store shelves. Instead, they choose a product provided by a brand that are familiar to them, indicating on some brand loyalty (see factor; *brand loyalty*). In conclusion, the power of buyers is estimated to be relatively high within this area.

Sports drink - High

The number of customers within this area are a bit less due to the fact that the targeted group are smaller in size (see factor; *number of customers*). However, the number of sports drink customers is increasing because of the increased awareness of nutritious food in the world, especially in the western world. Also, the fitness trend has made people more interested in these types of products. Therefore the number of sports drink manufacturers is increasing with time (see factor; *number of customers*). The casein-based products on the market are however very similar to each other in terms of ingredients, flavours and calorie content making it a competitive and price sensitive market (see factor; *difference between competitors*). Therefore, the power of buyers is estimated to be high.

Protein powder - High

The amount of customers within this area are even smaller comparing to the earlier mentioned areas due to that these products are mainly used by interested fitness people (see factor; *number of customers*). However, the number of customers within this area is also increasing, general training interested people are now starting to use these products as well. Therefore, many suppliers are now providing such kind of products. The differences between the products are notable, there are products based on various protein sources. The mixed protein powders can differ a bit regarding the amount and the included protein sources (see factor; *difference between competitors*). However, the casein-based products are in general pretty similar to each other in terms of price and appearance (see factor; *number of substitute products available*). The conclusion is that the power of buyers within this area is high.

Threat of substitute product

Infant food - Medium

The amount of big manufacturers providing similar casein-based products on the infant food market is larger which makes it harder for new products and brands to enter the market (see factor; *number of substitute products available*). However, new customers enter the market all the time, and the most important thing for them is that the products contain clean ingredients with high nutritional values (see factor; *buyers propensity to substitute*). This increases the possibility for new products to enter the market. Additionally, milk and egg are both substances from animals and therefore, the buyer would probably not care if milk was exchanged to egg. In that way, the threat of a substitute product is medium.

Instant breakfast - Low

The stressed lifestyles people have today have increased the interest of fast breakfast alternatives which has boosted the market in terms of number of available products (see factor; *number of substitute products available*). The number of suppliers of similar casein-based products are many and therefore it can be hard for newly launched product to hit the market (see factor; *buyers propensity to substitute*). Additionally, the customers time constraints are problematic for new products due to that the customers do not have time to scan the store shelves. Instead, they probably take a product they recognize from before. However, due to that casein-based instant breakfasts are very similar to each other, the customers would probably be interested in a product containing for example egg (see factor; *difference between the competitors*). In conclusion, the threat of substitute products are pretty low.

Sports drink - Low

The buyers of sports drinks often priorities the taste and the nutritional value of the products (see factor; *price sensitivity*). There are many big manufacturers offering both different och similar products on the market but the casein-based products are however very similar to each other. Despite this, customers should probably be willing to try new products (see factor; *difference between the competitors*). Additionally, because of the many brands that are on the market, it gets harder for people to stick to one single brand (see factor; *buyers propensity to substitute*).

However the current competition on the market can make it difficult for new entrants. Therefore, the threat of substitute products is estimated to be low.

Protein powder - Medium

The serious fitness people often use casein due to that it is slowly digested in the body. These people are not willing to try a new product based on anything else than casein (see factor; *buyers propensity to substitute*). However, the regular users of protein powders, who prioritizes the taste and the nutritional value of the product, probably have a higher propensity to substitute to another product based on for instance egg protein. As long as it tastes good and have the equal nutritional value (see factor; *buyer's ability to substitute*). Therefore, the threat of substitute products are estimated to be medium.

Power of suppliers

All areas - Low

The high number of suppliers, and the similarities between the casein-based products, makes all these areas competitive markets (see factor; *estimated number and size of suppliers*). Despite the similarities between the suppliers products, all manufacturers differ in size depending on for example how long they have existed. However, manufacturers are driven by the customer opinions and therefore they have to keep their products updated to meet customers need in order to be competitive (see factor; *uniqueness of each suppliers product*). Therefore, the power of suppliers is estimated to be low within all areas.

Threat of new entrants

Infant food - Low

The European government laws of infant food are sharper compared to ordinary food due to that infants are more fragile than adults, which should be taken in consideration as a new entrant (see factor; *government policies*). The many existing manufacturers and products on the market, already meeting the customers need, are also one factor that could be problematic for a manufacturer wanting to enter the market (see factor; *brand loyalty*). However, the high number of accessible distribution channels are positive for new entrants due to the ease of marketing their products in order get viral and to be competitive (see factor; *access to distribution channels*).

Despite this, it is estimated that the threat of new entrants is low due to the government policies, the giants and the high competition that already exists on the market.

Instant breakfast - Low

The market already have many suppliers and products meeting many customers need. The high amount of similar products however, seems to affect the brand loyalty due to that it is hard for the customers to stick to one single brand (see factor; *brand loyalty*). The European government laws should additionally not be an obstacle for new entrants due to that it follows the laws of ordinary pre-packed food (see factor; *government policies*). The accessible distribution channels are many which is positive for new entrants. However, the customers that buy these products often buy them on the go in small convenience stores meaning that the new entrant must reach these stores in order to be competitive (see factor; *access to distribution channels*). Therefore, it is estimated that the threat of new entrants is relatively low.

Sports drink - Low

As previously clarified, the brand loyalty among sports drink brands is estimated to be relatively low due to that the customers prioritize the taste and the nutritional value of the product, which is very similar between the offered products and brands (see factor; *brand loyalty*). The European government policies for these products falls under supplements. However, these laws are not additionally strict comparing to ordinary food laws which is positive for new entrants (see factor; *government policies*). These products have many distribution channels and can be found both on different websites and in stores (see factor; *access to distribution channels*). However, due to that there are very many and big suppliers on the market, already meeting many customers need, the threat of new entrants is estimated to be relatively low.

Protein powder - Medium

The brand loyalty for protein powder is as previously mentioned strongest among core athletics where many use casein because of its unique properties (see factor; *brand loyalty*). This is positive for current suppliers of casein if a new product based on another protein is launched. Among general users, the brand loyalty is not equally strong due to other priorities (see factor; *brand loyalty*).

Protein powder falls under the supplement laws in Europe, just as sports drinks do (see factor; *government policies*). The most widely used distribution channel for protein powder is websites which is beneficial for new entrants due to the ease of marketing. However, because of the increased interest and use of these products, large supermarkets have included them in their assortment (see factor; *access to distribution channels*). Hence, the threat of new entrants within these markets is estimated to be medium.

Rivalry among existing competitors

Infant food, Instant breakfast and Sports drink - High

There are many different companies within these markets, both giants and suppliers smaller in size (see factor; *diversity of competitors*). Additionally, infant food is a market estimated to have an average annual growth rate of 5.5 % until year 2023, reaching a value of USD 69 billion (see factor; *industry growth*). Instant breakfast is a market estimated to have an average annual growth rate of 4.2% until 2026, reaching a value of USD 1.8 billion (see factor; *industry growth*). Likewise for sports drinks (see factor; *industry growth*). However, the diversity among the casein-based products offered by different suppliers on these markets is not big, all products contain few and clean ingredients and the suppliers are marketing themselves considerably similar (see factor; *quality differences*). This indicates on competitive markets. Hence, the rivalry among existing competitors is estimated to be high within these markets.

Protein powder - High

This market is also estimated to grow just as the previously mentioned markets (see factor; *industry growth*). However, the diversity among the casein-based protein powders offered by different brands is bigger within this market comparing to the other ones (see factor; *diversity of competitors*). This depends on the different protein mixtures that the protein powders contain, offered by different suppliers. However, there are many suppliers offering similar products and protein mixtures as well, but there are some divergences on the market (see factor; *quality differences*). Hence, the rivalry among existing competitors is estimated to be high within this market.

6.1.2 High value nutrition bars

Whole evaluation of this product segment can be read in section 4.2 in Appendix.

Power of buyers - Low

The market for general bars, including protein-, weight loss- and snack bars is very big with many competitors, both small and large (see factor; *difference between competitors*). There is a high demand among consumers for bars, since they offer a convenient alternative for functional foods. The buyers strongly influence the products in terms of flavour and nutritional preferences (see factor; *buyers ability to substitute*). The largest product segment in this area today is high protein bars due to increased interest for fitness and muscle growth among young people. The segment of bars directed to older adults however, is close to non-existent. There are very few options for elderly and therefore they don't have the ability to substitute or to influence price (see factor; *difference between competitors*). The buyers of bars directed towards an elderly crowd does thereby have a low bargaining power.

Threat of substitute products - High

There is a great pool of different bars and the competition is tough. However, very few of them are marketed as bars made specifically for seniors. The fact that the population over 70 years will be substantially larger in coming years means that there will be a large pool of target customers for such a product (see factor; *number of customers*). If established bar-manufacturers recognizes this and they launch products specifically directed towards seniors, the threat could intensify in the future within this product segment.

Power of suppliers - High

Factors that affect the selling rate of bars are marketing strategies, flavours and nutritional value. The nutritional content of bars is, in some customer segments, more important than price. That is generally the case for physical performance-bars with a high protein content, without refined sugars (see factor; *difference between competitors*). Since most options of dietary supplements for seniors come in liquid form, a bar specifically formulated to meet the nutritional requirements of elderly would be unique (see factor; *number of substitutes products available*). With few substitute products available, the bargaining power of a suppliers offering such a product is high.

Threat of new entrants - High

Since bars work as a convenient alternative for a quick meal on-the-go, the regular “snacker” buys the product that seems most appealing at the moment in terms of flavour and nutritional content. Hence, brand loyalty does not constitute a entry barrier when it comes to bars that mainly focus on giving the buyer a quick source of energy. In the segment of high protein bars however, there seems to be a higher level of customer loyalty, much due to the high awareness amongst wellness- and fitness people (see factor; *Brand loyalty*). Long term loyalty is however hard to obtain since the bar market is constantly evolving with new launches every year. In the segment of bars directed towards seniors, the competition is low (see factor; *brand loyalty*). With the right product formula, marketing strategies and distribution channels, a new entrant offering such a bar could constitute a big threat.

Rivalry among existing competitors - Medium

There are both large, multinational companies and small, local companies that compete for market share and customer loyalty. Dominating brands are Nestlé, Kellogg NA Co, and Clif Bar. These are large companies offering bars within several product segments. In Europe alone, the market of energy bars is expected to reach US\$ 689 million by the year of 2023 and the rivalry among existing competitors is high, especially in the segment of high protein- or organic bars that promote a healthy lifestyle (see factor; *industry growth*). There is however low availability of bars marketed as a product for seniors and therefore the competition within this specific product segment is low at the moment (see factor; *number of substitute products available*). If large and well established competitors chooses to launch such a product however, rivalry could become high.

6.1.3 Specific egg yolk proteins

This product segment will not be evaluated through Porter’s five forces because of insufficient information about Fresenius Kabi’s purification possibilities of phosphopeptides and phosvitin. It is absolutely a segment of interest and when the information is accessible, it could be a potential area to look into for the company.

6.1.4 Protein-enriched products

Whole evaluation of this product segment can be read in section 4.3 in Appendix.

The market of protein enriched snacks is defined as the market of portable food that has been value-enriched and claims to offer a higher amount of protein, derived either from animal- or plant based protein sources. Earlier in the report, this segment also included protein-enriched ice cream and candy. Ice cream was excluded because it is a well established market with a lot of suppliers competing on the same marketing platform. Protein enriched candy is often a bar which has a full evaluation in the segment of “high value nutrition bars” and is therefore not of interest (see section 5.2). Our intention is to use the unrefined bonus product, PO80, that contains protein and essential fatty acids as well as other micronutrients, in an easy-accessible snack for elderly people due to the market gap that exist today for such products.

Power of buyers – High

The market of protein enriched products is mainly driven by the high awareness of people today, clean labels, transparent ingredient lists and an increased demand of portable and fortified food with reduced amount of gluten and allergens (see factor; *number of customer*). It contains widely distributed products in different shapes and forms, from a lot of suppliers, a continuously expanding market that is competitive. The products are challenged to always match the fluctuating needs of customers that at the same time have to be price competitive due to all existing alternatives (see factor; *buyers ability to substitute, difference between competitors*).

Threat of substitute products – High

In this market there are uncountable options and one has to define what type of products that are regarded as protein enriched. Threats of substitutes arise when a new entrant matches your product and gain customers because of some attributes, attributes such as amount of protein per item, price, portability, natural content, taste and so on (see factor; *buyers propensity to substitute*). Since the variety of products on the market is not limited, all possibilities lie in the imagination and innovation of people (see factor; *number of substitute products available*).

Power of suppliers – Low

Since the market has grown to this extent due to the awareness and demand of people wanting to eat healthy and nutritious protein rich food, the suppliers simply have to satisfy these demands (see factor; *buyers propensity to substitute*). It is also a market that lives on each customer's desire to buy the same product over and over again due to small portions and reproducible events. Because of the huge economical size of the market and the continuous expansion, a lot of new manufacturers tries to penetrate it (see factor; *estimated number and size of suppliers*). This leads to some prize competition of certain products which also decrease the bargaining power of the suppliers.

Threat of new entrants – High

Brand loyalty in this segment is in general low except from a few brands. In, for instance, the bars section where some companies build their marketing together with influencers in the fitness industry and therefore reach out to more people through it. They have also greater ability to stay with them, create a brand loyalty and the threat of new entrants decreases (see factor; *brand loyalty*). However, this is most probably not the case in the section of products focused on elderly people, where Fresenius Kabi's bonus product is a suitable alternative. In that section, the number of suppliers is much lower, the attributes of choosing a product has shifted from i.e. what person that is marketing it, to for instance the quality of fatty acids present (see factor; *uniqueness of each suppliers product*). Then the threat of such a new entrant could be considered as high.

Rivalry among existing competitors – Low

Due to all existing suppliers of protein enriched food, there is a contributing rivalry amongst them that also constraints prizes. However, the rivalry among competitors is mostly inside of each sub-segment since they are the suppliers that compete about the same customers. When the rest of the protein enriched products can be located far from the specific product, the only similarity is that both of them turns to the same customer segment but they are not directly competitors to each other (see factor; *diversity of competitors*). A general opinion of the product segment as a whole is that the rivalry is quite low.

6.1.5 Egg oil as dietary supplement

Whole evaluation of this product segment can be read in section 4.4 in Appendix.

This evaluation of segment has constraints such as:

- The dietary supplements are in context of improved health and does not include increased hair- and skin quality or hair growth.
- The market of the potential product is often compared to the market of fish oil supplements due to high similarities in composition, such as long-chain omega-3 polyunsaturated fatty acids (PUFA).

Power of buyers – Medium

The buyers of egg oil as dietary supplements are mostly located in Asia-Pacific. After comparing the size of the market of fish oil as dietary supplements and the merging market of all PUFA that today holds for USD 17.9 billion, one can assume that the market of egg oil supplements has great economic potential (see factor; *number of customers*). However, the USD price per mg of PUFA is cheaper for egg oil than fish- and cod liver oil which indicates that it is also more economical producing egg oil dietary supplements (see factor; *price sensitivity*). Today, there are not a lot of options of egg oil supplements worldwide unlike the fish oil supplements or other vitamins and minerals accessible for increasing health (see factor; *buyer's ability to substitute*). If the number of customers is low and they have a lot of power to seek discounts and special offers, the bargaining power increases. Egg oil as supplements is a very small market competing for customers from a much bigger market. None of them though has a huge number of buyers and the products have low prize distribution, which indicates a medium power of the buyers.

Threat of substitute products – High

The threat of substitute products is high if it matches the customers need in the same way as the original product, perhaps with a better price, which then becomes substitute friendly. Products existing on the market today has a lot in common and are all focused of providing the body with nutrients in order to increase health. However, they are differently marketed and turns to different customer segments but a pervading trend is to keep all ingredients as natural and ecological as possible (see factor; *buyer's propensity to substitute*).

To maintain customers, Fresenius Kabi would have to find a unique way of matching the customer profile with their natural and cyclic economy-derived product together with the two advantages they got compared to fish oil; a vegetarian alternative and the absence of heavy metals that accumulates in the fatty tissue of fish (see factor; *buyer's propensity to substitute*). Then maybe they could establish a strong position in comparison with other substitutes. The products on the market today are however quite similar to each other and provides the same benefits to each customer, even if they are marketed in some other way, which indicates a high threat of substitutes.

Power of suppliers - Medium

The number of suppliers on the supplement market is not that many and the numbers on the egg oil supplement market is even lower. High power comes from dominating suppliers that can choose how to distribute their products and to what prize. None such supplier exist on the supplements market but at the same time, there are not a gigantic number of suppliers either which would lead to a medium power at each of them (see factor; *number of substitute products available*).

Threat of new entrants - High

There is no existing brand loyalty due to i.e. difference in between best-sell lists which could indicate a higher threat of new entrants (see factor; *buyer's propensity to substitute*). However, in the food industry, there are some limiting regulations that also lead to resistance and challenges for new entrants (see factor; *government policies*). Therefore, the threat could be considered as slightly lower but it still occurs a high threat of the new entrants.

Rivalry among existing competitors - High

Existing competitors operate in the same narrow nish of food supplements which is based on a small diversity among products (see factor; *diversity of competitors*). The rivalry could therefore be higher which could then decrease the overall profitability of the suppliers.

6.1.6 Egg oil in hair care products

Whole evaluation of this product segment can be read in section 4.5 in Appendix.

Power of buyers - High

The increased availability of products on the hair care market has given customers many options to choose from and the competition among suppliers is generally very high. A long term brand loyalty is hard to obtain in this market since it is mainly driven by changing fashion trends and customer preferences (see factor; *buyers ability to substitute*). Some brand loyalty does however exist, much due to brand credibility and awareness among the consumers. The power of buyers can thereby be considered as high.

Threat of substitute products - High

The substitutes of an egg yolk based hair care oil are many on the cosmetic market. Both within the category of natural hair treatments and conventional hair treatments which contain synthetic or chemical compounds. An egg yolk oil would be most competitive in Asia Pacific where there already is interest and demand for cosmetic products containing egg oil (see factor; *number of substitute products available*) Globally, the threat of general hair care products is very high while the threat of egg oil products specifically, is low.

Power of suppliers - Low

Since there is a very large number of suppliers in this industry, the competition is very high. The major players of the market are well-established and multinational companies. No matter of size, manufacturers are driven by the customer preferences and need to keep their products updated to meet current trends and lifestyles in order to be competitive (see factor; *estimated number and size of suppliers*). The suppliers hence have a low bargaining power.

Threat of new entrants - Low

The hair care industry is expected to grow even larger in the forecast period due to better living standards and increasing demand for personal care products in developing countries. This attracts new entrants which will affect the profitability of existing competitors. To gain market share as a new entrant can however be problematic due to the high cost of entry.

In addition, when entering a cosmetic market one also need a lot of resources for manufacturing and marketing in order to be competitive (see factor; *estimated number and size of suppliers*). Such entry barriers makes it hard for new entrants to constitute a threat to existing brands.

Rivalry among existing competitors - High

Major multinational companies dominate the market of hair care and there is indeed a high competition. The difference of products from different brands are oftenly very small, hence brand awareness amongst customers is important. (see factor; *buyers propensity to substitute*). Natural or organic hair care products are expected to gain substantial market share in the future, hence the rivalry in this category of products is suggested to be very high- both from small and large manufacturers (see factor; *number of customers*).

6.1.7 Egg oil in skin care products

Whole evaluation of this product segment can be red in section 4.6 in Appendix.

Power of buyers - High

Since there is a great number of products available and it is mainly customer demands that drives the market of skin care products, the consumers have a high bargaining power. If a supplier offers a product at a competitive price, the buyer is more likely to choose that product over other, more expensive alternatives. In the segment of more exclusive products that offer high performance, the price sensitivity is more moderate but for such products, quality is crucial. The same goes for natural products that are becoming more and more popular on today's market (see factor; *brand sensitivity*).

Threat of substitute products - High

The number of competitors on the skin care market is very high and the number of substitute products is even higher. It is therefore extremely important for manufacturers to either offer high quality or a competitive price. The different products launched by different suppliers resemble each other in terms of ingredients and formulas, hence it is important for competitors to be innovative and well aware of current trends and customer demands (see factor; *buyers propensity to substitute*). The overall threat of substitute products is thereby very high.

Power of suppliers - Low

The suppliers on the market of skin care have little influence when it comes to changing prices for their product (see factor; *price sensitivity*). Since the cosmetic market as a whole is driven mainly by customer preferences and demand, the products of different brands resemble each other. This means that consumers have a lot of options available. Due to the increased interest for natural formulas such as oils and serums, the competition in this product segment will rise (see factor; *number of substitute products*). Hence, the power of suppliers offering natural products is generally low.

Threat of new entrants - Low

The overall cost for developing and launching skin care products is high. The leading companies on the market are great multinational brands which attract loyal customers through brand awareness and brand credibility (see factor; *brand loyalty*). Oils and natural formulas are today popular skincare products among customers. The leading players on the market does therefore invest a lot in R&D to launch such natural or organic products (see factor; *estimated number and size of supplier*). A new entrant, offering a natural products such as egg oil can expect a high competition. Hence, the general threat of new entrants is low.

Rivalry among existing competitors - High

The skin care market is highly competitive and dominated by multinational players with a lot of resources within R&D, manufacturing and marketing. Such companies are also leading in terms of brand loyalty which mainly is driven by brand awareness and brand credibility (see factor; *brand loyalty*). To be completely unique in the sector of skin-care is complicated and in order to target a niched customer group it is very important that the supplier can offer a unique selling point. Without that, it is very hard to compete against the giants dominating the market (see factor; *uniqueness of each suppliers product*). The rivalry on the skin care market is therefore high.

6.2 Choice of products

Since this project is all about building a scenario for a selection of fictive products, we have used criterias that would match the scenario of a diversification when making a conclusion from the evaluations in this chapter. In other words, the situation we are referring to is a product launch on a completely new market for Fresenius Kabi, independent of in-house production, collaboration or as a raw material supplier. The fictive products all contain the raw material P080, P80 or egg yolk oil, earlier referred to as “the bonus product”.

The preferred scenario for the force *Power of buyers* is that it is low. This would mean that the consumers have little impact on how the products are formulated. A low power of buyers means that changing trends and preferences of the consumers do not affect the industry as much, which in turn can be beneficial when it comes to long term profitability for Fresenius Kabi and the suggested product. On the other hand, one can argue that a high bargaining power of buyers could also be beneficial. If the consumers have a lot of impact, they can manipulate the market to a situation preferable for Fresenius Kabi.

The same goes for *Threat of substitute products*. Since the fictive products would constitute a substitute of existing products, we want this power to be high. If buyers propensity to substitute is high, Fresenius Kabi is more likely to succeed when launching a new product on the market.

The force *Power of suppliers* should preferably be quite high. If this is the case, the supplier have a higher probability of gaining profit from their existing portfolio of products. If there are large, multinational players on the market however, a high supplier power may lead to complete dominance of such companies that have a large pool of resources and loyal customers.

Since Fresenius Kabi would be a new entrant on all of the evaluated markets in the chosen scenario, we want the power *Threat of new entrants* to be high in mentioned situation. This means that there are few entry barriers which makes it easier for a new player to gain profit and attract customers. A high threat of entrants may however constitute a problem once Fresenius Kabi have an established product on the market but this will not be considered when evaluating this force.

The power *Rivalry of existing competitors* should preferably be low. A higher rivalry means a higher threat of competitors. The best possible scenario for Fresenius Kabi would be to enter a market where their product could be unique and not have many competitors that want to attract the same customers. On the other hand, a market with many suppliers indicate a high customer demand. Based on the information we have, we assume that there is a demand on the market for these fictive products and therefore, we prefer this power to be low.

All of the above mentioned criterias goes for the scenario where Fresenius produce the end-products on their own, or the scenario where Fresenius act as a supplier of raw material to an external partner with more knowledge of the new markets.

6.2.1 Egg yolk protein products

In table 13, a summary of the evaluated and ranked forces regarding the protein-based products can be read.

Table 13. A summary of the respectively estimated properties of the evaluated Porter's five forces. Under the column Casein 1 stands for Infant food, 2 for Instant breakfast, 3 for Sports drinks and 4 stand for Protein powder.

	Casein	Bars	Protein-enriched products
Power of buyers	1: High 2: High 3: High 4: High	Low	High
Threat of substitutes products	1: Med 2: Low 3: Low 4: Med	High	High
Power of suppliers	1: Low 2: Low 3: Low 4: Low	High	Low
Threat of new entrants	1: Low 2: Low 3: Low 4: Med	High	High
Rivalry among existing competitors	1: High 2: High 3: High 4: High	Medium	Low

Protein enriched products

The segment of protein enriched products and snacks resulted in a snack product focused on seniors in order to add energy in between meals. Such products are of great value for elderly people due to the many aspects of malnutrition that can appear when you get older. Therefore, this fictive product will be produced by the unrefined P080 that also contains all essential fatty acids and vital vitamins and minerals. A snack could also replace the popular afternoon cake that unfortunately, often contain high levels of sugar and unhealthy fatty acids.

High value nutrition bars

High value nutrition bars were further evaluated as a bar focused on seniors, intended to be used both as a meal replacement and a supplement to boost nutritional intake. As the population get older and we are able to maintain better living standards for longer time, it gets more important for seniors to get sufficient protein and nutrients in their diet. Bars are extremely popular when it comes to people from 18-40 years, indicating on a highly competitive market, but this trend have not yet reached the older population. There are several existing meal replacements and dietary supplements that elderly can take but these often come in liquid form. A bar containing all important nutrients would hence be a unique product on the market that is easy accessible for seniors to take.

Casein

Within the product segment casein substitute, the areas that have been evaluated as suitable for the bonus product are infant food, instant breakfast, sports drink and protein powder. The evaluation of infant food revealed a highly competitive market consisting of many similar products offered by different brands. Additionally, the government policies for infant foods are stricter comparing to original food and there are many regulations concerning the ingredients and the contained amount of each nutrient. Therefore, despite that the bonus product could have a great potential to replace casein in infant formulas, it has been decided to not present this as a future product proposal to Fresenius Kabi.

After evaluating the instant breakfast area it was revealed that it also is a competitive area where most of the customers buy their product on the go in small convenience stores. This makes it hard for new entrants on the market. The casein-based products available on the market are also similar to each other, just as the products on the sports drink market. The evaluation of the sports drinks area also showed a strongly competitive area. Additionally, these types of liquid-based products remind of Fresenius Kabis meal replacement product Fresubin. Therefore, despite that the bonus product could have a potential to function in a instant breakfast or a sports drink, it has been decided to not take these products further.

Last but not least, the area of protein powders was evaluated. It was explained that it is a more narrow market area, meaning that the targeted customer group is smaller when comparing to the other areas within this product segment. However, the customer group is starting to expand and reach the broader mass of people due to the fitness trend and the increased awareness of nutrients in the world. The old customers within this area are shown to often be very employed and interested in nutrition and therefore uses casein products because of its unique properties. Hence, they are not willing to substitute to other products based on another raw material. However, many of the new customers want a product that taste good and that contain clean and good nutrients indicating that they are more open to try a new product based on another raw material. Additionally, the most popular distribution channel for protein powders is websites. This is positive due to that it makes it easier for new entrants to establish on the market and to be competitive. Therefore, it is estimated that the refined bonus product could have a great potential as a raw material in a protein powder.

In conclusion, the products we chose to further evaluate are protein powder, protein-enriched snacks and high nutritional bars for elderly. The refined bonus product P80 is aimed to be used for the protein powder and the original bonus product P080 is suggested to be used for the other two products, snacks and bars.

6.2.2 Egg yolk oil products

In table 14, a summary of the evaluated and ranked forces regarding the oil-based products can be read.

Table 14. A summary of the respectively estimated properties of the evaluated Porter's five forces.

	Hair Care	Skin Care	Dietary supplements
Power of buyers	High	High	Medium
Threat of substitutes products	High	High	High
Power of suppliers	Low	Low	Medium
Threat of new entrants	Low	Low	High
Rivalry among existing competitors	High	High	High

Cosmetic markets are overall highly competitive with great multinational companies dominating the industry. The bonus product of Fresenius Kabi; egg yolk oil, offer many benefits in applications both within skin care and hair care, however many substitutes exist.

The competing products within hair care are mainly plant-based oils that offer nourishing fats and micronutrients that have an overall positive effect on hair. The consumption of hair oil is largest in Asia Pacific, which unfortunately not is the primary target region for Fresenius Kabi. The interest and demand for hair oils are however growing in Europe and the US but the players on these markets are tough to compete against as a new entrant. One option could be to sell the bonus product to a hair care manufacturer and let them be the supplier of the end product. Doing so is however not a very good option since customer preferences and fashion trends of hair care products constantly change.

This means that such a contract might not be long lasting since the great brands often change their products after occurring trends. In addition, the fact that the largest trend within cosmetics is natural or organic formulas makes an animalic alternative problematic.

An egg yolk oil based skin care product faces the same difficulties as an egg yolk oil based hair care product. The skin care market is dominated by major companies that operates in all regions of the world. They have great resources that allows them to launch new and improved products regularly. Customer loyalty also constitute a problem when launching a completely new skin care product. Customers tend to buy products from brands that have credibility and are well known. This means that Fresenius Kabi may experience problems by being a completely new face on the market. There is interest for an egg oil as a multipurpose remedy for skin but this interest is currently limited to Asia Pacific while the western populations have their focus on plant-based and natural options.

One can easily conclude that there are many entry barriers when coming in as a new player on cosmetic markets. Therefore, we have chosen to not go any further with fictive products within these segments.

Yolk oil as dietary supplement is one of the segments that we have chosen to focus on in the final steps of this project. Dietary supplements is an expanding market with a lot of players, using different sources of oil, production types and marketing strategies. Egg oil is mostly used in Asia-Pacific but oil in supplements in general, are popular all over the world. On this market, the bargaining power of customers is not as high as in skin- and hair care which makes it more regulated by the suppliers. According to big differences in best seller lists and highly ranked products, both the threat of substitutes and new entrants are high which are preferable for Fresenius Kabi's potential bonus product.

Using egg oil as dietary supplement instead of fish oil, which is the largest raw material today, has two major advantages. First of all, it is a vegetarian alternative and more environmental friendly. It does not contribute to overfishing of the seas and imbalance in the aquatic ecosystem. Today, the ocean has experienced consequences such as that about 30% of all the stocks are deemed to be overfished and extinctions of certain species directly and indirectly through long- line fishing techniques.

To produce dietary supplements with egg oil instead, which at the same time is a rest product, could mean that none of this would be necessary.

Secondly, the egg oil is free from heavy metals that otherwise accumulate in fish oil due to environmental contamination from i.e. industry. Such heavy metals are extremely harmful for humans and could lead to brain damage such as memory loss, deafness, loss of coordination, irreversible liver and kidney damage and even death.

A dietary supplement derived from the bonus product of Fresenius Kabi could complete the market and offer a healthy, sustainable alternative to all customers.

7. Business Case

7.1 Business Case ; protein-enriched snacks and bars for seniors

Findings from the global scanning of the egg yolk market, that was done in the beginning of the project, indicated a gap in the market of protein-rich solid supplements for seniors. Hence, snacks and bars directed towards seniors seem to constitute as strong alternatives for Fresenius Kabi's bonus product P080. After evaluating the product segments, it was clarified that these products have many things in common such as target customers, price setting, distribution channels, competitors and usage of bonus product P080. Therefore, these two fictive products will be presented as one single business case.

The business case include reflections and evaluations based on gathered information from Porter's five forces (which can be read in Appendix chapter 4.2 and 4.3) and the position of the company today (which emerged through consultations with Fresenius Kabi's representatives).

There are many things that favour the group of Fresenius as an organisation when discussing these specific, fictive products.

- They are directed towards the same customer segment as Fresenius Kabi's existing products within enteral nutrition, such as meal replacement drinks and yoghurts (see Appendix, chapter 2).
- The personnel at care units, especially legitimized nurses, are the ones making the choice of buying the products for the seniors. Fresenius Kabi is a well known brand in this supply chain, hence they have both brand association and brand credibility.
- The product would constitute a milk-free alternative and work as a good option for seniors with allergies in need of dietary supplements.
- Fresenius Kabi is an experienced production company which is positive in terms of in-house production of the products (see Appendix, chapter 2).
- Since P080 is a rest product, processing this further and making it to something more profitable constitutes a sustainable concept and contributes to a cyclic economy for Fresenius Kabi.

On the other hand, there are some things that speak against Fresenius Kabi as a supplier of these products. They might have deficit marketing knowledge of these specific products, bars and snacks, since such products are not in their portfolio today. From the very start, this project has been defined as a diversification for Fresenius Kabi according to the Ansoff matrix. Both a new market and a new product for the company comes with great challenges and a solution to this problem could be to consider Fresenius Kabi as a raw material supplier. Either in a collaboration with an existing company on the market, or simply as a distributor of the raw material to companies with suitable production lines. Even though bars and snacks for elderly people could use similar distribution channels as the other products within Fresenius Kabi's segment of enteral nutrition, such channels are restricted and niched.

The fact that there are very few competitors that offer specifically bars or snacks directed towards seniors creates an opportunity for the group of Fresenius to come in as an early entrant (see Appendix, chapter 4.2). By being the first one to offer such a product, Fresenius Kabi might have the capability of gathering a loyal following. There is an emerging need for convenient alternatives for food when it comes to elderly people. This customer segment will grow even larger in the future and the group of Fresenius could have a great advantage of being the only player in this product segment when that happens.

However, one should not neglect the possible threats for Fresenius Kabi. This is a ovo-vegetarian alternative but some people prefer a vegan diet and are therefore not suitable for these products. A threat could arise from a company satisfying these customers. Another possible risk could be other distributors with more experience and resources that might compete for the same customers. Such distributors may offer products not as good as Fresenius Kabi's fictive products, but with cheaper ingredients and more production experience within this area they can keep down the prices of their products. Additionally, in a situation with higher amount of sugar and saturated fatty acids, the product increase in durability. In that case could Fresenius Kabi be more competitive by acting as a raw material supplier.

In order to substitute existing alternatives, which primarily are liquid supplements such as shakes or drinks, a bar or snack should contain about 250 kcal per serving. The price for such a product should not exceed the price for existing alternatives which costs about EU€ 2-3 per portion which is 125 ml (Nutricia, 2018).

Figure 11 describes the pros and cons for Fresenius Kabi as a distributor of these products.

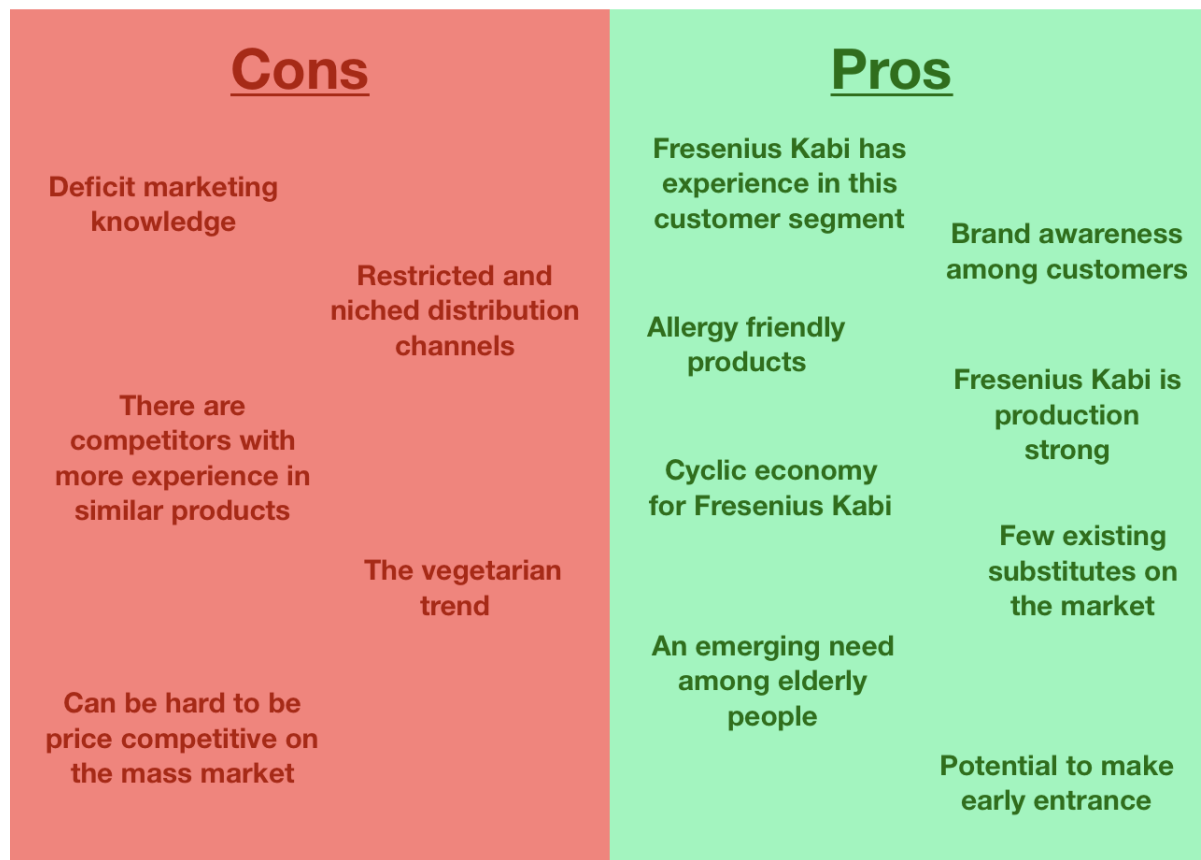


Figure 11. The pros and cons for Fresenius Kabi as a distributor of snacks and bars for elderly derived from their bonus product P080.

7.2 Business Case; protein powder

The many similarities between the bonus product of Fresenius Kabi and casein gave rise to the interest in the product segment of *casein substitute*. After evaluating this particular product segment with Porter's five forces, protein powder proved to be the most promising product area for the refined bonus product P80. This is because of its similarities in nutritional value and appearance with protein powders existing on the current market (see Appendix, chapter 4.1). Therefore, this product will be presented in this business case.

The business case include reflections and evaluations based on gathered information from the evaluation done with Porter's five forces (which can be read in Appendix chapter 4.1) and the position of the company today (which emerged through consultation with Fresenius Kabi's representatives).

Based on the previous evaluation and conclusions, we consider three potential scenarios for Fresenius Kabi.

1. Fresenius Kabi works as a raw material supplier and operates in a business-to-business concept.
2. Fresenius Kabi starts a collaboration with an experienced company within the protein powder market that has access to proper production skills, distribution channels and has the required marketing knowledge.
3. Fresenius Kabi starts an in-house production, process and market the product themselves.

Egg yolk powder has the benefit of being a milk-free, animalic protein source which means that it is suitable for people with e.g. lactose- or milk protein allergy. In addition, it is a product of high quality that contain all essential amino acids and less than 5% fat - properties that are desirable on the market of protein powders. What stands unclear however, is the ability of P80 to be flavoured. To compete against existing alternatives, the product has to offer a good taste other than just high levels of protein.

This might become a challenge for Fresenius Kabi. In that scenario, taking in external expertise from a co-operating company with more experience would be a good solution, this would represent scenario 2. Another choice would be to hire consultants or more proficient staff that offer the expertise Fresenius Kabi lack, but still make product in-house, which represents scenario 3.

What the company also need to consider is whether the end product should be sold as a powder for shakes or as a enriching supplement that can rise the nutritional value of other foods. Depending on which product type they choose, more processing of the bonus product might be needed. Shake powders for example, need to be dissolved quickly in liquid to avoid any clumps, which in turn might require more processing of the bonus product and the use of external expertise in order to get the right properties.

The distribution channels of Fresenius Kabi are very restricted and niched. Mainly because they are directed towards hospitals and people with malnutrition for different reasons. The typical buyer of protein powder will most probably not go to pharmacies or drug stores when they want to refill the powder shelf. Therefore, a suggestion would be to use other distribution channels than Fresenius Kabi's regular ones to reach out with the casein substitute product. For example they could use E-commerce or hypermarkets. E-commerce has actively been used for the sales of protein powders for a long period of time and hypermarkets are also growing in sales. A lot of existing companies in the field that offer one single product on this specific market, uses resellers as distribution channels. That would also be a profitable option in Fresenius Kabi's case.

As concluded from the previous evaluation, the price of the different protein powders accessible in Europe is in general very similar indicating on a price competitive market. One example of a casein protein powder is ProteinPRO. It contains 73 % of protein, 13 % of carbs and 7.7 % fat where the protein source is 100 % casein. This product costs around EU€ 13.8 for 500 g (ProteinPRO, 2019). In order for Fresenius Kabi to be price competitive with the fictive product, the end price should not exceed that price.

Since it is a diversification according to the Ansoff matrix, Fresenius Kabi lacks expertise in marketing this kind of product. In the case of scenario 3, where Fresenius Kabi choose in-house production of the product, external expertise would be necessary to facilitate the marketing. However, considering scenario 1 where Fresenius Kabi would act as a raw material supplier and sell P80 business to business, a selling team would perhaps be necessary at the company to individually contact potential partners and customers. A third option is a collaboration between Fresenius Kabi and a business with credibility, proper distribution channels and marketing knowledge, which would represent scenario 2.

There are several giants on the market of protein powder with great experience and that holds great market share. The fact that Fresenius Kabi lacks knowledge both within production and marketing in this area, makes them today non competitive against these big companies. Therefore, we favour scenario 2 where Fresenius Kabi starts a collaboration with an experienced company within this area. In order to see a summary of these mentioned scenarios, se figure 12.

<u>Scenario 1</u>	<u>Scenario 2</u>	<u>Scenario 3</u>
<ul style="list-style-type: none"> • Raw material supplier • Need to build a production line for processing P080 to P80 • Require a sales team to find potential customers 	<ul style="list-style-type: none"> • Collaboration with an experienced company • Will receive proper production skills, distribution channels and market strategies • Get brand credibility from the cooperating company 	<ul style="list-style-type: none"> • In-house production • Need to bring in external expertise for production and marketing knowledge • Need to expand their distribution channels • Need to build a production line for the whole process, starting from P080 all the way to the final product

Figure 12. The possible scenarios for Fresenius Kabi when launching a protein powder derived from the refined bonus product P80.

7.3 Business Case; dietary supplement

The findings from the global scanning of the egg yolk oil market, revealed beneficial properties with egg yolk oil in the field of skincare, haircare and dietary supplement. After evaluating these particular product segments with Porter's five forces, the most promising product segment for the oil part of the bonus product P080 proved to be dietary supplements i.a due to the high competition within the skincare and haircare industry. Therefore, egg yolk oil as a dietary supplement will be presented in this business case.

The business case include reflections and evaluations based on gathered information from the evaluation done with Porter's five forces (which can be read in Appendix chapter 4.4) and the position of the company today (which emerged through consultation with Fresenius Kabi's representatives).

Fish oil, in capsules and as liquid oil, is the most commonly used dietary supplement today that provides the body with healthy fatty acids. If Fresenius Kabi would produce an oil supplement derived from their egg-based bonus product, fish oil would constitute the biggest competitor. Therefore it is necessary to distinguish advantages that comes with choosing egg oil instead of fish oil. First of all, it is a ovo-vegetarian alternative and more environmental friendly. It does not contribute to overfishing of the seas and imbalance in the aquatic ecosystem. More information about that can be read in Appendix chapter 4.4. Second of all, the egg oil is free from heavy metals that otherwise accumulate in fish oil due to environmental contamination from i.e. industry. Such heavy metals are extremely harmful for humans. Additionally, the oil part of P080 have great application area as a dietary supplement since it is a natural source of D-vitamin and it can offer other micronutrients and all essential fatty acids in one capsule. These are aspects that have many proven health benefits.

Egg oil in general has bigger market share in countries in the Asia-Pacific. In the western countries, it is not equally distributed. This indicates that producing egg oil as dietary supplements is a weak signal and something that lies in the future for European inhabitants. Being the first to entrant such a market is of course a major benefit and especially when it comes to a company such as Fresenius Kabi that already has high credibility and awareness in the supplement industry and therefore, is a reliable producing name. However, being the first entrant involves some challenges as well. The product is unknown for the customers, it is high pressure on marketing skills and the situation requires dedicated early adopters.

The regular distribution channels for supplements of this character are pharmacies, health food stores or supplement stores, both online and physical shops. Pharmacies are, as earlier mentioned, one of Fresenius Kabi's current distribution channels. However supplement stores does currently not offer their products. They are therefore foreign to the company which means that Fresenius would have to expand their distribution channels if they choose to make an in-house production and launch the product themselves.

In the case where Fresenius would collaborate with another company, the required distribution channels might be available from start as well as the marketing knowledge for an omega-3 capsule. Many existing brands that offer supplements like vitamin D- or omega 3 capsules have already a broad net of contacts and retailers, hence it would be easier to get into the market by working alongside with on of them.

There is also the option of selling the egg oil as raw material from business to business. That scenario would probably not require as much expansion of the production line nore would it require as much external expertise. However, in order to sell the product as a raw material on the market of supplements, certain requirements related to purity and content need to be fulfilled. Therefore, Fresenius would have to make sure that their product reaches the level of purity that the customers require which in turn might lead to some process refinements.

As concluded from the previous evaluation, the price of an omega-3 capsule from fish differ a bit in price depending on the contained amount of polyunsaturated fatty acid (PUFA), the aimed end user, the overall ingredients and distributor. However, the evaluation concluded that an egg oil dietary supplement should be cheaper than fish oil containing as much PUFA and therefore would represent a competitive alternative. Hence, it would be recommended not to exceed the current price of the omega-3 capsules from egg supplements existing in Asia-Pacific. According to Amazon, one jar of 120 egg oil capsules cost around EU€ 16.8 (Amazon, 2019).

In order for Fresenius Kabi to reach out to customers and gain profit with its oil derived product, it would be preferable for them to focus on general health-conscious people. Perhaps through health- or sports magazines, store advertisement with a profitable starting deal or even showing up the product on different health fairs. In either way, it is important that the promotion clearly express the arguments why egg oil should be chosen before fish oil. If Fresenius Kabi tend to launch the product by themselves, they need to take in external expertise since they do not have any experience of this specific marketing platform.

Since Fresenius Kabi has great experience in the field of supplements, we suspect that a lot of knowledge already exist regarding the composition and production of an egg oil capsule. They are also credible as a brand in this segment of products and have already access to some of the suggested distribution channels. These facts all supports the scenario of Fresenius Kabi processing and launching the product themselves. One should however not neglect the fact that some external expertise might be required in order to produce and market the product since it is a diversification for Fresenius Kabi. What remain to be investigated is whether the egg oil still contains all important micronutrients, such as omega 3 and vitamins, after the purification process when phospholipids are being extracted. If there is an insufficient amount of such micronutrients, the health benefits of the oil may be very hard to argument.

Figure 13 describes the pros and cons for Fresenius Kabi as a distributor of a dietary supplement derived from egg yolk oil.

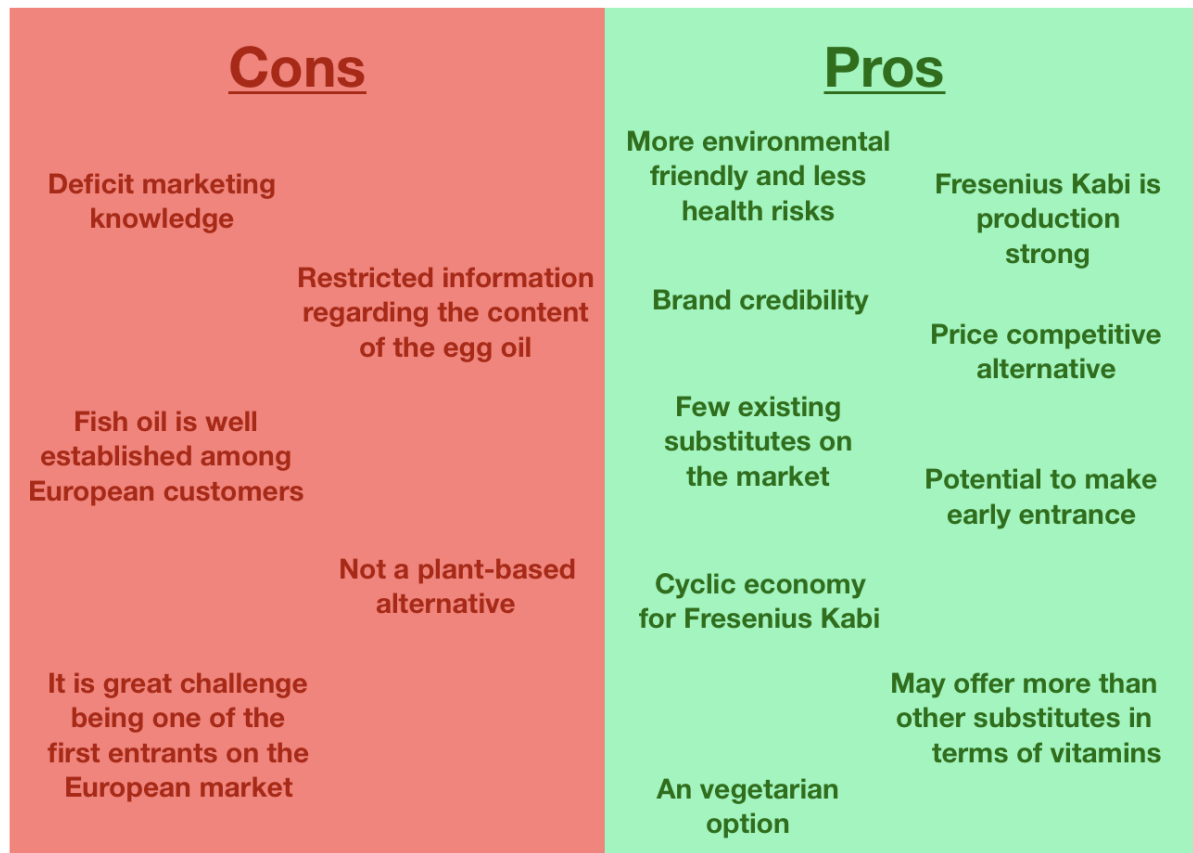


Figure 13. The pros and cons for Fresenius Kabi as a distributor of a dietary supplement derived from egg yolk oil.

8. Conclusion

The information generated from the business cases in chapter 7 imply that there are both pros and cons with each fictive product. The prospects differ depending on which approach Fresenius Kabi choose. Based on our analyses, the business case of protein enriched snacks and bars offers most advantages for Fresenius Kabi considering the fact that they are already familiar with this customer segment. In addition, there is a big gap in Europe on the market of bars and snacks representing products directed towards seniors. Many liquid supplements exist for this specific group of customers but solid options of highly nutritious supplements are extremely rare. Together with the many advantages of Fresenius Kabi producing an enriched product towards seniors, there are some disadvantages for the other two potential products; casein substitute and dietary supplement capsules. When it comes to the casein substitute product of protein powder, the market is saturated by big companies that are well established (see Appendix, chapter 4.1, *Estimated number and size of suppliers*). Egg oil as dietary supplement is a promising product that holds a lot of positive properties. This market is however primarily concentrated in Asia-Pacific and customer demand in the western countries is currently very low. Therefore, we chose to further evaluate high value nutrition bars and snacks in this final conclusion.

In order to make a fair comparison of our suggested, fictive products and the existing substitutes, we decided to focus on bars. Mainly because there are no existing substitutes of highly nutritious snacks for seniors, but also because bars are products that can be sold on the same distribution channels as Fresenius Kabis other products for enteral nutrition. There is at least one bar directed towards seniors on the market today, BOOST® Nutrition Bar launched by Nestlé. There is also a great number of liquid supplements such as drinks or shakes that can be compared to a bar offering the same advantages. In order to test whether a product based on P080 would qualify within this product segment, we created a fictive bar and compared it with two existing substitutes.

The bonus product itself contains 43 % of protein, 45 % of fat from egg oil, 10 % of water and about 3 % of phospholipids and some ethanol that remains after the phospholipid extraction. It containing around 579 kcal/100 g, see Appendix chapter 5.

The most common weight of a bar is about 40-60 grams. In order for the bar to be appetizing, we have concluded that the serving size should not be too big. However, at the same time, we want the bar to be energy-rich. Therefore the optimal size would land on approximately 50 grams per serving. In order to use as much of the bonus product P080 as possible, but still have room for additives like flavour and carbohydrates that generate texture, we estimated the optimal amount of P080 to be 60% of the bar. This corresponds to 30 grams of P080 per bar and the remaining part, 40%, will therefore consist of the earlier mentioned additives.

Based on the previous mentioned nutritional values of P080, and that one 50 g bar should contain 30 g of P080, we calculated the protein content to be $0.43 \times 0.6 = 26\%$ and the fat content $0.45 \times 0.6 = 27\%$, see table 16. 100 gram of P080 contains 579 kcal, 30 gram therefore contains $579 \times 0.3 = 174$ kcal. Common liquid supplements contain approximately 300 kcal and we want the fictive bar to be a substitute for such a product. Therefore, the calorie content must answer to this number, hence the fictive bar should contain at least 250 kcal. In order to reach the 250 kcal, the remaining 20 grams of the bar must contain 76 kcal of mainly carbohydrates.

In order to make a comparison between a fictive bar based on P080 and existing substitutes, a table was constructed, see table 15. In the table, some similarities between the products and the fictive product are illustrated.

Table 15. Comparison of the market demand, protein, fat, carbohydrates and price between BOOST® Nutrition Bar, Nutricia Fortimel Compact Protein Drink and a fictive bar based on P080. (MyFitnessPal, 2019; Apotek Hjärtat, 2019; Nutricia, 2018).

Product	Fictive bar (30g P080 /50 g bar)	1. BOOST® Nutrition Bar (50 g)	Difference between the Fictive bar and product 1	2. Nutricia Fortimel Compact Protein Drink (125 ml)	Difference between the Fictive bar and product 2
Kcal	250	210	40	300	50
Protein	7.8 g (26%)	11 g (21 %)	3.2 g	18 g (24%)	10.2 g
Fat	8.1 g (27%)	7 g (30 %)	1.1 g	11.8 g (35%)	3.7 g
Carbohydrates	~20 g (40 %)	25 g (48%)	5 g	30,5 g (41%)	10.5 g
Price	-	EU€ 2-3	-	EU€ 3	-
Market demand	high	high	none	high	none

Even though the table is based on estimated values regarding the fictive product, we conclude that it should be possible to produce a bar for seniors, based on P080, that is competitive on the market.

9. Self-reflection

Since the description of this project from Fresenius Kabi was extensive and quite general, for example the part of scanning the global protein market, we had to compromise when it came to the content of the report. As earlier discussed, a comprehensive project like this one, is all about finding balance between quality, time and resources. Since both time and resources were fixed parameters, referring to the limited amount of information available regarding the certain markets we looked in to, the only parameter that could be altered was quality. We are aware of the fact that certain elements of the report could have been done differently and there are things that we would have changed if we were to do this project once again.

The plan of the project was set late January with a clear view and detailed plan of how the first steps of the project were to be executed. These steps included the scanning of the global protein market as well as egg yolk protein- and egg oil markets. Later steps and transitions, including the evaluation of product segments and choice of specific fictive products and how they were to be performed, were never set in stone. Decisions were taken along the way once we reached the different milestones. Looking back, this created problems for us and was very time consuming. The fact that we did not know what the next chapter would entail, created an unnecessary stressfactor. One example of such an event was the transformation from product segments to specific products. In the beginning of the study, we planned to evaluate the product segments with a scoring matrix containing parameters of value for the bonus product and for Fresenius Kabi. However, when reaching this milestone, we concluded that it was not possible to use a scoring matrix due to difficulties when choosing parameters and the inability of evaluating specific parameters for a whole segment containing widely spread products. It might have been possible to use a scoring matrix if we had defined the segments in a more unitary way from the beginning. However, it would still have been hard to set up proper parameters. Instead of using the scoring matrix, we therefore used the framework of Porter's five force in order to evaluate the product segments.

Regarding the evaluations, Porter's five forces was probably not the best option. It was extremely time consuming and there was a lack of information that would have been needed in order to make full use of the framework. In an optimal scenario, we would have had unlimited access to information regarding the company's current position, their resources and more detailed information regarding the properties of the bonus product. This would have generated more detailed data and more accurate conclusions. Even if the main focus of this project was the product, we also had to consider the company behind the fictive products and their existing competitors in order to capture the true situation. Additionally, Porter's five forces is a tool used to evaluate the competition on markets with existing products. Hence it was very hard to make realistic conclusions since we have taken a raw material in powder shape and suggested a final, fictive product without taking the other stages in between in consideration. Meaning that we have not looked into Fresenius Kabi's capability to produce and form the fictive products, or even if it would be possible in general to create such products from the raw material.

From the beginning, we planned to end up with single products from the segments by doing a product/market-matrix after the evaluation with Porter's five forces. This was also an element that had to be rejected due to the time constraints and lack of information. Instead, the products were chosen based on evaluations with Porter's five forces.

Due to the fact that Porter's five forces took a lot of time, we had a narrow time range left for the business cases. We took the decision to build up the business cases in a way that allowed us to use information we already had access to. The business cases do present a more clear picture of the scenario of a potential product launch, but are still lacking important aspects that needed to be neglected due to time constraints.

Overall, we are pleased with the result of this project and now it is up to Fresenius Kabi to decide what they want to do with the material and conclusions we have presented.

10. Acknowledgment

We would like to express our gratitude to all people that have contributed to this project.

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12. Appendix

1. Research strategy

1.1 Distribution of work

Table 1 roughly visualise the distribution of work during this project. However, all chapters have been executed in close collaboration with each other and every chapter vary a lot in terms of content and amount of work.

Table 1. Distribution of work between all collaborators; Matilda, Elina and Jenny.

Matilda	Elina	Jenny
Methods being used	Expected impact	Purpose of the study
The project step by step	Study design	Aim of the study
Strategy of growth	Constraints	Strategy of growth
Industry competition	The global protein market (appendix)	The global protein market (appendix)
The global protein market (appendix)	The global egg market	The global egg market
The global egg market	Specific proteins in egg yolk	Casein substitute
High value nutrition bars	Egg oil as dietary supplements	Egg oil in skin care products
Egg oil in hair care products	Protein enriched products	Chapter 7, 8, 9, 10 and 11
Chapter 7, 8, 9, 10 and 11	Chapter 7, 8, 9, 10 and 11	-

1.2 Study design

There are three guidelines available to orientate a study. These are exploratory, descriptive and causal. Down below is detailed description of them.

Explorative

One motive of an explorative research is the potential growth for a company through new ideas and acknowledgements. Therefore it plays an important role in marketing and business strategy, and is a suitable tool in the beginning of a study. Another application area of an explorative research is the ability to define company issues to a greater extent, choosing a different path to work upon and listing actions that need more statistics. On the contrary to gathering the most accurate data, a explorative study is where the researcher get a hint of underlying problems or new initiatives that should be further investigated. Explorative research creates a bigger understanding for the area of inspection rather than generate statistically accurate answers (Lekvall, Wahlbin, 2001).

Descriptive

A descriptive research is absolutely crucial to a study implementation due to the fact that it is made by quantitative analysis and give rise to the volume of the study. As opposed to the explorative research as previously described, the descriptive one is structurally designed in a way that enables it to generate statistically measurable data. Therefore, it is primarily used to more closely define an opinion, characteristics or a behaviour by the subject of investigation (Lekvall, Wahlbin, 2001).

Causal

Causal research is similar to descriptive in sense that it also has a quantitative and structured design. The two of them differ in meaning of explanation of the relationship between variables. When using a causal study, the investigators want to find out the true meaning of variables; which are the cause and which of them that are the effect of the cause. In that way, the effect of a causal variable can be predicted when a relationship is determined (Lekvall, Wahlbin, 2001).

2. Strategy for growth

Fresenius Kabi offers products and services for clinically and chronically ill patients. They have products within infusion therapy, clinical nutrition and transfusion technology. Down below is a deeper description of the three areas.

Infusion therapy

In the segment of infusion therapy, there are two headlines; intravenously drugs (I.V. Drugs) and infusion pumps. I.V. Drugs are being used in case of emergency, when the patient is in need of fast working drugs directly into a vein. Inserting drugs intravenously means that the drug can travel through the bloodstream and expand to the entire body in a few seconds. It is also used when the patient undergoes a surgery or during intensive care, in cases of inability to consume drugs orally or if the patient's digestion does not work properly. There are a number of intravenously administered drugs offered at Fresenius Kabi which are mostly used in emergency wards and intensive units.

Infusion pumps are another clinical device in infusion therapy that is produced by Fresenius Kabi. There are syringe pumps that enable drugs to be delivered in the patient during a longer period of time and therefore, it is possible to insert smaller amount of drugs that still is effective. To administer pharmaceuticals which are efficient at minimum amount is not possible with a customary needle. In Fresenius Kabi's product portfolio, one can find different pumps depending on the wanted accuracy of the infusion solution. The syringe pump is used to provide patients with small quantities of drugs, from 0.1 up to 200 milliliters per hour, and the volumetric infusion pumps that can deliver from 1 up to 1500 milliliters per hour (Fresenius SE & Co. KGaA).

By analysing the infusion therapy section, it is concluded that the existing customer segment for Fresenius Kabi at this point is the health care institutions such as hospitals.

Clinical nutrition

Many companies are today focused at producing products with the purpose to lose weight due to that obesity is very harmful for the body. Instead, Fresenius Kabi has chosen to focus on products that can counteracts malnutrition since it is equally harmful for the body.

Malnutrition occurs when the body not is provided with sufficient energy or nutrients over a long period of time. Nutrients such as protein, carbohydrates, fats, vitamins and minerals. When the nutritional state in the body not is good enough, the patient gets weaker and therefore cannot handle diseases and infections equally good. For this reason Fresenius Kabi offers products within enteral nutrition and parenteral nutrition in order to improve the nutritional status in patients who fight against different diseases.

Therapies of enteral nutrition are for patients who are unconscious or have a sufficient digestive function but experiencing problem with loss of appetite, chewing or swallowing, suffer from neurological or gastrointestinal diseases. This type of nutrition is administered by sip feed or tube feeds which Fresenius Kabi offers. Within this area Fresenius Kabi also offer different nutritious shake and creams containing a lot of energy, easy to consume.

Parenteral nutrition are for patients whose stomach or intestine no longer work properly. The reason for that can be due to an illness or operation and therefore, the nutrition needs to enter the body in a different way. Within parenteral nutrition Fresenius Kabi offers a product in form of a three chamber bag containing all the components of a balanced nutrition; carbohydrates, amino acids and fats as well as minerals, vitamins and trace elements. All the nutrients are injected intravenously and enters the bloodstream as molecular components and therefore the nutrients can quickly be absorbed by the body. Fresenius Kabi provides different numbers of liquids with a variety of compositions that either can be used on their own or together in a mixture, customized to a patient (Fresenius SE & Co. KGaA).

The primary customer segment for the clinical nutrition are therefore healthcare institutions and hospitals. Thus, these products are aimed for the same market as the product portfolio of infusion therapy.

Transfusion technology

Except from products within clinical nutrition and infusion therapy, Fresenius Kabi also offer a variety of medical devices such as blood cell separators, autotransfusion devices and blood bags.

The blood cell separator provides several applications to separate or collect different types of cells in the blood. One application is the collection of cells from a patient's blood in order to re-infuse these cells before surgery. Another application is to obtain certain blood cells of a donor for transfusion purposes. One can also use the cell separator to remove diseased cells in a patient. This is for example applicable for patients with autoimmune diseases or leukemia.

The blood bag systems are devices that consist of bags with a venous cannulae and an integrated needle protection, along with pre-donation sampling pouches and varying filtration device. These systems come in six different types of bags and are used worldwide for blood component preparation and blood supply. The bag systems are further supplemented with other devices to offer accurate and sterile blood supply. Currently, more than 90% of all blood donations are facilitated by the use of these systems (Fresenius SE & Co. KGaA). The primary customer segment for the transfusion technology devices are healthcare institutions and hospitals. Hence, these products are aimed for the same market as the Fresenius Kabi product portfolio of clinical nutrition and infusion therapy.

As mentioned in previous chapter, the purpose of the project was to find a strategic market and application areas for Fresenius Kabi's bonus products; egg yolk protein and egg oil. These are not the main components in any existing products in their portfolio. Hence, we were looking at a new product for the company Fresenius Kabi.

In terms of market, we looked into a wide range of protein based products or ingredients that had similar characteristics as the original bonus product, P080, and the refined bonus product, P80. This led us in to new customer segments and a diverse selection of markets. The company wanted suggestions for new and alternative applications for their high qualitative protein. Hence, we had to investigate undiscovered markets for Fresenius Kabi.

3. The Global Protein and Egg Markets

3.1 The Global Protein Market

Protein is a very important nutrient because it is the most fundamental component in humans, especially in tissues (Wu, 2016). The body needs protein in order to create energy, repair tissue and for growth. Proteins consist of one or several polypeptides which are folded into a three-dimensional structure to form a functional protein. A polypeptide is a chain of amino acids which are linked together via peptide bonds. In total there are 20 amino acids which can be divided into two separated groups; essential and non-essential amino acids. The human body can synthesize the non-essential amino acids but not the essential and therefore it is important to include these in your diet (Boland, 2013).

The suggested amount of protein and amino acids acquired on daily basis for the human body has shifted the last decades. This depends on the growing interest of dietary requirements which has lead to an increased amount of studies about the biochemistry of amino acids and nutrition. Therefore, the knowledge about the need of proteins for humans has increased over the years (Wu, 2016). On the market today, there are many different sources of protein. Figure 1 illustrates the distribution of the various protein sources around the world today (Henchion et al., 2017; FAOSTAT, 2012; Boland, 2013).

Global Protein Supply

■ Fish & Shellfish ■ Meat ■ Vegetal ■ Dairy ■ Other animal (incl.egg)

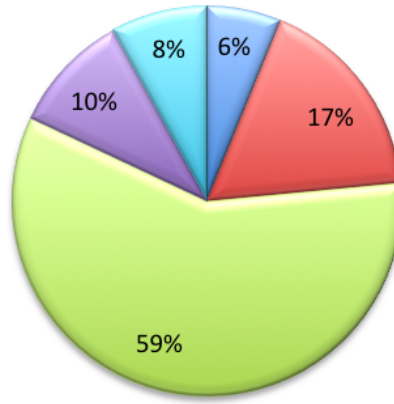


Figure 1: The pie chart illustrate the distribution of the different protein sources around the world today (Henchion et al., 2017; FAOSTAT, 2012; Boland, 2013).

As figure 1 shows, vegetables are the largest source of protein in the world (Henchion et al., 2017; FAOSTAT, 2012; Boland, 2013). These are plant-based protein sources such as grains, cereals, beans, seeds, pulses, nuts, legumes, algae and soy products. However, the majority of these protein sources often lack one or more essential amino acids, or do not contain the sufficient quantity necessary to meet human nutritional need. Therefore it is important that vegetarians and vegans have a varying diet. On the other hand, the environmental impact of vegetal sources is significantly smaller compared to other protein sources (Henchion et al., 2017).

Protein supply of animal feed

One reason why vegetal proteins are the biggest piece of global protein supply is because a lot of animal feed is derived from these proteins. The most common type of vegetal protein that is used in livestock production, such as agriculture and aquaculture, is the Soybean meal. The popularity of soybean meal depends on the high protein content of soybeans, it contains about 44%-49% of proteins. These proteins are very accessible for animals and provides them with a good amino acid profile. As the developing countries have started to increase the consumption of meat and other animal-based protein sources, the production of soybean meal has also increased significantly during the last couple of years.

Unfortunately, this also means that the environment has been harmed even more due to the considerable large impact soybean meal has on the environment. The large environmental impact is both due to the production itself, soybean meal is produced as a byproduct of oil extraction, and the distribution from big exporters such as North and South America (Stiles, 2016).

Out of all crop production globally, 35% is addressed to animal feed and 65% to human foods, see figure 2.

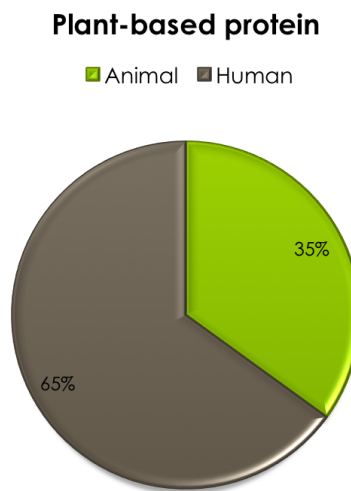


Figure 2. Distribution of plant-based protein to animal feed and human food.

Of course, these numbers are shifting depending on country. In developed countries for example, where the consumption of livestock products is larger, the same numbers are 60% and 40% respectively and can be visualised in figure 3.

Plant-based protein developed countries

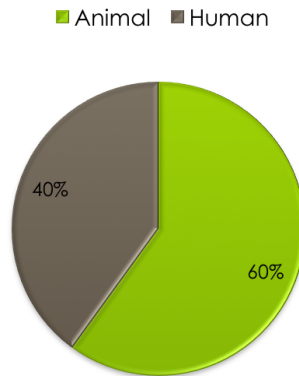


Figure 3. Distribution of plant-based protein to animals and humans in developed countries.

Due to the increased meat consumption in developing countries, these numbers are believed to increase as well. Especially in countries that are world leading producers of soybean meal such as Argentina and Brazil. However, it is not sustainable to continue eating a lot of livestock products in developed countries as the meat consumption keeps on increasing in developing nations. The ratio of protein demand between animal products and human food is 20:1 for beef, 3:1 for milk and 4-9:1 for lamb, pigs and chickens. For example, this means that one kilogram of beef requires 20 kilogram of plants. In a forthcoming future, with a growing population together with an increasing use of resource-intensive food, it is absolutely essential to shift the ratio of plant-based protein supply from animals to humans all over the globe (Stiles, 2016).

Protein supply of human feed

Today, meat is the second largest protein source in the world, see figure 1 (Henchion et al., 2017; FAOSTAT, 2012; Boland, 2013). Meat is an important source of protein due to its high nutritional value, it contains many of the essential amino acids and has a high net protein utilization and digestibility. It is also a good source of minerals, such as iron and zinc, and it also contains vitamins A, B, D and E. Despite the health benefits that meat consumption provides, the production and consumption of meat has a large negative environmental impact. It produces high levels of greenhouse gas emissions which contributes to the climate changes.

The production of meat also affects the environment negatively because of the land use, the use of energy and chemical input. However, meat production is seen as an important part of economic growth (Henchion et al., 2017).

The third largest protein source today in the world is dairy due to the well established global milk industry, see figure 1 (Henchion et al., 2017; FAOSTAT, 2012; Boland, 2013). There are many health-focused scientific studies showing that milk contains the sufficient quantity of the essential amino acids that humans need. Therefore, a lot of people see milk as a good nutritious base component in different kind of foods. The different properties of milk gives the opportunity to create a great diversity among milk-based protein products. The outcome of this can be seen in the various types of dietary supplements that has been shaped in recent years; milk-based protein drinks and powders have become very popular. Despite the advantages of milk proteins, production of milk also has negative impact on the environment because of the need of land and water. Just like meat production, emission of greenhouse gases is also a side effect of milk production. However, during the last decades there have been some technological improvements in the milk industry which have reduced the number of animals required to produce the same volume of milk (Henchion et al., 2017).

Other animals is the fourth largest protein source in the world today, see figure 1 (Henchion et al., 2017; FAOSTAT, 2012; Boland, 2013). This includes for instance eggs, insects and bacterias (Henchion et al., 2017). Egg is a very good nutrient source due to its balance between fat and protein. Studies have shown that egg yolk contains the sufficient amount of the essential amino acids that are recommended for humans and it also has other beneficial health effects; increasing immune function and maintaining a healthy blood pressure (Huizen, 2017).

According to a study done by researchers from the University of Oviedo in 2018, the egg industry is believed to contribute to greenhouse gas emissions and water contaminations (Abín et al., 2018). The researchers investigated the environmental impact of egg industry in Spain. Together with France, they account for 25% of the total egg production in Europe.

With focus on 18 different environmental categories such as ozone depletion, climate change, human toxicity and land occupation, the research team analysed vigorous egg production. As a result, the study revealed that the largest environmental footprint is correlated to hen feed and the replacement of new laying hens. Water consumption and chemicals used for cleaning on the other hand, did not contribute significantly which was previously assumed (Abín et al., 2018).

Fish and shellfish are the smallest sources of protein in the world today, see figure 1 (Henchion et al., 2017; FAOSTAT, 2012; Boland, 2013). Fish has a higher protein content and a lower feed rate compared to land based animals. Fish- and shellfish proteins also contain many of the essential amino acids. There are scientific evidence that report other benefits with the consumption of fish and shellfish, many that are related to the fact that fish and shellfish contain omega 3. Decreased risk of inflammation, heart diseases and arthritis are some of these. Despite this, there are concerns regarding large consumption of wild fish due to its potential contamination with heavy metals (Henchion et al., 2017).

3.1.1 Social and cultural differences; protein utilization

All over the globe, people eat a lot more protein today than they did 50 years ago. Since 1961, the total meat production has grown 4-5 fold with Asia as the largest meat producer standing for 40% to 45% alone. But it is not just the Asians that eats a lot of meat, the average meat consumption per capita has increased about 20 kg during the same period. This number means that the level of meat consumption does not correlate with the increasing population, it is bigger than that. However, it is possible to identify a connection between the growth in meat consumption and countries which has experienced a big economical shift such as China or Brazil (Ritchie, Roser, 2017).

This pattern is over all very consistent, except when it comes to India. People in India lives dominantly by a lacto vegetarian food culture, in order words - they do not eat meat, fish, chicken or egg but has no prohibition for other dairy products such as milk, cheese or yogurt. About 70% of the vegetarians in the world lives in India. Out of these vegetarians, 75% are lacto vegetarians and 25% are lacto-ovo vegetarians, meaning that they do not eat meat but eat eggs and other dairy products.

In India, the meat consumption per capita has stayed almost the same since 1961 (Rammohan et al., 2011). According to the same source, the large number of vegetarians in India is associated and influenced by the teachings of *ahimsa* or “non-violence” inherent in Hinduism, Buddhism and Jainism. Moreover, the vegan lifestyle is not widespread in India, less than 1% do not eat anything that is animal-based (Flood, 1996).

Comparing this numbers to the United States reveals that only 7% of the total population in the U.S is estimated to be vegetarians (Rammohan et al., 2011).

The lack of people living a vegetarian lifestyle has consequences such as that most of the North Americans eat more than 110 kg meat yearly per person. That is not, however, the highest consumption by country. Australians like meat even more. The average Australian eat 116 kg per year (Ritchie, Roser, 2017). Furthermore, the contrast between animal-based products in North America and the rest of the world is big. When mapping all protein sources of worldwide consumption and protein sources for North America 2014, figure 4 and 5 illustrates the results (Wu et al., 2016).

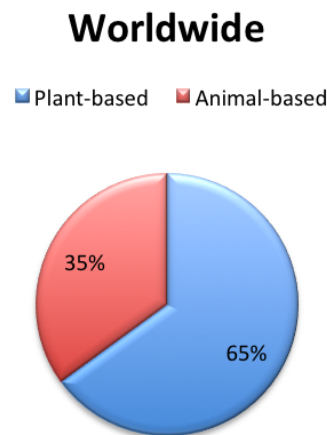


Figure 4: The distribution of animal- and plant- based protein worldwide (Wu et al., 2016).

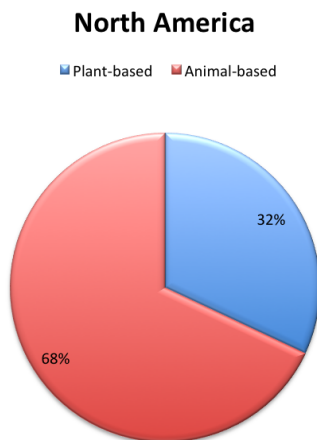


Figure 5: The distribution of animal- and plant- based protein in North America (Wu et al., 2016).

North America and the rest of the world is almost completely reversed to each other in terms of protein supplements derived from plant versus animal.

When it comes to Africa, the major differences in economic welfare and average income between countries influence the patterns of meat. Over all, the average African eat 20 kg of meat per year. But some countries does not consume more than 10 kg per person and other more wealthy countries such as South Africa up to 60-70 kg (Ritchie, Roser, 2017). In 2007, World Health Organisation (WHO) wrote in their technical report that, according to amino acid requirements for humans, recommended daily income is 0.66 g protein per kg body weight. Sadly, many people living in developing countries does not live up to these recommendations. Only 3% of dietary energy in general low income countries comes from meat and offal. Roots and tubers stands for about 11% and pulses, nuts and oilseeds causes 6%. The remaining 79% of daily intake of energy is mostly from cereal-based staple foods. It is still an ongoing problem in developing countries to provide the population with sufficiently amount of qualitative protein on a daily basis. A diet that is inadequate leads to a broad number of deficiencies. In Africa, the population deals with diseases such as iron-deficiency anemia, endemic goiter caused by iodine deficiency and vitamin A deficiency due to undernutrition (Schönfeldt, 2012).

Even though Africa is dealing with some major diseases due to their diet and that it is a great challenge to beat the malnutrition in Africa, research has revealed that even a small

amount of animal-based products added to a plant-based diet can improve child development and maternal health significantly (Schönfeldt, 2012).

Together with the Americans and Australians, the people living in Europe also eats a lot of meat with an average of 80 kg per person per year. But the increase of meat consumption in these countries has been a lot slower over the past 50 years in comparison with low-income countries. It is more of a stagnating or even decreasing development (Ritchie, Roser, 2017).

Different trends and patterns of what kind of meat the population consumes varies a lot depending on the location in the world. Pigmeat is very popular in China and stands for 66% of total meat consumption per person unlike the situation in Argentina, where beef and buffalo meat accounts for more than 50% of the total amount of meat. In New Zealand, the population prefer to eat mutton and goat to a greater extent than the rest of the world. In 2013, the New Zealanders ate almost 20 kg mutton and goat per capita. Other meat types such as wild game, horse and rabbit is not that common at the global level. However, people living in Gabon (central Africa) seems to be found of it due to the fact that 25% of its meat consumption comes from such sources. It has however declined since 1961 when the same number was 70% (Ritchie, Roser, 2017).

The popularity of consuming eggs also varies a lot depending on location. According to Ritchie and Roser, the distribution looked like figure 6 in 2013:

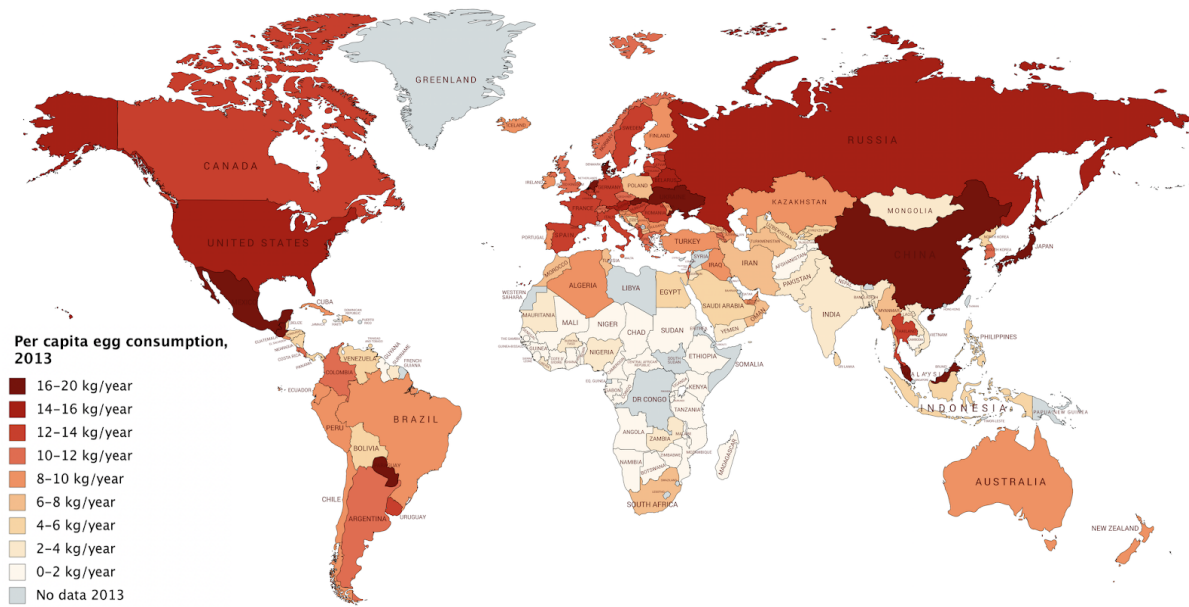


Figure 6: Egg consumption per person per year in 2013, dark red indicates higher amount (Ritchie, Roser 2017).

North America together with Russia and China were leading countries in consuming eggs. When zooming in on Europe, one can see that Denmark and Netherlands were the countries eating most eggs, consuming 15.35 kg and 14.03 kg respectively.

Today, the consumption of the various plant-based protein sources differ around the world. As mentioned earlier, plant-based protein sources are grains, cereals, beans, seeds, pulses, nuts, legumes, algae among others. The major protein source in the world is cereal. More precise, maize, wheat and rice are the most consumed protein sources in the world. The distribution in the world among the different plant-based protein sources are illustrated in figure 7. It is visualised that wheat is the most consumed plant-based protein source in Western. Also, 45 % of the total protein intake in Eastern and Southern Africa is maize, but in Ethiopia the major protein source is teff. It is also illustrated that 21 % of the total protein intake in West och Central Africa is from maize, but West Africa also eat a lot of millet. In India, they mostly eat rice and millet but 4 % of the total protein intake in South Asia comes from maize (Henchion et al., 2017).

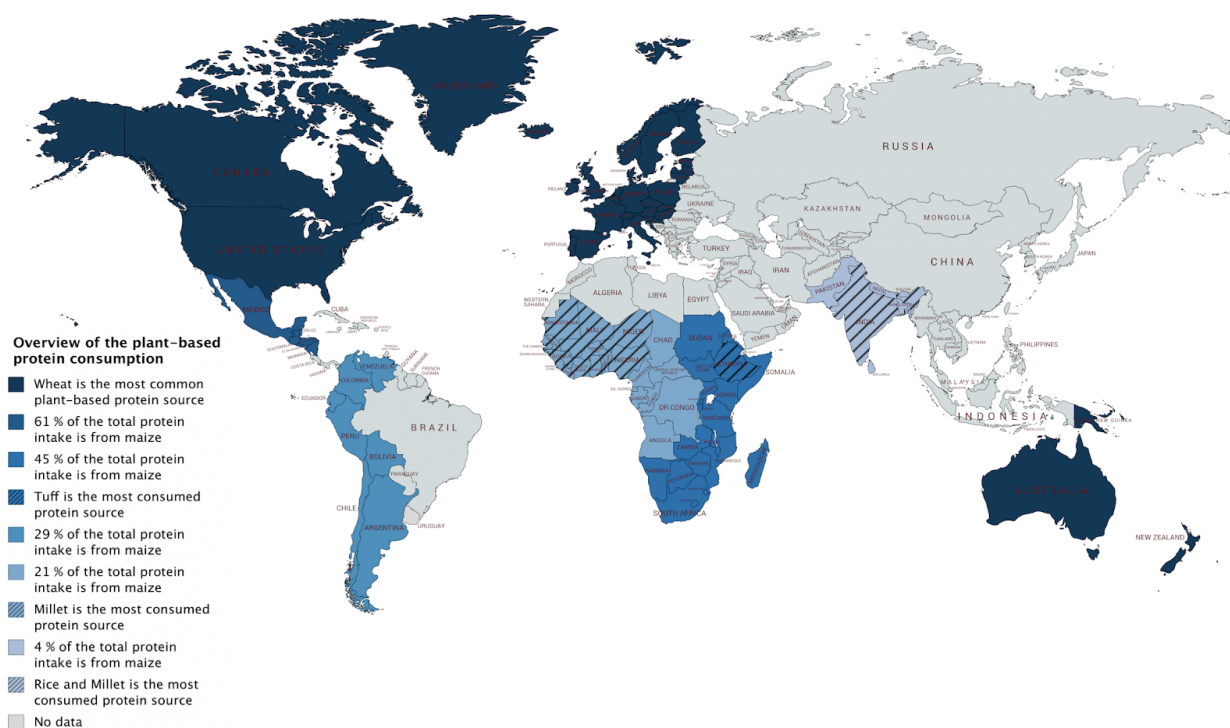


Figure 7: Overview of the plant-based protein consumption in the world (Henchion et al., 2017).

3.1.2 Historical development of the protein market

Protein consumption has changed through history and our diet today differ quite a lot from the diet humans had 50 years ago, see figure 1 and 8. The first requirements of different macronutrients in human diet was established in early 1940s. Surveys then showed deficiency of micronutrients amongst the people in many industrialized countries (Abbott, 1966).

While the protein resources in developed countries slowly started to increase as a result of urbanization and increased income, the protein supply declined in developed countries with about 6% between 1945 and 1966. The protein supply was still adequate for feeding the population in these countries. However, due to economical and social obstacles that hindered the distribution, some segments of the population did not get the required amount of protein anyway. In other words, there was a need for increased protein production and better distribution systems already back then (Abbott, 1966).

In 1966 approximately 70% of the global supply of proteins came from vegetable sources,

see figure 8. Even if the supply of grains were very similar in developed and developing countries, the supply of animal-based proteins such as egg and meat varied quite a lot. The availability of animal-based protein could vary from 20 grams daily per capita down to 3 to 4 grams, between the western countries and developing countries respectively (Abbott, 1966).

Before the 21st century, grains were the main source of protein in most countries aside from Argentina, the US, Australia, Canada, New Zealand and Sweden (Abbott, 1966). Now the picture is rather different. The increasing supply of animal derived products in developing countries, in combination with a growing consumption of meat and dairy in developed countries, have changed the global distribution of protein consumption (see Figure 1).

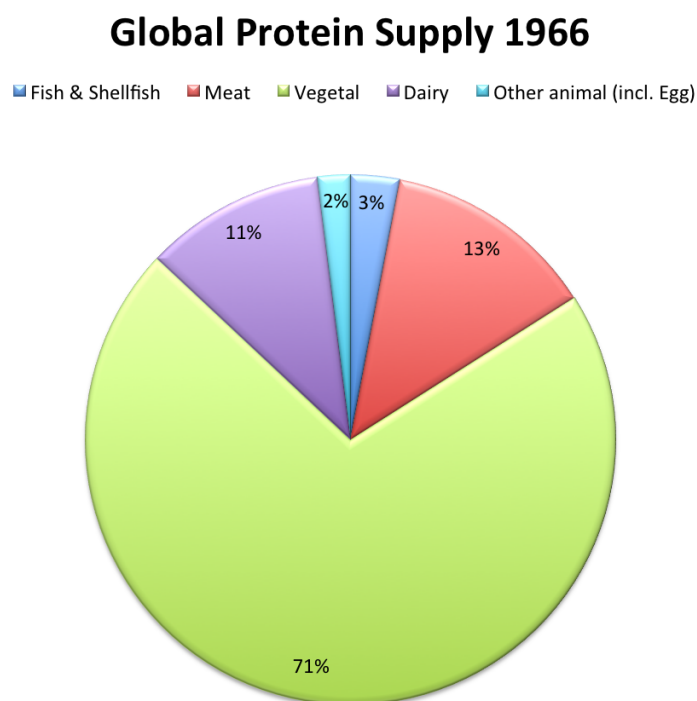


Figure 8. The pie chart illustrate the distribution of the different protein sources around the world in 1966 (Abbott, 1966).

The protein gap

After the World war II it was suggested that the widespread malnutrition of protein in developing countries was causing a certain condition amongst children. The condition went by the name Kwashiorkor and meant “the disease of the deposed child”. In 1960’s it became a strong belief amongst nutritional scientist that the protein deficiency was due to lack of meat and high-protein foods in the developing world. The UN recognised this as the so-called “protein gap”, a worldwide protein deficiency. Agencies such as FAO highly prioritized this protein gap and much research was focused on improving the global protein nutrition (15th Session of FAO Conference, 1969). One of the actions taken to solve this protein gap was by developing protein-rich strains of cereal (Webb, 2017).

The protein gap was however exposed as false some years later. It was revealed that protein deficiencies amongst children in developing countries was very rare. In 1975, analyzes showed that the malnutrition amongst people in these parts of the world was due to lack food in general, not low-protein intake specifically. One factor contributing to the false assumption of a protein crisis was the high estimation of human protein requirements. After world war II, the recommended amount of protein for a two-year old was estimated to be 40 grams per day. Today, that number is estimated to be 18 grams per day. When using the requirements from 1943 as a guideline, even children in developed countries would have been categorized as protein deficient (Webb, 2017). No wonder that surveys showed that there was a lack of protein amongst population in both developed and developing countries.

The Recommended daily allowance (RDA) of protein for adults and children are significantly lower today. Despite this fact, the supply of protein is not sufficient to feed the global population, partly due to overconsumption of protein-rich foods in high income countries (Brown, 2018). Even if the protein gap theory was proven to be false approximately 50 years go, we might head towards a real one in the future if we do not change our way of consuming and producing food.

3.1.3 Future trends and prospects

As the global population continues to grow, the demand for nutritious food will increase. The increased urbanisation and economic development in middle and low income countries has led to changes in the global dietary patterns. The demand for sources of protein is expected to increase substantially in the future, especially in developing countries (Henchion et al., 2017). As a result, the world production of meat is expected to double by the year of 2050 (FAO's - Meat & Meat Productions, 2019). The expected increase of animal-based protein production cause concerns regarding food security and sustainability. Today, two thirds of the agricultural area in Europe are used for livestock production (Henchion et al., 2017). In addition, FAO reports that the emissions from global livestock represents 14.5% of all anthropogenic greenhouse gas, where cattle represents 65% of the emissions from livestock (FAO- Key facts and findings, 2019). Hence, the increasing demand for animal-based protein will be a great challenge for our planet.

The increased awareness in developed countries however, provide forces to slow down the growing demand for animal-based protein. Today, people are more aware about the impact food production and consumption have on the environment. The health concerns regarding processed meat and saturated fatty acids is also rising, along with the ethical issues about animal production. As a result, vegetarianism has grown internationally and dietary trends such as “flexitarianism” is something that is encouraged (Leitzmann, 2014).

Now in the 21st century, many initiatives are appearing regarding a sustainable protein supply for the global population. One example of such an initiative, is “The Protein Challenge 2040”. It is facilitated by Forum for the Future and involves international organizations, international businesses and non-governmental organizations. They all work together with the aim to answer the question of how to provide enough protein to 9 billion people in a healthy, environmental friendly and affordable way. The Protein challenge 2040 arguments that the best way to tackle the future problem of increased protein demand is by making the production of animal-derived protein more sustainable in combination with increased consumption of plant-based and new emerging protein sources (The Protein Challenge 2040, 2019). These are generally accepted facts. As a consequence of this, the future protein market will be affected by the risen awareness of the environmental impact from livestock industries.

Existing protein sources in the future

Meat

Meat plays a key role in the human diet in terms of providing energy and essential micronutrients. In the past decades, the consumption of meat has increased substantially. Between 1990 and 2009, the consumption increased with almost 60%, from 175,665 thousand tonnes to 278,863 thousand tonnes (Henchion et al., 2014). Due to higher income in for instance Middle East and Asia, this trend is expected to continue. The growth of consumption per capita in developed countries is however suggested to be saturated, due to changing demographics and a growing health and dietary awareness (Henchion et al., 2017).

Plant-based Protein

Plant based proteins are important in both human and animal nutrition and the major part of the global dietary protein intake is through cereals. These foods appear in some form in all diets and are cultivated in widespread regions of the world. Rice, corn and wheat are the main plant protein sources consumed globally and are particularly important protein sources in the diet of developing countries (Henchion et al., 2017).

Cereals work as rich sources of bioactive peptides and are thereby connected with several health benefits. They offer a broad selection of bioactivities such as anti-inflammatory, antioxidant and anti-diabetic properties (Cavazos, Mejia EG de, 2013). They are however lacking sufficient quantity of some amino acids to meet the need for human nutrition (Henchion et al., 2017). A combinatory diet of both pulses and cereal however, can help to overcome the problem of insufficient variability of amino acids in a vegan or vegetarian diet. From a land use perspective, plant-based proteins are more beneficial than animal-based proteins. Plant-based proteins are also a better choice when it comes to greenhouse gas emissions. There are however environmental criticism aimed at plant-based proteins due to its use as animal feed (Henchion et al., 2017). As the livestock production grows bigger, the demand for nutritious food for the animals increase as well. Up to 50% of the global grain harvest is used for the production of animal feed today (Spiegel et al., 2013). Approximately 12 million hectares of land outside Europe is used for livestock production to meet the European demand of cereals.

Such high intensity plant protein production brings severe consequences when it comes to use of water and soil degradation (Henchion et al., 2017). The growing awareness of the health related benefits of plant-based proteins along with the ethical and environmental issues related to intense meat production, might lead to increased consumption of vegetal sources of protein in human diets in developed countries. Especially since the usage-level of animal-based protein seems to have stagnated in many of these countries. But in order for that to happen, a shift from the way consumers think of vegetal proteins as imitations or side dishes to animal protein products is required.

Dairy

A dominating component of the global human diet is dairy based ingredients. Many scientific and nutritional studies prove the advantages of using milk as a nutritional base of foods since it facilitates a rich source of protein. The global milk industry is highly developed today and the market is continuously evolving due to recent upcoming trends in sports and lifestyle nutrition. The amino acid profile of dairy-based proteins makes them a beneficial source of protein for muscle gain and physical performance. Due to the large amount of essential amino acids in dairy based products, they match very well with the recommended human nutritional intake of essential amino acids (Agarwal et al., 2015).

Techniques such as genetic selection combined with effective feeding regimes of animals are used to increase the yield of protein in milk production. There are also membrane separation techniques to separate specific protein ingredients, which generates a wide variety of applications for dairy ingredients (Henchion et al., 2017).

Concentrated milk protein products are often manufactured as powders but the market for nutritional lifestyle foods is rapidly growing. New forms of products containing a high amount of milk proteins such as milkshakes and puddings are filling up the shelves in stores around the world. This is mainly in developed countries where a protein rich diet is an well established trend. The milk protein concentrates (MPC's) are generally categorized as: Whey-based protein, casein-based protein and total milk concentrate (Henchion et al., 2017). The MPC's resemble each other in texture but can differ in uptake rate of certain amino acids (Tipton et al., 2004).

These MPC's are not only used in products aimed for lifestyle nutrition, they are also used in the manufactured process of varying forms cheese, ice cream and fermented dairy products such as yoghurt (Tipton et al., 2004).

Emerging economies with increasing income are one of the factors rising the demand for dairy proteins. As the development of new technologies continue, a production process that generates safe, functional and high quality dairy-based protein products are waiting in the future. Hence, dairy based products are expected to remain a leading source of protein (Henchion et al., 2017).

Fish & Shellfish

Fish is commonly regarded as healthy choice of protein source. Seafood such as fish have a high protein content with a low feed conversion rate. This makes them a more sustainable choice than terrestrial animals. Their flesh is rich of amino acids and omega 3 and seafood can be coupled to several positive health effects such blood pressure control and maintenance of bone health (Henchion et al., 2017).

In many parts of the world, mainly in coastal communities, the consumption of fish and shellfish is increasing. Aquaculturing, meaning the cultivation of populations in fresh- and saltwater under controlled conditions, stand for 50% of all the seafood consumed globally. By the year of 2013, aquaculturing was suggested to supply the main source of fish. This is partly due to the growing demand of food but also due to the fading wild capture fisheries. In order to keep the aqua cultivation sustainable, the use of chemicals and soy as feed has to decrease as well as the pollution and habitat destruction of waters. There are however companies that are striving towards a more sustainable system for aquaculturing. One example is the feeding of shrimps with microorganism which in turn feed on the excrement of shrimps, a feeding cycle that maintains itself. If more such initiatives are taken, aquaculture holds great promise of being a key player in a circular and sustainable food system in the future (Henchion et al., 2017).

Vegetal proteins (pulses and legumes)

Pulses serve as the major source of protein in many regions of the world and they are often seen as a key player when it comes to overcoming the struggle with protein energy malnutrition in under-developed countries (Henchion et al., 2017). There are also increased interests for these proteins in developed countries as vegetarian and vegan diets are growing more popular. Even if there are many health related benefits with vegetal protein, some important nutrients are deficient such as vitamin B12, iron and calcium, especially in a strict vegan diet without any dairy or egg ingredients (Clarys et al., 2012). Unlike animal derived proteins, plant-based proteins as pulses may not fulfill the required amino acid profile in human diets. The required balance of amino acids may however be achieved by combining cereal and pulses, rising the nutritional value of the vegan products (Henchion et al., 2017).

New biological inventions such as plant breeding and genomics might make the production of plants more efficient in the coming future and new emerging technologies such as remote sensing and advanced monitoring can help producers to reduce the risks of pests and weather related damage. Some technological inventions however require a lot of energy and comes at a high costs which means that they are currently most relevant for the production of high value-crops (Henchion et al., 2017).

The consumption of plant-based proteins might not be expected to grow as much as the meat consumption in the foreseeing future. However, the rising awareness about environmental and health related benefits of vegetal foods in combination with new technological development makes plant based proteins a promising alternative in the challenge of filling the increasing protein demand.

New and emerging sources of protein

Even though the production of some existing protein sources will increase in coming years, there will grow a demand for new and more sustainable alternatives. Such new alternatives could be insects, algae and in vitro meat (Spiegel et al., 2013).

Insects

Populations in many part of the world have used insects as a source for energy for many years. For at least 2 billion people, insects are a common ingredient and a part of their traditional diet (Huis et al., 2013). One major advantage with insects compared to livestock is that they do not compete for big areas of land and require much less water. They do also offer the possibility of taking part in organic side-streams by feeding on waste products from other productions. Even though these creatures are significantly smaller than regular livestock animals, up 80 % of their body weight can be consumed by humans, as opposed to cattles for example where only 40% of the body weight can be digested by humans. Approximately 40-75% of the dry weight of an insects consist of proteins and they offer a good source of important nutrients such as zinc, minerals and essential amino acids (Henchion et al., 2017).

There are however concerns about insect consumption from a food safety perspective since the area is argued to be under-researched as of today (Belluco et al., 2013). The production systems for insects are currently very expensive och needs further development in order to make commercialized insect-based protein products for the global population (Huis et al., 2013).

Algae

Algae is another potential source of protein in the future. They are a large group of organisms using photosynthesis as energy source but are normally separated from the terrestrial plants. Amongst algae - microalgae, seaweed, duckweed and rapeseed are suggested as novel potential sources of protein. Algae is comparable to vegetal proteins in their nutritional profile, but the production of algae is suppressed by high costs and technical difficulties (Henchion et al., 2017). Currently, 30% of the global algal production is used in animal och fish production as feed (Spiegel et al., 2013).

Some groups of algae are however used for human intake even if more research is needed to extract algal proteins for commercialized production. Microalgae, for example, are currently used as supplements in western countries and have become a popular component in a healthy diet. The canola proteins derived from rapeseeds have many functional

properties and have been utilized as human food ingredient in a few food products in countries such as the US and Japan (Spiegel et al., 2013).

The accumulation of heavy metals by algae do however contaminate waters. There are problems with processing such contaminants which also pesticides in the algal production. This has led to concerns about the environmental safety as well as food safety. To make algae a competitive alternative as protein source in the future, inventions and new methods to ensure that heavy metals don't contaminate the waters, as well as the products, are needed (Spiegel et al., 2013). There is however no available market or economic information that can tell if algae has an industrial potential which makes it hard to raise fundings for the required research within the field (Henchion et al., 2017).

In vitro meat

Great progress in the field of cell engineering has been made under the last decade and there are several examples where researchers have succeeded with making an actual piece of meat in vitro. The first in vitro hamburger was made in 2013 by Mark Post at Maastricht University (Henchion et al., 2017). The little piece of meat took two years to make and the cost for it was about £200 000. Currently, researchers and start-ups are continuing with the development of in vitro meat production, aiming for a cost reduction and improved properties of the synthetic meat (Henchion et al., 2017).

In vitro meat production is advantageous in terms of environmental impact since it offers a possibility for humans to consume meat without having to feed and slaughter animals. It is also a better alternative than meat in terms of greenhouse gas emission, antibiotic resistance and water waste (Swartz, Elliot. 2017). The process of producing in vitro meat follows certain engineering protocols with stem cells as starting material. These cells are isolated and identified before the cell cultures are set to grow (Swartz, 2017). There are many challenges with producing large amounts of in vitro meat, one of which is the process of making the cultured meat safe for consumption. The media for cell growth have to be safe to eat as well and it can be hard to control the speed of cell growth in the media which may cause cancerous formation of the cells (Henchion et al., 2017). Even if cell culture technology can develop to achieve cultured meat with the required amount of essential amino acids, some important nutrients remain a challenge. In particular such macro and

micro nutrients that forms in animals through environmental factors when they graze and build muscle by moving (Henchion et al., 2017).

One may think that synthetic meat would be a perfect meal for a vegans but since the starting material, the stem cells, are taken from an animal, vegans are not the ideal consumers. Instead, in vitro meat holds great potential to work as a substitute amongst meat-eaters who values animal- and environmental welfare. There is however a reluctance towards synthetic meat around the world and it seems that people are sceptical of incorporating in vitro meat in their daily diet (Henchion et al., 2017).

Prospects

There are no doubts that animal-derived proteins will play a key role in the future protein market with its many applications and by-product streams. Many sources do however show that the future development of animal protein production are going towards more sustainable process practices with the use of cheaper raw materials that generates products with improved health characteristics (Spiegel et al. , 2013). In order to provide the growing population with protein in a sustainable way, novel protein sources will in addition have to replace some animal proteins in both human food and animal feed (Spiegel et al. , 2013). The production of the novel protein sources must however develop with respect to environmental impact and cost efficiency in order for them to become a competitive alternative in the future. In Figure 9, an overview of the existing novel protein sources with respect to market entering time and application area is illustrated.

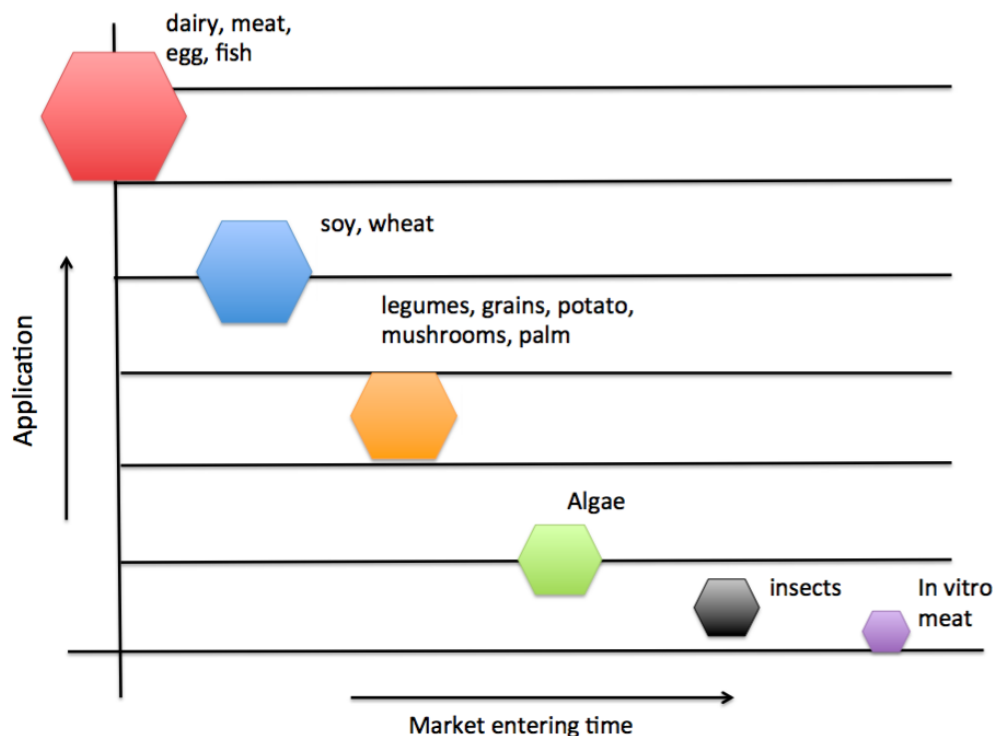


Figure 9. Overview of existing and novel protein sources with market entering time plotted against extent of application for different protein sources in both food and feed (Spiegel et al., 2013).

3.2 The Global Egg Market

3.2.1 History

Egg has been a well known protein source for centuries. Far back in time, during the second millenium, the ancestor of the modern chicken; the Indian wild red jungle fowl, was distributed around Europe, Middle East and China. In the fifteenth century, the egg was imported to the New World on Columbus's second voyage. These chicken eggs were the most valuable protein source they had because the chickens laid eggs year-around. The production of eggs later spread over the border when families in the US started to raise chickens in order to provide the households with both eggs and poultry. During the nineteenth century in the US, larger farms with chickens producing eggs arised and thereby the egg industry was born. During this time, farms with flocks of 400 hens were standard (How products are made, 2019).

Dehydration of egg was initiated in central US during the late 1800s. However, when the Panama Canal opened in 1914, low-cost dried-eggs were imported to the US from China. As a consequence of this, the production of dried eggs dropped off in the US. Instead, processing of liquid and frozen egg products began in the US between 1930 and 1940. Moreover, during World War II the production of dehydrated eggs in the US were revived in order to supply military and lend-lease needs (American Egg Board, 2019). After the war, the chicken farms were gradually modernized with automated techniques in feeding, breeding and developing of efficient henhouses which gave rise to more modern high-volume chicken farms. Today it is common that chicken farms have from 100 000 to a million hens (How products are made, 2019).

3.2.2 Social and cultural differences in egg production and consumption; 1961 and 1992

In the 1960s, the US was the largest producer of egg in the world. They produced 3.7 million tonnes eggs during year 1961. Not far behind, with 1.52 million tones produced eggs, was China. Other large producers of egg in the 1960s were several countries in Europe, South and Southeast Asian, South America and also countries like Canada, Mexico, Japan och Australia, see figure 10. The amount produced eggs for these countries varied between 140 000 to 900 000 tonnes year 1961 (Ritchie, Roser, 2017).

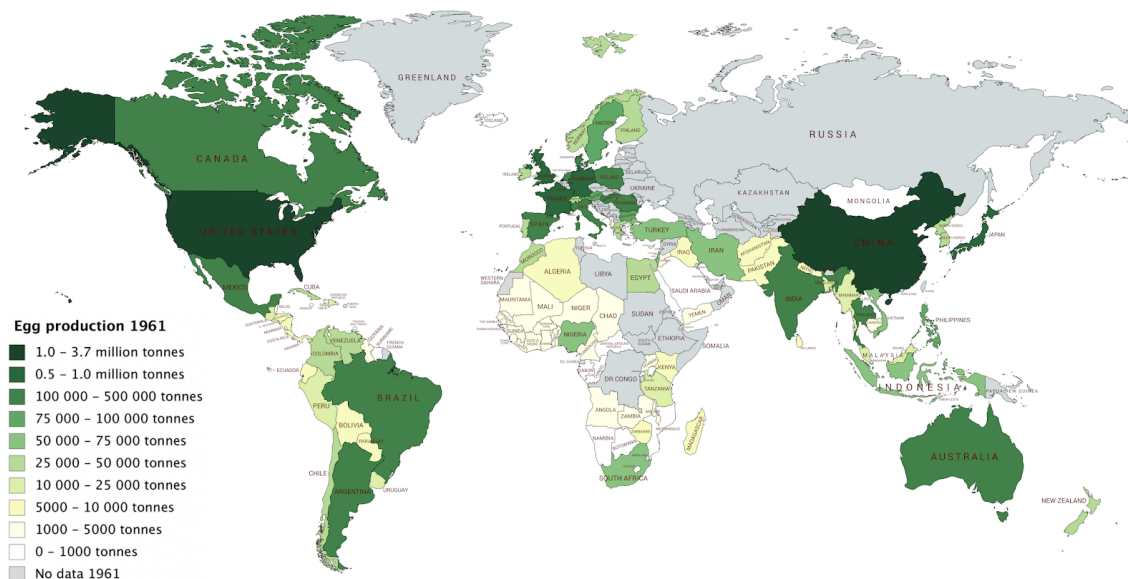


Figure 10. An overview of the egg production in the world 1961.

In 1992 the production of egg had change a bit in the world. China was during this time the largest egg producer with its 10.46 tonnes and the second largest egg producers were Russia, Japan and the US with their 2.41, 2.57 and 4.19 produced tonnes, respectively. India, Mexico and Brazil were also leading egg producers during the 1990s. Generally, the production of egg in the world had increased considerably from the 1960s due to the growing demand of eggs in the world, see figure 11 (Ritchie, Roser, 2017).

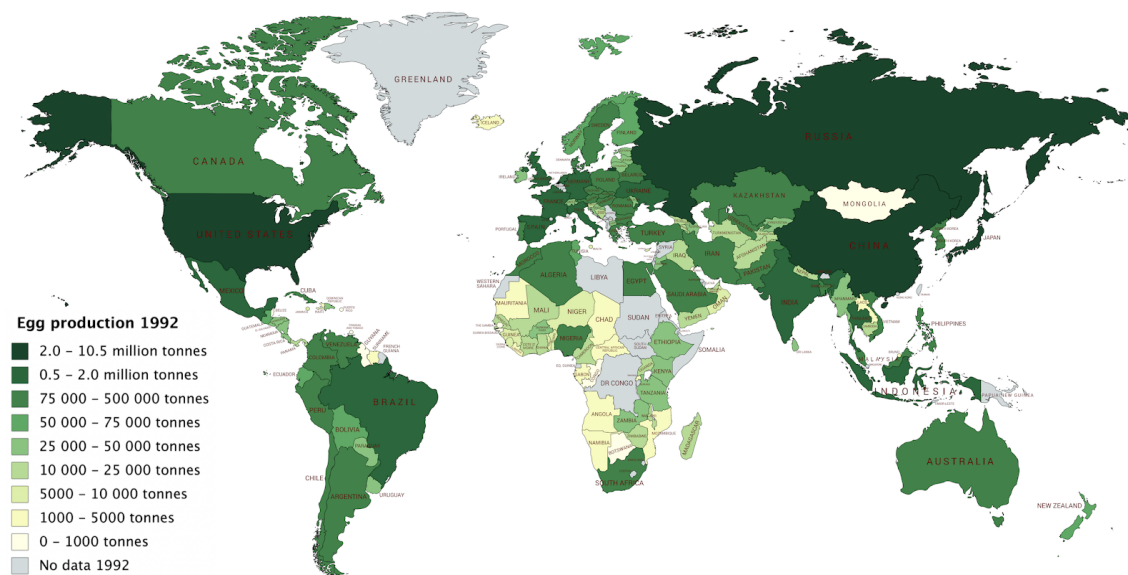


Figure 11. An overview of the egg production in the world 1992.

The consumption of egg has also shifted in the world the past decades. According to the data that has been stored, the USA, Israel, New Zealand, Canada and the UK were the countries that consumed the highest amount of eggs per capita during 1961, see figure 12. The US, Israel and New Zealand had an egg consumption around 17 kg per capita. Canada and the UK consumed around 15 kg eggs per capita (Ritchie, Roser, 2017).

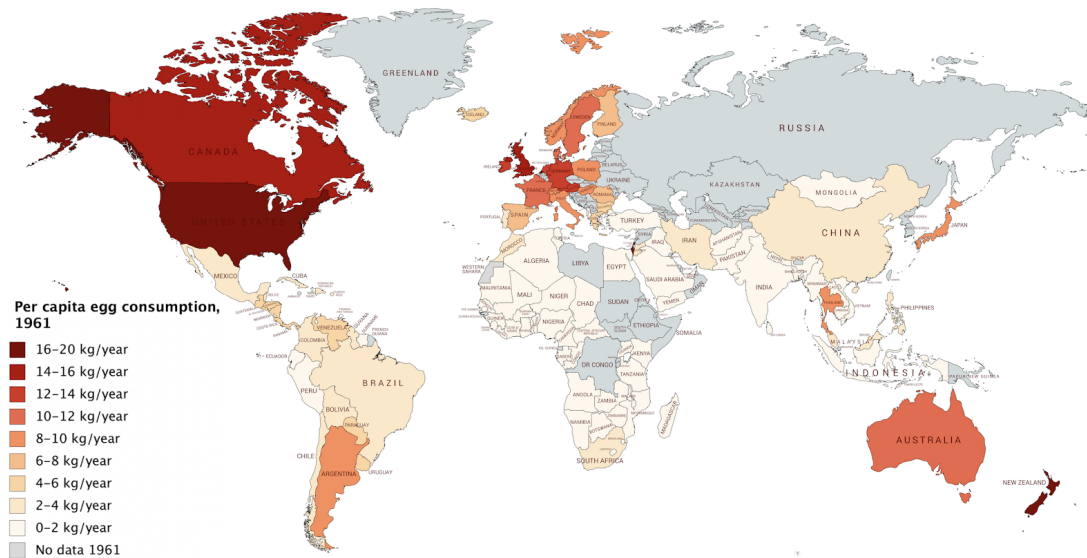


Figure 12. An overview of the egg consumption per capita in the world 1961.

By 1992, the consumption of egg per capita in the US had decreased to around 13 kg per capita but New Zealand still had the same consumption, see figure 13. In Russia, Japan and several countries in Europe the egg consumption had increased significantly. The leading consumers of egg per capita in 1992 were Japan and Hungary with their 20 kg (Ritchie, Roser, 2017).

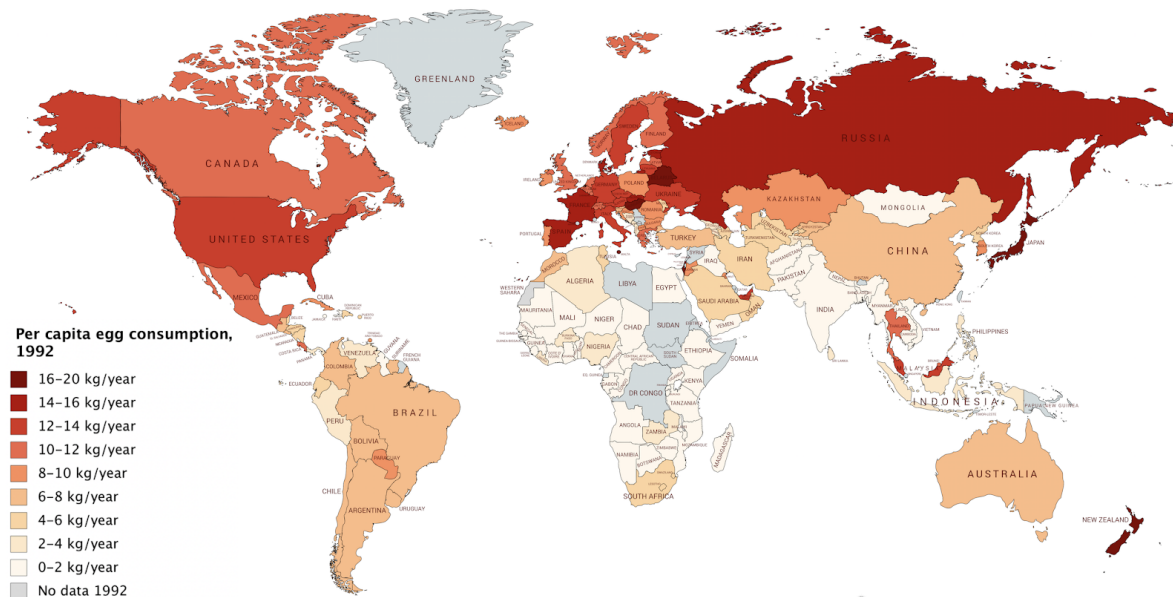


Figure 13. An overview of the egg consumption per capita in the world 1992.

3.2.3 Possible application areas for egg oil

As the egg oil has increased its popularity, further research have been conducted to investigate other applications of this nutrient-rich oil.

Egg oil could for example have application in treatments of skin diseases such as psoriasis. A clinical study of the effect egg oil has on hardened epidermis was carried out by a scientist, Mohamed Abdessalam. He claimed that a formulation consisting of egg oil, sea salt, mineral chalkette and aromatic substance actually caused disappearance of hardened epidermis and led to decreased itching. Only two days after application of the formulation, one could see normalisation of the earlier hardened skin. He later patented this formulation as a medicine against skin diseases in 1989 (Yacobi Mohamed Abdessalam, 1992; Madan, Nanda, 2017). There are also indications of egg oil having a positive effect on skin aging. Egg oil has, as earlier mentioned, proved to cause reduction of ROS production and have a nourishing and moisturizing effect on skin. Hence, using egg-oil as an ingredient in skin care products have shown potential to improve the texture of skin and delay wrinkle formation (Madan, Nanda, 2017). Natural cosmetic products without unnecessary chemicals is very desirable on today's cosmetic market. A growing awareness amongst people about what effects synthetic compounds can have when it penetrates the skin and enter the body, makes egg-oil an attractive alternative.

There are already some products on the market containing egg oil, such as "crème du CIEL" manufactured by Charismon®. The product contains 4.5% egg oil and is currently used around the world for prevention of premature aging and for increased elasticity and firmness of the skin (Charismon®, 2019).

4. Evaluation of product segments

In order to investigate which of the product segments that Fresenius Kabi's bonus products had their best application possibilities within, the framework of Porter's five forces was used. Every evaluation was made by the supposition that the bonus products have been processed into a potential, fictive product. This can either be done in-house by the Fresenius Concern, in an alliance with an external partner or the bonus product can be sold as raw material. However, this is not something that has been taken into account when doing the evaluations, since it is a decision to be made by Fresenius Kabi. The number of factors linked to each force was restricted due to the limited level of information available regarding each product segment and it is important to not base conclusions on insufficient data or facts. Furthermore, these evaluations include reflections and conclusions made by the authors of this project which should not be taken as scientific facts but rather discussions and assumptions based on gathered material.

4.1. Evaluation; Casein substitute

Power of buyers

Number of customers

The food application areas of casein are very widespread and therefore the target customers amongst the different areas are very distinguished. As concluded before, the food casein application areas that are most interesting for the bonus products of Fresenius Kabi are infant food, instant breakfasts, protein powder and sport drinks. This is due to the similarities in nutritional composition and appearance between the bonus product and casein.

In order to specify the number of customers within the product segment casein substitute, one has to look into the possible application areas separately. Infant food is an area with a large number of customers due to that there are many infants in the world and therefore there are many companies that manufacture infant foods. Infants are defined as children under 12 months. Within this area, it is companies that are the customers of casein due to that they are the buyers of the ingredients for the products that they produce. Otherwise, they produce the casein by themselves.

However, the number of customers (producers of infant food) and end customers are large due to that there are many suppliers within this area (Brandes, 2019).

Next application area, instant breakfast, is an area that have many different companies as customers of casein, just like infant food. There are instant breakfast products that are in powder form which are intended to be mixed with milk or something similar in order to be eatable. Other instant breakfast products are already in a liquid form, ready to be consumed instantly. The companies that produce these kind of products either buy the ingredients for their products or produce them by themselves, but with great probability they buy casein. Furthermore, the target market for these types of products are customers who are busy and live on the go, which many are today (Lantos, 2010). In other words, the need of these kind of products are big which means that the companies that produce these products need to produce much of them and therefore the number of customers within this area are large. In contrast, casein protein powder does not have the same amount of end customers due to that the products are aimed and used by a specific group of people; the training nerds. However, it is common knowledge that the sales of protein powders in general are increasing in the world due to the increased awareness about the importance of training and nutrition. Thus, the so called active athletes have increased rapidly during the last years (Imbibe, 2016). This means that the number of companies that produce these kind of products also are increasing. The same is for sports drink. In conclusion, the total amount of customers within this product segment are relatively large.

Price sensitivity

As done in the section above, a separately review of the different suitable application areas within the product segment has to be done in order to estimate the price sensitivity. Within infant food, it should be a considerable price sensitivity due to that the companies that buy the ingredients for their products probably buy them in large quantities. It should be the same within the instant breakfasts area. If the companies can keep the prices down of the ingredients in their products, they can earn more money or keep the prices of their products down which is favorable for the end customers. For the protein powder and sport drinks areas, which are areas that have a more narrow target group compared to the other areas within this segment, it is a bit different. The things that seem important for the end customers is the ingredients and with good marketing and well selected distribution channels people in the western countries do not seem to care if their favourite protein

powder or sports drink raise a little bit in price. However, the price of the casein that the companies buy in order to make their products should be important in the same manner as for the other areas within this segment.

In conclusion, the price of the casein should be relatively sensitive within this segment due to that the customers are companies who buy casein in large quantities.

Buyer's ability to substitute

In order to analyse the buyer's ability to substitute one, again, need to look into the different food application areas of casein within this product segment. Casein is used within infant food and instant breakfast in order to rise the nutritional value of the products. However, there can be companies that use casein in their infant food and instant breakfast products because of other reasons. This is because casein has other good properties, such as emulsifying and water adsorption, like mentioned earlier in the chapter about casein substitute. If the companies use casein in their products not only to give nutritional value to their product, but also because of the other good properties, it is estimated that the buyer's ability to substitute is not tremendously large. However, within these areas, the most important thing is that the products contain ingredients that are nutritious. This should affect the buyer's ability to substitute on a positively note because it is not casein itself or the brand that matter, it is the nutritious value of the product. Therefore, the buyer's within these areas should be fairly enthusiastic to substitute casein with another substance, as long as it is equally nutritious.

Within protein powder and sports drink it is a bit different. These areas are within a more defined and clear market and the end customers that buys these kind of products are often very employed to live a healthy lifestyle. Of course it differs between the end customers as well. For example, the so called core performers that are experts within these areas often priorities the content of the products compare to the active athletics that prefer good tasting products (Imbibe, 2016). However, this does not mean that any of them stick to a specific product or brand more than the other. But if they find a brand that provides them with a product that is good tasting or contains the right ingredients, the step of changing brand and product could be relatively big. Therefore, the producers of the core performers products should be more restrained to change the content in their products. However, the

producers of the active athletics products should be more unbridled to change an ingredient in their product, as long as it tastes the same.

Difference between competitors

The difference between the competitors also differ between the application areas within this product segment. If we look in to the infant food business we find several brands. Ranker.com has done a ranking list based on parents recommendations where they have voted on the top baby food brands available on the market today. The ranking list include 75 baby food brands (Brandes, 2019). We look at the most popular brand, Earth's best, who is marketing themselves as an organic baby food supplier with quality ingredients, simply packaged and available in regular stores with reasonable prices (Brandes, 2019; Earth's Best, 2018). For infants they offer formulas, cereals, jars and puree pouches. The formulas are in powder form and are all based on milk protein concentrate. The cereals comes in several flavours and are rich in iron, vitamins and minerals. The jars and the puree pouches also comes in different tastes and do not contain any artificial ingredients. All their products contains few ingredients and are marketed as GMO-free and they offer products that are vegan and vegetarian (Earth's Best, 2018). According to Amazon, the price of one earth's best veggie plastic tubes pouches is US\$ 0.40 (Amazon, 2019).

The second most popular infant food brand is Gerber (Brandes, 2019). They are also marketing themselves as an organic brand and they offer many types of products for infants. They offer formulas for both everyday feeding and for tummy troubled infants, cereals, food in glass jars, plastic tubes and pouches and last they also have different types of snacks. Thus they are a brand that offers more different type of products compared to the brand Earth's best. The formulas they offers are both in powder and liquid form, they also have probiotic drops and specific powders with high iron content. All the formulas for everyday feeding contains milk protein concentrate but some of the products marketed for tummy troubles contains soy protein instead of milk protein. The cereals they offer differ a lot, some contains grains and other rice. There are tuna oil and fish gelatin in some of them and some are vegetarian and vegan. As mentioned earlier, the food they offer comes in glass jars, plastic tubes pouches and comes in several flavours. Some products contain meat and other are vegetarian and vegan, just like the brand Earth's best products (The Gerber Store, 2019). According to Amazon, the price of a Gerber veggie plastic tubes pouches is US\$ 0.38

(Amazon, 2019). Additionally, just like Earth's best, Gerber is also expressing that their products are GMO-free and the number of ingredients in their products are also few. These brands are therefore very similar.

The biggest difference is that Gerber offers a few more products and all their products are not organic which all Earth's best products are (The Gerber Store, 2019). The brand that is the third most popular on the market today is Plum Organic (Brandes, 2019). This brand is very similar to Gerber and Earth's best, they are also offering GMO-free organic formulas containing milk protein concentrate, different pouches and bowls (Plum Organics, 2019). According to Amazon, the price of a Plum organic veggie plastic tubes pouches is US\$ 0.46 (Amazon, 2019). Of course there are other brands on the market that are niched toward different areas, but the conclusion is that the brands that offers infant foods containing milk proteins, like casein, in general are pretty similar.

If we look in to the instant breakfast application area, we mostly find instant breakfast that are drink-based, both in powder and liquid form. My-best.net has put together a list containing top 10 Best Instant Breakfast Drinks to Buy Online 2019 (My Best, 2018). They mean that you have to choose between an instant breakfast that taste good or is good for your body, you can not have it all. Carnation is probably the most well known brand that offers instant breakfast. They are marketing themselves as a nutritious fast breakfast alternative even though my-best.net is claiming that Carnation products contain a lot of sugar, which is true if you look on the ingredient list (My Best, 2018; Carnation, 2019). They offer both instant breakfasts in powder and in liquid form and they offer flavours like vanilla, chocolate, strawberry and café mocha. Their powder products should be mixed with milk before use and comes in three forms; Light start containing less carbs and 13 g of protein, Original containing 13 g of protein and extra High protein content containing 18 g of protein. The difference between them is that the powder products with extra high protein content contain whey protein in addition to the dry milk protein ingredient.

Otherwise they are pretty similar, for example the products contain flavours that are both natural and artificial. The liquid products come in the same different forms and they contain milk protein concentrate and soy protein isolate. However, the liquid high protein products contain a bit more of these, in total 15 g of protein, comparing to the original

liquid product's 10 g and light start liquid product's 13 g (Carnation, 2019). According to Amazon, the price of a Carnation liquid high protein bottle is US\$ 0.15 and the price of an original powder serving is US\$ 0.33 (Amazon, 2019).

Another brand that is similar to Carnation is Ensure (My Best, 2018). Their slogan is strength and energy and according to them, they offer nutritious products with high protein content (Ensure, 2019). However, my-best.net mean that this products contain a lot of sugar, just as Carnation products (My Best, 2018). Moreover, they offer more different types of products and flavours than Carnation does. They have eleven types on products, one powder-based product and ten liquid-based products. The powder product contains milk protein concentrate and soy protein which together make up 8 g of protein per serving. They have two liquid products that are aimed to be drank before and after surgery. The other eight liquid products are called clear, light, original, plus, high protein, max protein and enlive. They contain different amount of protein and calories, from 8 g protein to 30 g protein and from 70 g kcal to 350 kcal. The proteins are milk protein concentrate and soy protein, some of the high protein products also contains whey protein (Ensure, 2019). According to Amazon, the price of an Ensure liquid high protein bottle is US\$ 0.17 and the price of an original powder serving is US\$ 1.42 (Amazon, 2019). Ensure and Carnation are therefore pretty similar to each other. The biggest difference is that Ensure is a bit more expensive and they have a wider product range.

Moreover, there are many other brands that offer instant breakfast products that both are similar to the above mentioned products but also differ a lot. There are liquid products that only are based on soy proteins, which Soylent offers (My Best, 2018). There are other liquid products that only are based on vegetal protein, such as protein from pea, pumpkin and hemp, which the brand Vega protein offers (Amazon, 2019). These products are often a bit more expensive than the earlier mentioned. Furthermore, there are brands that offer products that contains less sugar and are considered to be a healthier alternative. One example is the brand Ambronite that, for instance, offers a vegan powder based product, ready to drink after adding water. This product is a lot more expensive than the other powder products on the market (My Best, 2018). In conclusion, there are many products on the instant breakfast market that are similar. The good tasting ones, with sweet flavours, often contains more sugar. There are brands that offer both healthy and not as healthy

alternatives, and there are brands that only offer one of them. You can find products based on different protein sources and the instant breakfasts that contain milk proteins are often the sweet tasting ones. In other words, everybody can find an instant breakfast product that is suitable for them. In conclusion, there are many different alternatives on the market today. However, there are many similar products on the market as well, offered from different brands. Especially the casein-based ones.

If we look in to the casein-based sports drink and protein powder market we see many alternatives. Premier protein offers a sport drink-based on calcium caseinate and milk protein concentrate, in total it contains 30 g of protein. Premier protein have this product in different flavours and according to amazon it costs around US\$ 0.15 per serving (Amazon, 2019). Another brand that is offering a sports drink based on casein is Pure protein, they have two different types of casein-based sports drinks. One product is based on calcium caseinate and milk protein concentrate containing 35 g of proteins and 150-170 kcal per serving depending on flavour (they offer 5 different flavours). The other casein-based sports drink they offer is based on milk protein isolate, whey protein concentrate and calcium caseinate and contains 30 g of proteins and 140 kcal. This product comes in vanilla and chocolate flavour (Pure Protein, 2017). According to Amazon the first mentioned product costs US\$ 0.18 per serving (Amazon, 2019).

Another brand that offers sports drink based on casein is Muscle milk. They have many different types of casein-based sport drinks. The biggest differences between them are the contained amount of proteins and calories, but all their products are based on different kind of caseins. They contain both calcium and sodium caseinate and some of the products also contain whey protein and milk protein concentrate. The range of contained amount protein and calories of their products are from 18 g of protein to 40 g of protein and from 100 kcal to 320 kcal per serving. They also offer many different flavours (MUSCLE MILK®, 2019). According to Amazon the price of Muscle milk sports drink containing 40 g of is US\$ 0.25 per serving (Amazon, 2019). By looking on the products that the different brands are offering one can see that they are very similar to each other. The biggest differences are the offered flavours and the price. Otherwise, the ingredients in the products are pretty similar.

Protein powders that contains casein are in general very similar to each other. However, some protein powders containing casein contains a mixtures of different proteins, for example whey protein and casein protein, and these can differ a bit depending on the protein mix (Amazon, 2019). However, the protein powders that have casein as the main protein source are very similar. The biggest difference between the brands are the offered flavours and the prices. One example of a brand that is offering 100 % casein protein powder is Optimum Nutrition and according to Amazon you can buy 4 pounds for US\$ 44. Dymatize is another brand that offers exactly the same type of product for US\$ 50 per 4 pounds. Both of these brands offers their products in different flavours (Amazon, 2019). In conclusion, the differences between the protein powder brands are very small. They have very similar product ranges and offer products that are very similar to each other. However, as any other application area, there are brands that are niched towards different fields. But the general picture is that there are many similarities between the competitors. Additionally, the most suitable application for the bonus product within the protein powder area is protein powders consisting of different proteins. This is because customers that buy protein powders only containing casein probably buy it for the reason that it is slowly absorbed by the body. This is a special property of casein that the bonus product does not have. Therefore, adding the bonus product to a mixed protein powder is a better alternative which, for instance, has the purpose to recover and refill the body with energy after a workout.

In total conclusion: We can see that the infant food products in general contain fewer ingredients than instant breakfast products.

Threat of substitute products

Buyers propensity to substitute

This factor refers to customers loyalty to a brand or a product. Within the infant food area, as mentioned earlier, the end buyers (the parents) of infant foods seem to prioritize the nutrient content of the products and of course, that their infant likes the product.

Therefore, if they have found a product that their infant likes containing the desired nutrients, they probably choose to continue buying food products from that specific brand (Brandes, 2019). However, different parents think differently. Some parents like to try different types of food products, and other have infants with for example tummy troubles

and therefore buy a product that they know works for their child. A conclusion is however that the most important thing is the nutritional value of the infant food products. In addition, because it already exists very many brands within this area, it is probably hard for parents that have healthy kids to stick to only one brand. Additionally, if a new brand appear on the market that seem good, many parent would probably try it. Therefore, buyers propensity to substitute within infant food, amongst the general mass, is assumably pretty strong.

Among the instant breakfast area, the end customers are mostly people on the go. As mentioned earlier, there are many different brands providing similar products on this market which makes it harder for people to get attached to one single brand. Also, there are alternatives on the market that are healthier and not as healthy making the products suitable for different kind of people. Just as it is within the infant food area, the conclusion is that it is hard for customers to stick to one single brand or product without falling for something new.

As mentioned earlier, the sports drink and protein powder areas are a bit special due to that there are end customers that are very aware and selective concerning what nutrients they are eating. Therefore, these customers probably not are eager to try a new lunched brand containing nutrients that are not fitting their diet. However, there are also end customers within these areas that only want to refill with energy after a workout and they are probably more likely to try a new brand on the market, as long as it tastes good. The conclusion is therefore, among the general end customers, that the buyers propensity to substitute within sports drink and protein powder areas is relatively high.

Number of substitute products available

As described in the section “difference between competitors”, there are different infant food products available on the market today: formulas, pouches and cereals for instance. However, those that contain casein are mostly the formulas, both the liquid- and powder-based. The differences between these products, among the brands, are as mentioned not big. There are some product for tummy troubled infants containing other protein sources or other more gentle ingredients, but otherwise the products are very similar to each other (Earth’s Best, 2018; The Gerber Store, 2019; Plum Organics, 2019). Within the instant

breakfast area, the situation is pretty similar. Most of the instant breakfasts are drink-based and comes in liquid- and in powder-form. Those who are more sweet tasting, both the liquid-based and powder-based alternatives, often contain milk proteins like casein. But there are also other alternatives containing soy protein. Nevertheless, other vegan powders and smoothie-like drinks are also available on the market. However, those who are based on milk proteins are very similar to each other. Of course, the flavours and the amount of calories differs between the products (My Best, 2018).

Among casein-based sports drinks and protein powders the differences between the available alternatives are, as mentioned, the amount of contained casein, the calorie content and the flavours. Among the protein powders that contain a mixture of different protein sources, the mix of the different protein sources can differ (Amazon, 2019). Therefore it can be concluded that the number of substitute products available are bigger within these two areas comparing to infant food and instant breakfast areas.

Power of suppliers

Estimated number and size of suppliers

Within the infant food area, as mentioned in the section about differences between the competitors, there are very many suppliers. Ranker.com has in total listed 75 brands that offers infant foods, but there are for sure more brands on the market. However, the suppliers are not equal in size, there are some suppliers smaller in size that offer special products in order to satisfy infants with specific needs (Brandes, 2019).

One example is the brand VitaMeal, manufactured by Marrakech, who is the world first provider of halal baby food (Agro food industry, 2019). But there are also suppliers on the market that are very big, like Earth best and Gerber mentioned before (Brandes, 2019). Additionally, according to research and markets, the global baby food and infant formula market reached a value of US\$ 50 Billion in 2017 and milk formulas is estimated to represents the largest product type (Research and Markets, 2018). So, indeed it is a large market and the number of suppliers are large.

It is harder to find information about the estimated number and size of suppliers within the instant breakfast area. However, by looking on the best sellers within instant breakfast on Amazon one can see many different brands and suppliers (Amazon, 2019). Moreover, the earlier mentioned list that My-best.net has put together, there are additionally brands listed (My Best, 2018). It is therefore concluded that there are pretty many suppliers within this area. The size of the suppliers of course differ, but as mentioned earlier, is Carnation one of the giants on the market. However, there are many newly started brands that are offering more healthy products which are growing because of the rising awareness of healthy food. One example is brands that are selling acai powder (Amazon, 2019). Therefore, it is estimated that the number of supplier is big, maybe not as many as within infant food but there are many. Instead, there are more giants within this area, but at the same time the smaller brands are growing bigger and bigger and are piecewise taking larger parts of the market.

Within the casein-based sports drink and protein powder areas, the number of suppliers are big, that is a fact just by searching “Casein protein shake” and “Casein protein powder” on Amazon (Amazon, 2019; Amazon, 2019). Additionally, the global protein supplements market was valued to US\$ 12.4 billion in 2016 (Grand View Research, 2019). Lumina Intelligence are also stating that there are 411 brand on the protein powder market today, which is a lot, which indicates that the competition among the supplier is hugh. Lumina Intelligence has also listed the biggest manufacturers and the largest, Iovate Health Sciences International Inc, is offering 80 brand variants in total 20 countries. Based on reviews, the most popular manufacturer in Europe seem to be Myprotein. Among the manufacturers that Lumina Intelligence has listed, the brand offering the smallest amount of brand variants is SFD SA, offering 20 different types. This is however pretty many, there are manufacturers that are smaller. There are many brands offering plant-based sports drinks and protein powders that are smaller in size due to that these types of products are relatively new on the market. However, they are increasing in popularity (Lumina Intelligence, 2018).

Uniqueness of each suppliers product

As stated in the section about differences between competitors, there are very many suppliers within infant foods who are offering casein-based formulas that are very similar

to each other. Some brands have however chosen to focus on products that contain ingredients that are more gentle for the infants tummies, but these types of products can also be found among big brands product portfolios. Some brands are only offering powder-based formulas, some are only offering liquid-based formulas and other are offering both liquid- and powder-based formulas. However, the liquid-based and the powder-based products amongst the different brand have many similarities, like that many are organic and contains similar ingredients (Brandes, 2019). The brand Gerber is thus offering very many different types of formulas for babies in different stages containing additionally, very specific ingredients. This type of portfolio is pretty unique (The Gerber Store, 2019). But in general, many casein-based infant foods are containing few and clean ingredients, which the parents are preferring to feed their kids with. In conclusion, there are uniqueness of some suppliers within the casein-based infant food area, but in general the products between the brands are very much alike. The brands offering casein-based instant breakfasts are in general offering pretty similar products. As stated before, the products that are sweet tasting (which often the milk-based products are) and contain more sugar are very similar between the brands. For instance Ensure and Carnation are two brands offering very similar products. However, there are other brands that are offering similar sweet tasting products but instead are based on other protein sources, such as soy. But there are many suppliers offering products based on other protein sources which means that it is not unique. Furthermore, there are brands offering plant-based instant breakfasts, but not as many as offering casein-based and soy-based, which makes it more unique. These products are both in liquid and in powder form (My Best, 2018).

However, our goal is to investigate the markets of casein-based products in order to find a suitable area for the bonus products, and the plant-based products are therefore not included. We would therefore conclude that the casein-based instant breakfast products are pretty similar between the suppliers.

Among the casein-based sports drinks and protein powders, many similarities can be seen between the products that the brands are offering. Like mentioned earlier, some brands are offering casein-based protein powders and sports drinks that contain a mixture of different protein sources. However, there are many brands offering these kind of products which indicates that it is not unique. The suppliers offering the most unique products are those

who have different plant-based products due to that these are relatively new on the market and therefore, there are not as many suppliers manufacturing these kind of products yet (Lumina Intelligence, 2018). However, like mentioned for the infant foods, these products are not relevant due to that we are investigating the market of casein-based products. Therefore, it is concluded that the uniqueness of the suppliers products within the casein-based protein powders and sport drinks are not that big.

Threat of new entrants

Brand loyalty

As mentioned before, there are many brands offering infant foods and the most important thing for the end customers seem to be that the products contain clean and nutritional ingredients and of course that their kids like the food. Therefore, the brand loyalty amongst the infant food do not seem to be very large.

However, if parents have tummy troubled infants they probably stick to a product they know work for their kid. Among these parents there probably exists some brand loyalty. On another note, one have to remember that there always will be new first-time parents on the market which means that the threat of new entrants probably will decrease due to that all brands and products will be new to them. In conclusion, as long as a new launched product contains few and clean nutritional ingredients, it will probably be purchased by the general end customer.

Among instant breakfasts the brand loyalty should not be that strong due to that there are many different suppliers within this area, but the casein-based products offered from different brands are very similar to each other which makes it harder for people to get attach to one single brand. Additionally, the customers that buy these kinds of products are mostly stressed and on the go which probably make them just pick a product in the store. However, this can also be a threat of new entrants due to that stressed customers do not have time to examine a new product in the store and therefore select a product they recognize. In that way, there probably exist some brand loyalty among these specific customers. Nevertheless, customers that just want a nutritious breakfast choice probably are willing to try a new brand.

As stated before, within protein powder and sports drink the brand loyalty differ a bit between the different end customers. Some core performers consume casein because of its specific properties; it is slowly breaking down in the body. Therefore, brand loyalty towards casein exists among these consumers. However, the general consumers that consume sports drinks and protein powders in order to refill their body with energy and nutrients probably do not have the same brand loyalty. They prioritise the taste of the product, but of course some consumers also look at the ingredient list. If a customer find a product that they like the taste of, they probably continue to buy it which indicate on brand loyalty. However, an estimation is that the general customer in this area would not be afraid to try a new launched product within these areas.

Government policies

Within government policies, the focus will be within Europe due to wishes from Fresenius Kabi. Regarding Europe's government policies within infant food there are some constraints. European Commission has defined specific rules to ensure appropriate nutritional composition and enough consumer information for infant foods, like formulas, processed-cereal and baby food (European Commission, 2016). However, there are the formulas that contain proteins derived from milk and therefore, only the government policies of this product type will be clarified.

According to European Commission, infant formulas are products that currently are covered by Commission Directive 2006/141/EC. The directives contain requirements for the composition and the labelling of infant formulas (European Commission, 2016). The criterias regarding the composition of the formulas involve the minimum and maximum amount of energy, protein, carbohydrate, fat, mineral substances, vitamins and certain other ingredients that the formulas can contain (Kommisionens Direktiv, 2006). It is stated that all the ingredients in infant formulas have to be proved to be suitable for infants in relevant studies. There are also requirements regarding the purity of the ingredients and the limited value for the most common pesticides are 0.01 mg/kg while others more toxic pesticides have even lower limited values (European Commission, 2016). There are also regulations regarding the quality, for instance the hygiene and the materials used while producing the products. It is also regulations regarding the amount of contained cow-milk-protein, but that is nothing that Fresenius will have to take into account due to

that their bonus product contain proteins derived from egg yolk (Kommisionens Direktiv, 2006).

There are also restrictions regarding the labelling of these kinds of product. For instance, it has to be clear regarding what age the product is aimed for, if the product contains sufficient amount of ingredients to cover a whole meal, an ingredient list, expiration date and it also has to be clarified that breastfeeding is superior. There are also restriction regarding marketing of infant formulas. In summary, the constraint concern that it is not allowed to market the products via store advertising and in general the marketing only can contain information that are scientific and actual facts (Kommisionens Direktiv, 2006).

Instant breakfasts are oftenly in liquid and in powder form, and are therefore pre-packed food which means that there are legislation of labelling, advertising and packaging in the EU and these are regulating the market of instant breakfasts. The regulations ensure that the customers get enough information about the products, for instance the content of the products, and therefore the producers have to follows these restrictions (Fransvea, 2014).

According to the EU regulation 1169/2011, the information that are mandatory to add when labelling pre-packed foods are: Name of food and net quantity, list of ingredients, the quantity of ingredients, expiration date and storage conditions, nutrition declaration and any ingredient used in preparation that is still present in the product that could cause allergies. Substances like flavouring, food enzymes or additives that are used when manufacturing or preparing the product under the assumption that these substances still are present in the final product, should also be listed on the product (Fransvea, 2014). Of course that are more things to take into account when launching a new food product within EU. However, since Fresenius have meal replacement products in their portfolio they should already have knowledge about these.

European government policies for protein powder and sports are included under food supplement laws, directive 2002/46/EC, due to that they are concentrated sources of nutrients (or other substances) with a nutritional or physiological effect (European Commission, 2016). These rules and regulations exist in order to protect customers against possible health risks and to ensure that they are not provided with information that can

mislead them. However, in Europe, food supplements are regulated as foods which means that there are not any specific regulations regarding protein powders and sport drinks, except additionally labelling if the products contain extra high concentration of a nutrient, for example protein. There are regulations regarding the highest contained amount of minerals and vitamins for foods, but that should not be a problem in this case due to that the bonus product comes from a natural source (egg yolk) (European Commission, 2016). This means that all the ordinary EU regulations regarding foods, for instance the earlier mentioned labelling rules, also are applied for protein powders and sports drinks.

In conclusion, there are for sure many government policies within the food industry in general, but they are not as strict as they are within the pharmaceutical industry. Since Fresenius Kabi is a company that already has product both within the food industry (meal replacement- or supplement products) and pharmaceutical industry, they should already have knowledge about these policies and therefore these should not be obstacles for them regarding launching a new product within this area.

Access to distribution channels

Today, Fresenius Kabi's existing products; energy drinks, fiber drinks, protein drinks, crèmes, soups and thickening powder are sold at hospitals, pharmacies and a limited number of websites (Fresenius SE & Co. KGaA). Oftenly, the products are prescribed by a doctor or dietitian. Hence, the distribution channels Fresenius Kabi has today are quite limited.

Infant foods have very many different distribution channels and can be purchased at the most normal grocery shops, supermarkets, hypermarkets and at many different websites. The range of brands are smaller on the supermarkets and the hypermarkets which is not strange due to that these stores are smaller. The brands that are sold at these stores are chosen by the owners of the stores (or by the management of the store chains) or by wishes from the end customers. Of course, manufacturers want to sell their products in real stores in order to promote their products and also to reach more customers. Today, the majority of consumers buy their infant foods in grocery stores, but due to peoples changing time lacking lifestyle, customers are leaning to buy these products in passing from supermarket and hypermarkets. Additionally, nowadays many customers are trying to be more time

effective and ordering their food online (Market Research Future, 2017). In conclusion, the number of distribution channels within infant food are many and easily accessible.

It is hard to find data on accessible distribution channels for instant breakfasts. However, by own experience the different liquid alternatives can be purchased at different grocery stores, hypermarkets and supermarket. Different instant breakfasts alternatives can be found at so called corner shops, or convenience shops, where many people run in and buy easy accessible food alternatives. Additionally, instant breakfasts can also be purchased online at many different websites. Conclusionally, instant breakfasts products are easily accessible through different distribution channels.

Among protein powders and sports drinks, the number of distribution channels also are large and easy accessible. According to a report of the protein supplement market from 2016, the online stores accounted for the majority sales in 2016 (Grand View Research, 2019). This is probably due to that these kinds of products are easy to evaluate based on reviews which means that many dare to buy them online.

Additionally, these kinds of products were from the beginning aimed for a specific targeted group, and therefore it was not worth it for the ordinary supermarkets to add these kinds of products to their assortment. However, today more people buy these kinds of products due to the increased awareness of healthy and therefore they can be purchased in ordinary supermarkets. But the majority sales of these products are still online today.

Rivalry among existing competitors

Diversity of competitors

In the section differences between competitors some of the biggest distributors of infant foods were mentioned and it was stated that the similarities between them were many; the offered product types, the price, the formulas contain milk protein and that many offer organic products. The biggest differences between them are that some brands offer more different types of products, i.e have a wider product range, for instance specific formulas for tummy troubled infants containing probiotics and soy proteins. Moreover, other brands are niched towards different areas, but these brands often do not have products containing milk protein which are the ones that are interesting in this case. Therefore, the conclusion is that the diversity among the competitors is quite small.

As also stated in the section differences between competitors, the brands that are offering milk protein based instant breakfasts are very similar to each other. They offer many different sweet tasting flavours and contain pretty much sugar. The price is also similar between the brands. However, there are brands that are offering products based on other protein sources than milk, like soy and pea for instance, which is a diversity between the brands. However, those products are often bought by other customers; the vegetarians and the vegans. In conclusion, there are a diversity among the competitors of instant breakfasts, but not so much among the brands offering instant breakfast products based on casein.

On the protein powder and the sports drink market it is more diversity among the competitors. The calorie content, the mixture of different protein sources in the products and the price differs. However, the competitors on the market also offer many similar products as well. It is more usual that the sport drinks are more similar to each other because the content and the price often are alike.

The biggest difference between the protein powders is however the composition of different protein source and the contained amount of each protein source. In conclusion, the largest estimated diversity among the competitors of casein-based products are within the protein powder market even though there are many similarities between the brands as well.

Industry growth

As mentioned earlier, the global baby food and infant formula market reached a value of US\$ 50 Billion in 2017 and the market is expected to increase to a total value of US\$ 69 Billion by 2023 which represent an average annual growth rate of 5.5% between 2018-2023 (Research and Markets, 2018). This is a quite big expected growth. However, according to research and markets report, it is expected due to that parents nowadays are willing to spend more money on high-quality food for their infants to ensure the health of their kids. Additionally, the growth is estimated due to the increased amount of working women in today's society which extend the need of convenient and portable nutrition for their infants (Research and Markets, 2018) .

The industry of instant breakfast is also expected to grow accordingly to Bakery and snacks article (Hyslop, 2017). More specifically, the global market of on-the-go breakfast was valued to US\$ 1.23 Billion 2016 and the market is estimated to be valued US\$ 1.8 Billion 2026 which represent an average annual growth rate of 4.2% between 2017-2026. The fast global growth is mostly concentrated to the western world due to the changing lifestyles where people are more stressed and have less time and therefore need fast and easy breakfast alternatives. The growth of the instant breakfast industry is expected to be slower in other region in the world where the stressful lifestyle is not as palpable. But in total, globally, the industry is expected to grow the following decade (Hyslop, 2017).

As mentioned earlier, the global protein supplements market was valued to US\$ 12.4 billion in 2016 and according to the Protein Supplements Market Size & Growth industry Report, an average annual growth rate of 6.5% is expected between 2017-2025. Hence, a quite large industry growth is also expected to happen within this market. However, the largest growth is expected to happen for the plant-based products due to the increased amount of vegetarians and vegans in the world.

But still, the sales of the milk-based products are also estimated to increase. The estimated growth is believed to happen due to the increased awareness of healthy diets among people, which lead to that people want to achieve an active lifestyle and also maintain it (Grand View Research, 2019).

In conclusion, all the areas within the casein substitute segment are expected to grow very much.

Quality differences

In order to discuss quality differences between products, one have to define what quality means within the different areas of casein substitute. According to research and markets report “Baby Food and Infant Formula Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2018-2023”, infants do not have developed muscles and teeth to chew with which means that infant foods are the main source of calorie and nutrient intake for them. Additionally, today parents are more willing to spend money on high-quality food to ensure the health of their infants. Therefore high-quality infant foods means organic, few and clean ingredients, and good tasting products (Research and Markets, 2018). As stated

earlier, the brands that are offering infant formulas are very similar to each other; the ingredients and flavours are pretty much the same and they often are organic. Therefore, the quality among the different formulas are reasonably alike. There are also many brands offering specific products, example for tummy troubled infants containing probiotic and other ingredients that are nicer to the stomach. However, this does not mean that these products are higher in quality just because they contain other ingredients and that they are aimed for other kids. Of course there are brands on the market offering semi-manufactured foods with not as clean ingredients, as additives and sugar, which therefore are estimated to have a lower quality. However, these brands are today not the giants on the market.

Peoples busy lifestyles has influenced the breakfast market globally which has lead to the growth of the instant breakfast market. As mentioned earlier, the awareness of nutritious food has increased in the world the last decades which in turn has lead to an increased demand of healthy food in the world (Transparency Market Research, 2016). Therefore, the quality of the instant breakfasts products are predicted to depend on how nutritious the products are, and of course how good tasting they are.

As previously mentioned, the casein-based instant breakfast products offered from different brands are very similar to each other, both the liquid and the powder ones. The ingredients and the amount of each ingredient are pretty much the same. Therefore, the quality differences are small. Of course there are other products within this market that are based on other protein sources and therefore are perceived as more clean and healthy due to that these products often contain less calories. However, these are often seen as not equally good tasting as the milk based products. Additionally, these products are in this case not interserger due to that they do not contain milk protein.

Among protein powders and the sports drinks, the users of these products are a bit wide spread as previously stated. The core users are in depth with the content of the products while the ordinary athletics are looking for a good tasting product that can refill them with energy and good nutrients after a workout. Therefore, the definition of quality within this area is a bit hard to define. However, the sports drinks are often used by the ordinary athletics which means that the flavour and the nutrients are important factors in terms of quality. The sports drinks on the market are similar to each other, in terms of contained

nutrients and offered flavours, indicating that the quality differences are not big. The quality of the protein powders are like mentioned harder to define due to the user are more widespread. However, all users would probably prefer small amounts of sugar and less additives in their products. Therefore, an estimation is that high-quality products contain less sugar and have clean ingredients. Most protein powders on the market today nonetheless are very clean, but some contain more sugar than other indicating a small quality difference.

Brand loyalty

As previously stated, the brand loyalty among the general customers within infant food are not that big due to that there are very many manufacturers offering similar formula products on the market. Additionally, there are always first time parents on the market meaning that all brands get new chances all the time. However, the customers that have infants with specific needs probably are loyal to the brands that they know work for their infants. As also mentioned before, it should be pretty similar within instant breakfast due to that there are many supplier within this area. However, many of these customers are stressed and probably do not have time to explore new products. Instead they take a product that already are familiar to them. Taking that into account there are some brand loyalty within this area.

The brand loyalty among protein powders are as previously stated estimated to be bigger among the core users due to that they are often picky with the content of the products. They are therefore loyal to a brand that they know contain the right ingredients. Among the general users, who prefer good tasting products, probably are willing to try different suppliers. However, if they find a product that tastes good, they probably stick to it.

4.2 Evaluation; High value nutrition bars

Power of buyers

Number of customers

The industry of nutrition bars has experienced massive growth in the past decades. Consumers find bars as the perfect snack on-the-go which matches very well with the hectic living people have in western countries today. These individually wrapped foods

come in all sorts of flavours and shapes, which increases the probability that every customer will find a likeable bar. In addition, you can almost buy them wherever since it is also convenient for grocery stores to have them in their assortment due to their long shelf life and high sales rate.

The number of nutrition bars from different manufacturers on the market in the year of 2015 were 1 012 according to the website Business Insider. That is more than four times as much as the number of bars the year before (Lutz, 2015). This brings strong indications of a higher level of consumption and thereby an increased number of customers. The highest number of consumers for energy bars are 18-44 years old. The US have currently the biggest market followed by Mexico, Japan and Australia. The annual volume of consumption of energy bars went over 180 million kg in North America in 2017, a number that is expected to become even higher in the near future (Research and Markets, 2018). This is however statistics for energy bars which includes both sports nutrition bars and snack bars. The customer segment we intend to aim the nutrition bar against, seniors, seems to have a much lower consumption of bars. That could however potentially be due to the fact that most nutrition bars are marketed towards a younger, more active crowd.

It is safe to say that there is a great pool of customers within the product segment of energy bars. However, there is limited information regarding the number of consumers that are of age 45 and older. What we do know is that the number of people over 70 will increase substantially in a near future, hence it is a big crowd to focus the products towards (Mechanic, 1999). In conclusion, the number of customers depends on which customer segment we chose to direct our product towards.

Price sensitivity

In terms of price sensitivity, the bar manufacturers seems to have nothing to worry about as of today. With the right ingredients, good marketing and well selected distribution channels people in the western countries do not seem to care if their favourite bar raise a little bit in price. According to the Business Insider, a bar that used to cost US\$ 1 a decade ago, now costs US\$ 3, and still the sales level of bars are higher than ever (Lutz, 2015).

The ingredients that is needed to make an average bar only costs about 25% of the selling

price. Normally, packaged foods have a profit margin on 20% to 30% but bars on the other hand, have profit margins as high as 40%-50%. Hence, customers pay a lot for the products but maybe not as much for the actual food (Lutz, 2015). Since bars often are a quick solution for loss of energy and and customers buy them in a hurry, a price difference of US\$ 0,50 to 1 might not strike then as a cause for concern.

When looking at the price of a regular protein enriched nutritional shake for elderly, you get surprised of its high price. Most nutritional shakes are however prescribed by a doctor or dietitian which means that the price gets substantially lower for the buyer. Nevertheless, a nutrient-dense and convenient alternative for foods for elderly, such as a bar, should not be that price sensitive, considering the high price of the existing alternatives.

Buyer's ability to substitute

The market of bars as a whole is very competitive with many different multinational manufacturers. The strongest competitive characteristics of bars on the market are their clean label ingredients and their flavours (Research and markets, 2018).

That means that the customers are not necessarily making their choice based on brand or price, they rather go for the nutritional- and flavor characteristics. It is very rarely that a grocery shop or convenience store only has one sort of bars. Hence, the buyers have the ability to substitute if there is a bar that suits their desired characteristics better. What is worth mentioning is that there are very few substitute bars directed towards an elderly crowd in the stores today. Hence, if it is specifically a bar meant for older adults the customer is looking for, the buyer does not have the ability to substitute to another bar.

Difference between competitors

There are remarkable differences amongst the bars out on the market. This is mainly due to the fact that they are directed towards different customer segments. For people seeking for muscle mass growth or a supplement to take after hard workout, bars with a very high protein content are preferred. This customer segment does generally not have high requirements of the ingredients being natural or organic. Most popular protein bars of such character are full of additives and synthetic flavours to compensate the grainy texture and taste of protein powder. The same goes for weight loss bars only that there is even more focus on a low calorie content (Orlando dietitian. 2015).

For the crowd grabbing for a healthy snack between meals, ingredients like nuts, seeds or oats are desirable. These ingredients constitute the protein source in such bars while the flavour normally is achieved by adding ingredients like honey, syrup, dry fruits, cacao or spices. This customer segment appears to be more careful with the ingredients hence, the most popular snack bars are the ones that are marketed as “non-GMO”, “organic” or “all-natural” (Orlando dietitian. 2015).

A nutrition bar aimed for elderly would end up somewhere in between the above mentioned bars. It would however need to be supplemented with specific minerals and vitamins in order to argue that it is created specifically for the nutritional needs of older adults.

Other differences between the competitors on the market is the distribution channels they use. Social media has become a valuable channel for many bar manufacturers. It is an effective tool for raising a demand for a certain product amongst specific customer segments by using the customers themselves as a communication channel to adhere other buyers. Some manufacturers however stick to a more conservative type of marketing, through magazine advertisement or free samples in stores or fairs.

There is also a difference between the size of manufacturers. Some manufacturers like CLIF & COMPANY have customers all over the world. Their products can be bought in the US, Canada, Europe, Australia and New Zealand and are directed towards athletes and people going regularly to the gym (Clifbar, 2019). Less active crowds are however also buying their products due to the organic and natural content of these bars. Smaller or private producers of bars act on more limited demographics but that can also be advantageous. They have the ability to attract a more loyal following since many customers want to support local producers.

Threat of substitute products

Buyers propensity to substitute

As previously mentioned, the buyers have propensity to substitute their primary choice of bar towards another alternative if the nutritious content and flavour of the new bar fits

their preferred characteristics more. Of course, price should also be considered when discussing this aspect but it appears that nutritional value and flavour are more important than price for this matter (Lutz, 2015). With new bars appearing in the stores with different flavours and textures, it is hard for customers to stick to one single brand or product without falling for something new.

Number of substitute products available

There are a great pool of different bars on the market today. However, very few of them are marketed as a bar made specifically for older adults. As mentioned in previous chapter about product segments, Nestlé has launched a product very similar to what we have in mind. BOOST Nutrition Bar, which seems to be the most competitive substitute aimed for elderly out on the market today. Looking at the market for meal replacements as a whole, there is a much greater collection of alternatives to choose from. Drinks, powders and soups govern the market of replacement foods for old adults and such products constitute the most competitive substitutes if we don't limit the segment to bars.

In conclusion, there are a great number of substitute products available however, if the senior customers are seeking for a non-liquid alternative, the number of competitive products on the market are very few.

Power of suppliers

Estimated number and size of suppliers

Since the global market for energy bars are very big and have increased in size and sales substantially over the past years, there are a great number of multinational suppliers. Some of the major key players are NATURE'S BOUNTY CO., CLIF BAR & COMPANY, KELLOGG NA CO. These bar company's does however not direct their products towards the crowd of old adults specifically, even if some of these bars might be consumed by elderly. There is also a great pool of private label brands on the market that constitute a source of competition for these giant players. They have the advantage of making more personalized products with new flavours and clean label ingredients (Research and markets, 2018).

The market for nutrition bars directed to the crowd of elderly are far more inconversant and there is very little information available about the number of existing manufacturers and hardly any statistics about the market sales. This gives an indication of a smaller number of suppliers and key players. It could be due to a low level of demand for bars, since the existing products like drinks or soups already satisfy the need for supplements or meal replacements amongst the elderly crowd. In Europe in 2016, the second largest customer segment of nutritional and dietary supplements were the geriatric population, which is the branch of medicine that focuses on age-related diseases and difficulties (Grand View Research, 2018). Dietary supplements and meal replacements such as drinks or soups goes under this category hence, there is a great size of customers as well as suppliers of such products. The growing population of old adults in combination with eating or metabolic disorders related to aging indicate a future growth of the market as a whole and hence, a growth of suppliers (Grand View Research, 2018).

Uniqueness of each suppliers product

Nowadays, it is quite complicated to create a completely unique bar since there is a huge number of different suppliers.

These suppliers influence each other, both with regards to ingredients and marketing strategies hence, it is really hard to create a bar that stands out from the rest. It has not always been this way though, many of the major brands today once started their success story by offering a unique bar.

Quest nutrition for instance, who is one of the best sellers in the segment of protein rich bars, was one of the first brands to offer a healthy bar with the taste of something very “unhealthy”. When their chocolate chip cookie bar reached the shelves in the stores, everybody wanted this guilt-free treat (Fiberstar. 2016). They addressed the complexity of being on a strict and healthy diet but still having cravings for sweets and immediately stood out from the existing substitutes. Today, several manufacturers uses this strategy of offering guilt-free treats that tastes like e. g. a brownie or cookie dough but contain low-calorie and sugar free ingredients. Such bars does however require a lot of sweeteners and additives in order to simulate the real taste and texture of a cookie or brownie.

DuPont Nutrition & Health, St Louis also had a unique selling point by basing their products on plant based protein only. They launched a line of soy protein isolates that could be used in nutritional bars specifically. The greatest advantage of soy protein isolates instead of dairy based protein is that it prolongs the shelf life of products as well as enable suppliers to produce vegan or vegetarian alternatives of protein bars (Fiberstar. 2016). Today, there are hundreds of bars based on soy protein isolates or a blend of whey protein isolates and soy protein isolates. Hence, plant based protein content is no longer a unique characteristics on the bar market.

In 2014, a brand called Mamma Chia brought diversity in the category of bars by offering organic Chia Vitality bars. Chia seeds, which nowadays are commonly used as a component in low calorie diet, offers a source of protein completely derived from plants and high levels of omega 3. The ingredient Chia was unique itself in 2014 but today, you can find this superfood in several organic or nut-based bars as well as rice cakes, muesli and breads. Other unique ingredients that have appeared under the last decade are buckwheat, amaranth, millet and popcorn. None of which surprises the regular buyer of bars any longer (Fiberstar. 2016).

One bar that can be regarded as ordinary or unique however, is the BOOST Nutrition Bar from Nestlé. From what we have seen, they seem to dominate the segment of bars directed towards the senior crowd by simply be the only player.

Threat of new entrants

Brand loyalty

Since the market of energy bars are driven by the demand for a quick and convenient alternative for healthy foods and not by status of certain brands, a brand loyalty is very hard to obtain for the suppliers. If a competing manufacturer launches a bar with more organic ingredients, higher protein content or better flavours, the customer is likely to prefer the new bar over the one they regularly buy. Of course, some brands like QUEST Nutrition are more popular than other brands, especially in the US. Mainly because QUEST Nutrition put a lot of resources on online sales. This gave them a “first mover” advantage

over other brands that focused on physical shop sales (Menayang, 2017).

As for bars specifically directed to old adults, one could argue that Nestlé have a first mover advantage since they are one of very few or perhaps the only manufacturer that focused on the nutritional needs of seniors and hence, created a product specifically for this group of people. It is hard to predict or distinguish a brand loyalty of BOOST® nutrition bars since there are very few substitutes on the market (New Boost Nutrition Bar Provides Nutrition On-The-Go, 2013).

Government policies

The legislation of labelling, advertising, packaging and presenting different kinds of foods in the EU regulate the market of nutrition bars. These regulations exist to ensure that the consumers get a high level of information regarding the content of foods. Manufacturers and retailers today have, due to these regulations, a high responsibility of food safety risks related to their products (Fransvea, 2014).

According to the EU regulation 1169/2011, certain information is mandatory when labelling pre-packed foods, some of such information requirements are;

- Name of food and net quantity (weight)
- List of ingredients
- The quantity of ingredients
- The date of durability, (expiration date) and storage conditions
- Nutrition declaration
- Any ingredient used in preparation that is still present in the product that can cause allergies (Fransvea, 2014).

What also should be listed on the package of products are substances like flavouring, food enzymes or additives which are used when manufacturing or preparing the product under the assumption that these substances still are present in the final product (Fransvea, 2014).

The government policies of food industry are far from as regulated as for the pharmaceutical industry but it is still a very controlled market with many guidelines to follow. Since Fresenius Kabi already have meal replacement- or supplement products in

their portfolio in forms of drinks, this should however not be a problem. Under the assumption that the company has knowledge about the policies that are regulating the market of supplement foods, government policies should not constitute a big obstacle when launching a nutritional bar directed to old adults.

Access to distribution channels

The distribution channels of Fresenius Kabis existing products within the category of nutritional supplements are well established. The company offers energy drinks, fiber drinks, protein drinks, crèmes, soups and thickening powder (Fresenius SE & Co. KGaA). The majority of these products are currently sold to customers at pharmacies and are often prescribed by a doctor or dietitian for e. g. cancer patients or other patients suffering from metabolic constraints. The pharmacies and hospitals are hence the main distribution channels of these geriatric products, channels that certainly could work for a nutritious bar of same character.

The main distribution channels for general energy bars in Europe are supermarkets and Hypermarkets. Online sales is however getting larger and grew with the rate of 7% between the years of 2012 and 2017 in certain countries (Mordor Intelligence, 2018). We suspect that pharmacies, online sales and assorted supermarkets are the type of distribution channels with greatest accessibility for Fresenius Kabi and a nutritious bar directed towards seniors. In order to attract more customers, it would be advantageous to broaden the sales channels and hence find more alternatives than just pharmacies.

Rivalry among existing competitors

Diversity of competitors

There is some diversity between the competitors on the market of energy and nutrition bars but it is mainly their specific customer segments that diverge from each other. Based on the customer needs and demands, the manufacturer formulate products differently. Some focus on organic and clean ingredients, while others are prioritizing a high level of protein with a low energy content even if it might lead to that the majority of ingredients are additives or synthetic compounds.

Since there are very few clear competitors for bars directed towards older adults, it is hard

to find diversity amongst them. There are however differences between general bars for sport- or weight loss purposes and bars directed towards seniors. Nestlé's bar BOOST Nutrition Bar does e. g. contain several micronutrients such as vitamin E, A, calcium and magnesium (New Boost Nutrition Bar Provides Nutrition On-The-Go, 2013). This means that they are focusing on other nutrients than most other brands which mainly are prioritizing a high fiber content as well as strengthening protein.

Industry growth

The industry of general energy bars, which includes both sports nutrition bars and snack bars, are a billion dollar market. between the years of 2011 and 2016, the market had a growth rate of 10%. This growth is fueled by the increasing demand for healthy on-the-go snacking alternatives and functional foods.

In 2017, the global energy bar market was at about US\$ 5.1 billion were North America stood for the biggest consumption volume; 180 million kg of bars. During the forecast period of 2018 to 2023, the market is anticipating to register a CAGR of 4.9% (Research and markets, 2018).

In Europe alone, the market of energy bars is expected to witness a CAGR of 4.7% under the same forecast period and is predicted to reach US\$ 689 million by the year of 2023 (Mordor Intelligence, 2018).

The growth of other drink and food alternatives are however expected to present a challenge for the bar industry in the long run. The year-over-year growth of bar industry is hence expected to stagnate in a more distant future. In order to keep a competitive position, the makers and marketers of bars will have to maintain reasonable prices and find unique selling points (Intel, 2014). The overall market for supplements and nutrition was valued at 31.7 billion in Europe the year of 2016 and is expected to witness a CAGR of 5.9% in the future (Grand View Research, 2018). This is partly due to the expansion and increased accessibility of distribution channels for nutraceuticals and the increase of geriatric population throughout Europe. The consumption of dietary supplements is very high amongst the geriatric population and this population stood for the second largest segment in 2016. Taking all these facts into consideration, one could argue that a supplement

directed to older adults should be witnessing a bright future in industry of supplements and nutrition in Europe.

Quality differences

When discussing quality differences between existing bars on the market today, one have to conclude which characteristics and qualities that are desired. One meaningful aspect that could be countable as quality is e. g. the flavour. Organic ingredients with low levels of refined sugars and high protein content might come at the expense of flavour. Hence, some bars have a synthetic or bitter taste which makes customers qualify the bar as bad or inadequate even if it offers a lower calorie intake and reduced sugar content.

Texture is also a very important aspect when it comes to bars and this can be a bit tricky, especially when forming a protein rich bar. Such bars are often based on protein derived from soy or dairy proteins. When protein blends such as whey protein isolate and soy protein isolate is mixed together, they can expose antagonistic effects (Coelho das Neves). This means that the choice and blend of protein might affect the texture which is why many protein bars are grainy.

Another aspect in terms of quality is the date of durability of the bars. It says itself that a higher content of synthetic preservatives and additives leads to a longer date of durability. While a granola bar can remain its quality for 6-8 months if stored properly, a protein bar can last even longer, however it gets a very hard texture over time. Since there is a great variety between the ingredients in different bars, the quality is also diverging.

Brand loyalty

As mentioned earlier, there is no clear brand loyalty within the market of bars, it is mainly a search for clean label ingredients and a good flavour that determines the customers choice. The part of the population that seeks for a nutrition bar specifically formulated to fit the nutritional needs of older adults however, might be showing some form of loyalty towards Nestlé. This is mostly due to the lack of substitutes, but one should not underestimate the powers that comes with being the first one on the market, which Nestlé seems to be. We do however suspect that if there is another, similar alternative for senior nutrition bars with a more unique selling point, customers are likely to substitute from existing alternatives.

4.3 Evaluation; Protein enriched products

This product segment will be investigated with focus on protein enriched chips and snacks, such as crackers and biscuits. Previous in the report, ice cream and candy were also included in this segment. Candy was excluded in the evaluation since most of the detected types were bars or products that used plant-based protein as protein source (see table 12 in the section of “protein enriched candy”). Bars is not of interest due to the complete investigation in the product segment “high value nutrition products” that evaluates the potentials of using the bonus product in nutritious bars for elderly people. Candy with plant-based protein as source is neither a possible substitute for the bonus product since the bonus product is animalic and reach out to a completely different segment of customers.

Regarding to ice cream, there are a lot of suppliers on the market today and we consider it to be a well established market. These are also products that are marketed as a “guilty-free pleasure” and a way of eating something unhealthy for fitness inspired people, which does not correlate with the highly nutritional value on the bonus product.

The last remaining part is therefore the main focus of this evaluation, chips and snacks. Additionally, we believe this could be a product segment that primarily turns to elderly people as well. They like snacking in between meals and what is better than if this snacking also could lead to an increase in nutrients that completes the daily need of protein and polyunsaturated fatty acids?

The market of protein enriched snacks is defined as the market of products that has been value-added and claims to offer a higher amount of protein, derived either from animal- or plant based protein sources. Animal based protein could be meat, fish or poultry and plant based protein could be lentils or protein-enriched seeds (Future Market Insights, 2019).

Power of buyers

Number of customers

Functional snacking, which are being offered by these new and trending value-added snacks, has expanded to consumers globally due to the ability of fast nutritional intake in a busy lifestyle. Such lifestyle is often found at people living in big cities where conventional food habits have become more and more absent. In underdeveloped countries where malnutrition is a major issue, food fortification and value-added food is believed to be a tool in combating such challenges. This has also led to an increase in demand of such products, together with protein snacks which is a market considered to grow even more (Future Market Insights, 2019).

In January 2018, Polaris Market Research wrote that “the global healthy snacks market size was valued at US\$ 25.231 million in 2017”. In that article, healthy snacks were defined as nutritious food that the consumer eat in between meals in purpose to add vital nutrients in daily manner. Such snacks are often low in fat and calories and could be dried fruits, meat snacks or cereal bars among others (Polaris Market Research, 2018).

The potential product derived from Fresenius Kabi’s bonus product correlates with these products in matters of “value-adding in between meal”-snacks, but will not be low in calories and fat in order to serve as a weight preservation kind of food.

From these numbers, one can assume that the total protein-enriched market has been growing for the last couple of years and will continuously expand, with products differently marketed in broad range of area.

Price sensitivity

In terms of protein added chips and snacks, both markets show a similar price point for many suppliers. Since it is not a substitution of food but rather a complementary kind of food, customers should not be paying too much. These products have similar price section as regular chips and snacks such as popcorn or salted peanuts. That indicates that the price sensitivity is quite high. It is important that such products are not too expensive, or at least has a price not too much above the rest of the competitors in order to stay price competitive.

Furthermore, high price sensitivity is also confirmed by the report in Future Market Research in 2018. Even though protein enriched snacks is a growing market it is at the

same time retained by factors such as expensive production, high demands on well-assorted manufacturers and a developed cost-competition between competitors (Future Market Insights, 2019). These three aspects can be considered as a limitation of full expansion of the market.

Buyer's ability to substitute

In the field of protein enriched products, there are multiple suppliers, a variety of formulations and some gigantic global key players (Future Market Insights, 2018). This indicates that the ability to substitute for the customers is high because there are always other alternatives. However, it is also a market widely distributed by different approaches of the products. When it comes to highly nutritious products to combat malnutrition or increase the nutritional intake, the numbers of suppliers is a lot fewer. Using Fresenius Kabi's bonus product in such kind of protein snacks is preferable turned to elderly people, but it could also be in order to serve young people with enough nutritions for proper growth and development. Of course, nutritious meals are preferable but some kids simply do not have fully appetite or good habits. Then value-added snacks could be an option in order to keep up high nutritional intake (Nutrition News, 2018).

However, it is challenging to define the word "snacks" since it involves a lot more products, and a variety in products, than for instance bars or chips. But if we stay to the definition that it as intake in between meals, it can still consist of a broad range of food. Depending on different areas of the world, the food are preferably salty, derived from milk or sweet. In 2006, the people in the US enjoyed salty snacks very much which, together with chips and popcorn, accounted for 14,3% of total snacks consumed. At the same time, sweet snacks such as fruit and sweets were not that popular in the US but very popular in Mexico, Brazil, China, Oman and France (Hess et al., 2016).

Since it does not exist a global definition of snacks it is difficult to estimate the ability to substitute. What can be concluded from the information above, and earlier mentioned sections in the report, there are always opportunities for healthy, unhealthy, fast, slow, high-calorie, low-calorie snacks to complete the daily meals. The question is- how can a potential new product satisfy the need of a healthy, well balanced and highly nutritious food completion? If Fresenius Kabi could answer that question with a protein enriched product,

with potential focus on seniors and growing people, then they would be competitive in the jungle of substitutes.

Difference between competitors

The main difference on the market of protein enriched products is the focus of marketing. When it comes to snacks, or small-food between meals, there are difference in nutritional value according to amount of sugar and salt in comparison to fiber, vitamins and protein. Even though there are a considered limitation of healthy snacks, the product segments can be divided into sections such as Dried Fruit snacks, Meat snacks, Cereal and Granola bars, Nuts and Seed snacks amongst others. As mentioned earlier, the popularity of each sections depends a bit on different global area and the suppliers constantly invent new products in order to meet the customers fluctuating needs. At the same time, the market leaders and leading companies are always trying to expand their customer base by creating new collaborations with each other as they stretch their products over a broader range of offering possibilities. One example of such situation is when Kellogg's Special K introduced Special K Nourish and Protein Snack Bites which is a on-the-go, protein bar and far from the regular breakfast cereals that they are famous for (Polaris Market Research, 2018). To summarize the information above, the difference between competitors is big due to the many different sections that all are included in snacks but on the other hand small due to all collaboration between leaders which evens out differences between them.

Threat of substitute products

Buyers propensity to substitute

Since it is a constantly changing market and suppliers always tries to match the demands from customers, one can estimate that the propensity to substitute is quite high. It is important for each customer that the product offers exactly the required benefits and if that is not the case, there are other products on the shelf that can be bought instead. The price sensitivity and variety of products are contributing to easy access of other brands.

Number of substitute products available

This section is in need of a closer definition. Number of substitutes available of regular nutritional snack food are endless if that includes things like mixes of dried fruit, nuts and

chocolate, turkey roll-ups, greek yogurt parfait, tuna etc. In other words, small bites or slices of energy rich food with low sugar and high protein content.

So let's stick to products available that are portable and easy to access in a hurry, in other words- food that does not have to be processed before eating. A magazine named "eat this" posted a list of 25 best high protein snacks that the recommended to eat when the time was limited and the energy low. Among those 25 products, there were products like oatmeal cups, peanut butter squeeze pack, dry roasted edamame, crunchy chickpeas, seasoned tuna medley with crackers, chia bars, protein chips, hummus chips and mozzarella sticks to name a few (Eat This, 2018). Only the imagination and the sky seems to be the limit.

As the market is growing and new entrance is happening all the time, it still seems to be some brands that have the biggest market share and are leading companies. A dozen of companies appears at several websites in different context which indicates that there are some brands that together constitutes a major market share.

However, the market of Europe is a great area for a new entrance, or for expansion possibilities. In 2017, the global Healthy Snacks Market had the largest share in Europe (Polaris Market Research, 2018).

Power of suppliers

Estimated number and size of suppliers

The number of suppliers are many due to a globally increasing market which was valued at US\$ 25.231 million in 2017 according to Polaris Market Research (2018). A market that big and extensive also indicates large sizes of suppliers which correlates with a quick overview of market research today.

Uniqueness of each suppliers product

Uniqueness of the products is mostly the amount of nutritions where the balance of protein, sugar and fat is highly distinctive. Snacks for kids that are supposed to provide them with nutritions which support them to optimal growth are preferably snacks that contains 200 to 500 calories and 5 to 10 gram of protein (Nutrition News, 2018). One protein rich drink that ends up in those intervals is PediaSure™SideKicks®, which contains 10 grams proteins and 180 calories. Additionally, it has 25 growth-supporting vitamins and minerals and 3

grams of fiber (PediaSure, 2019). Other than calorie and protein intervals to exist between, there have been an increasing demand for naturally sourced and organically produced value-added food. This empowers suppliers in the field to broaden their product portfolio and offer multiple ranges of organic protein snacks (Future Market Insights, 2019).

The suggested uniqueness of Fresenius Kabi's product would be a complete supplement of all essential amino acids and fats together with highly nutritional vitamins and minerals. The customer segment of interest is primarily elder people but also younger people that are in growth phase and in need of nutritional food.

Threat of new entrants

Brand loyalty

The brand loyalty is low due to i.a. a considerable small cost for the customer and no emotional connection to such kind of complementary food. However, today there are protein supplements on the market that are marketed in association to well known persons to increase selling rates by a feeling of solidarity among customers.

That sort of marketing probably leads to some kind of brand loyalty. Otherwise, new entrants will most likely not have to worry about existing loyalty towards brands on market.

Government policies

In the evaluation of "casein substitute", it is possible to read about how dietary supplements are controlled by the government and different policies. When it comes to these products, it is difficult to classify them into correct sections. But in similarly to casein substitute, a product that is enriched with the bonus product of Fresenius Kabi would most probably be denominated as Directive 2002/46/EC.

Access to distribution channels

The distribution channels of protein snacks are divided into modern trade, retail stores, specialty store, wholesalers & distributors and online retailers (Future Market Insights, 2018).

Modern trade is the biggest distribution channel and retail store second largest but there are a shifting happening when online stores have more impact in the fortified food sector. Additionally, many manufacturers sell their product on their own website and online retailers are therefore predicted to grow even more in terms of market sales of protein snacks in the future (Future Market Insights, 2018)

The distribution channels of Fresenius Kabi does not correlate that good with the mentioned leading channels of protein snacks. Since they are using medical platforms to their products an idea could be to use such channels to reach out to for instance home care institutes and pharmacies. As the online stores grow even more, they can also do as the other manufactures and sell their products from their website.

Rivalry among existing competitors

Diversity of competitors

Since there are not an actual and definite section of food market that includes value added snacks and food, it is difficult to create an general opinion of the diversity. As mentioned in earlier chapter, the difference is big because of the many sections and small because of collaborations between the leading companies. The main difference is in marketing of products. Snacks that is combined by already existing products, such as turkey roll-ups, is examples can not be marketed in a special way the separate products can be listed in i.a. “perfect snacks” by websites. But in this growing and most needed market, it seems to be successful to find a niche or something that diverse the product from others in the same field. A general trend is to have a product that is as organic and natural as possible. An example of it is Ips Protein that offers chips and popcorns that are protein and value added and marketed as a “regret-free, satisfying snacking” that are free from gluten, GMO corn, bio-available through whey protein, contains nothing artificial and are certified kosher. The protein content are 6 grams per serving which results in 11% of recommended daily value (Ips Protein Snacks, 2019). Ips has therefore found its marketing area; natural, healthy and free from guilt. The same goes for Vegan Rob’s that has a product “Probiotic Cauliflower Puffs” which is also free from gluten, GMO, vegan and added with probiotics that should support with digestive and immune health. It consists 3 grams of protein per serving (Vegan Rob’s, 2019).

Today, potato chips is not the only alternative on the market. There have been an explosion of new market entrance of healthy snacks made by black bean, pea sticks, legumes, pea and lentil combined, cauliflower among others. However, a lot of these new and healthier snacks do have a lot in common with the regular potato chips that people have eaten for a long time. Many of them, not all, are also free from gluten, GMO and vegan. Sometimes, it is not just about the content of the new product but how the company decides to visualise it.

Industry growth

As mentioned earlier, the market of healthy protein enriched snacks is expanding and have been expanding for last years. In the section of “number of customers” one can read that “in january 2018, Polaris Market Research wrote that “the global healthy snacks market size was valued at US\$ 25.231 million in 2017”. In that article, healthy snacks were defined as nutritious food that the consumer eat in between meals in purpose to add vital nutrients in daily manner”.

Bakery and snacks confirmed the direction of clean labels and ingredient transparency trends when they published “Protein still reigns as top trend in healthy snacks” in January 23th 2019. Apparently, the occuring major trends of 2018 were addition of protein, fiber, fat amongst those clean labels and ingredient transparencies. A high protein content is mainly driven by the millenials and people of 50-64 years, the year of 2019 will not underperform in protein-fortified food as different snack segments. Other than this, the snack segment will also be benefited by the approach of easily accessible fast food that still provides the body with a healthy set-up of nutritions. In a general opinion, vitamins and minerals are being replaced by protein and other micronutrients that comes along with the protein source, such as calcium, magnesium and phosphorus in milk protein (Hyslop, 2019).

Lifestyles that increase in popularity, and seems to continue to increase throughout 2019, are Keto and Paleo. Keto is a dietary lifestyle that includes in general high fat and low carbs and Paleo is a diet similar to what people ate in the Stone Age. This means that 2019 will most probably offer a focus on healthy fatty acids and high quality proteins (Hyslop, 2019).

Such forecast is very beneficial for a protein enriched product derived from Fresenius Kabi's bonus product.

Quality differences

Quality difference on protein enriched snacks depends a lot on which purpose the customer are looking for. Products within the fitness profile is reduced in fats and carbs and the quality of the products is evaluated by the protein content and, in some ways, taste. Other qualities could be gluten free, presence of certain amino acids or texture. The quality today are in general based on clean labels and natural ingredients.

Brand loyalty

Products in this segment are mainly substitute friendly and not emotionally or "subscription liked" attached to customers. This leads to a low brand loyalty for each customer. Therefore, it is important for all companies to be easily accessible for the customers because if there are other options, more accessible, the customers can choose them effortlessly. It is a market constantly growing and in experience of new entrants but the products have to be available.

4.4 Evaluation; Dietary supplement

This evaluation of segment has constraints such as:

- The dietary supplements is in context of improved health and does not include increased hair- and skin quality or growth.

Power of buyers

Number of customers

To investigate the number of customers, one can either look at the existing market of egg oil in supplemental capsules today, or the market of fish oil as dietary supplements assuming this is potential customers to egg oil as well. As earlier described in the report, the European fish oil market was in 2014 valued at 0.69 billion US\$ and was expected to increase even more in the years to come (Grand View Research, 2016). The same numbers worldwide in 2014 was US\$ 2.25 billion and the same source expect the numbers to reach US\$ 4.08 billion in 2022 (Grand View Research, 2019). It was 9% of the global consumption

of fish oil in 2014 that was directly used by humans. This is believed to show proper benefits of the next 7 years due to the many health improvements that comes with increased intake of essential fatty acids (Grand View Research, 2019).

There are no doubts that the fish oil market, and therefore dietary supplements with long-chain omega-3 polyunsaturated fatty acids found in i.a. seafood and eggs, is a market highly valued. As long as the bonus product can reach the required purity, the potentials of using it as dietary supplements are endless.

As for the egg oil based supplements, the market share is biggest in countries of Asia-Pacific. By merging all products containing omega-3 polyunsaturated fatty acids (PUFA) globally, the market holds for approximately US\$ 17.9 billion and is expected to reach US\$ 18.7 billion in 2023. The Asia-Pacific accounts for the secondly largest market share.

Price sensitivity

Compared to other food-categories with products containing long-chain omega-3 polyunsaturated fatty acids, such as fish and seafood, eggs are much cheaper considering the amount of nutritious fatty acids present.

However, when it comes to supplements is fish- and cod liver oil supplements much cheaper. Fish oil supplements had a minimum price of US\$ 0.03 per 500 mg of PUFA and cod liver oil supplements had a maximum price of US\$ 0.20. These numbers compared to eggs that had a mean value of US\$ 3.4 per 500 mg PUFA shows that it is more economical to produce oil supplements with same amount of PUFA than to sell it in its ordinary form. Same number for freshwater fishes was almost US\$ 7, which is more expensive than for the supplements (A. Watters et al., 2012).

According to these facts, an egg oil dietary supplement should be cheaper than fish oil containing as much PUFA and therefore would represent a competitive alternative.

The previously mentioned product of Orihiro from Japan with egg yolk and garlic oil in capsules, has a marketing price of US\$ 20 for 120 tablets on Amazon (Amazon, 2019).

A quick overview of the existing fish oil capsules on market today indicates on a relatively low distribution. However, there are some alternatives more expensive than others which

are marketed as for instance “dietary supplements for extreme athletes”. In summary, the price sensitivity for egg oil as food supplement probably is what it is for similar products in food industry. There will always be customers choosing the cheapest alternative but depending on marketing and difference in customer segments- some customers chose the more expensive product with a desirable content and a selling advertising.

Buyer’s ability to substitute

To continuously compare potential egg oil capsules with fish oil, the market for fish oil contains a lot of different alternatives for customers to choose from. However, capsules derived from egg oil has not yet reached Europe and the western world at the same extent that it is consumed in Asia-Pacific and a possible serie of events could lead to a first entrance on that market in this part of the world. The ability to substitute between different egg oil dietary supplements in Europe is very low.

Difference between competitors

When it comes to yolk oil based products, the main difference is the distribution between cosmetic- and health enhancing products. The health related supplements are mainly formed as capsules and comes with different focus.

One product from “the vitamin shoppe” has used yolk lectin to produce capsules with overall health improvements through nutritional support (Vitamin Shoppe, 2019). Then there are those who use a combination of yolk oil and garlic oil to provide customers with multi conditioned dietary supplements, which seems to be widely used in Japan (Rakuten Global Market, 2019; Amazon, 2019). It is also a product formed in pills at Alibaba.com, made by egg shell membrane and egg oil that works as a health care supplement and joint pain killer (Alibaba, 2019). However, it does not say for what purpose the egg oil is added and why it works as a pain reliever. Other than that, the difference between products does not seems to be that big. The existing products on market in this segments are all focused on providing the body with nutritions in order to improve health in one way or another.

Threat of substitute products

Buyers propensity to substitute

Since the ability to substitute between egg yolk oil based dietary supplements in Europe is

very low, the propensity would be considered as low as well. This is due to the lack of products existing on market today and could change over time if these products gets attached in european countries. To investigate this further, one can compare the propensity with how customer act on the fish oil market and the possible substitution from fish based to egg based.

There are amounts of products today in the market of fish oil based dietary supplements. They can differ in marketing and purity. Some of them are marketed as GMO-free and derived from wild-caught fish or purified with molecular distillation in order to remove heavy metals and other toxins. Other brands have been in business for a long time and are marketed as experienced products, highly trustworthy. When looking at different best-seller lists, it is difficult to distinguish factors that are decisives because not one of them look the same in the listing products (Amazon, 2019; Reviews, 2019; Labdoor, 2019). The variating best-seller lists together with the fact that a customer probably do not get emotionally attached to a fish oil product, ends up with the conclusion that the propensity to substitute between these products are relatively high. However, the potential product from Fresenius Kabi's bonus product is not derived from fish, it is derived from egg. That is why the propensity to substitute from fish to egg is of interest.

According to John Staughton (2018) in "9 best fish oil substitute", omega-3 eggs, plant-based foods, canola oil, flaxseeds, chia seeds and leafy vegetables are the best substitutes if one do not want to eat fish. Omega-3 eggs are not usual eggs but eggs that have been enriched through flaxseed feeding. These eggs are the only food, apart from seafood, that includes biologically active long-chain omega-3 polyunsaturated fatty acids (Staughton, 2018).

Together with the occuring health trend today, vegetarian (non-meat eaters) and vegan (non-animal based eaters) food have become more popular. Dietary supplements derived from egg instead of fish offers a vegetarian, more sustainable and more environmental friendly alternative. Overfishing is today a giant problem which will lead to horrible consequences due to imbalance in the aquatic ecosystem. Whole communities relies on specific fish stocks and since about 30% of all the stocks in the ocean are deemed to be overfished, these communities will also starve. Overfishing means also the end of certain

species. Some commercially attractive fish species serves the risk of direct extinction, but overfishing means also extinction of other species indirectly due to long-line fishing techniques where not only the target species ends up. Such species are for instance sea turtles, sharks, seabirds, whales and dolphins to name a few (Emily M, 2018). To choose omega-3 fatty acids, in order to complete your diet, derived from egg instead of fish is therefore a much better option according to the maintaining of ecosystem on earth. Eggs compared to fish has in general two big advantages; a vegetarian alternative and absence of heavy metals.

It is commonly known that environmental contamination such as heavy metals (for instance mercury, arsenic and cadmium) accumulate in the fatty tissue of fish, due to industrial sources closely located to the water where the fishes are fed. These toxins also accompany the fish oil and therefore to humans eating these supplements. The consequences such heavy metals have in humans include brain damage such as memory loss, deafness, loss of coordination, irreversible liver and kidney damage and even death. It is therefore very important to eat fish oil supplements that have been properly purified in order to remove toxins and contaminants (BrainMD, 2017). Not only does fish oil have a big environmental impact due to overfishing, the purification process to remove heavy metals is also harmful. The propensity of substituting from such a product should therefore be acceptably high for this kind of product.

Number of substitute products available

Substitute products within yolk oil supplements are not many. Counting only those directed to health improvement and eatable, not more than 20 suppliers globally.

Power of suppliers

Estimated number and size of suppliers

After scanning the market, there seems to be one big distributor in Japan, Orihiro. There are a couple of other brands that shows up which also have used the combination of garlic oil and yolk oil in their products. Size of these suppliers is hard to estimate due to lack of information.

Uniqueness of each suppliers product

Uniqueness depends on which kind of product that is evaluated. Uniqueness between fish oil products can be form of oil; liquid, emulsified liquid or as capsules. It can also be difference in purification and marketing but over-all are the products similar to each other. Addition of extra ingredients are not that common and it seems to be desirable to have as natural product as possible. The number one bestseller on Amazon is produced on wild caught fish which also promotes for a natural approach. As mentioned earlier, most of existing dietary supplements from egg yolk oil has addition of other components in their product. In the narrow segment of food supplements, there are just a few things that diverge the products apart and the uniqueness of each supplier are very low.

Threat of new entrants

Brand loyalty

On the fish oil market, there are a lot of products and completely different best-seller listed products. This indicates that it is a market supportive of new entrance and new brands which continuously tries to convince the customers that their product is better, more pure, cheaper and more accessible than the other products. The brand loyalty according to these facts does not seems to be that high. However, the egg oil market is not equal established in Europe and western countries which could open up for a first move and first entrance. Perhaps a bravely move of being one of the first products in a specific area could pay off by conquering a great market share and potentially, through the right advertisements, could also create a brand loyalty. This hypothesis is difficult to confirm through comparison with fish oil because it has been a long time since the first entrance on that market.

Government policies

When it comes to dietary supplements, the policies is a difficult to sort out. Primarily, it does not exist a global agreement of how to define categories that includes products which is for instance known as dietary supplements, natural health products, complementary medicines or food supplements. The definition can also differ depending on country, the same product can be considered as supplement and regulated as food in one country and as a complementary medicine in another. In China and India, there are also existing

framework for traditional medicine which confuse things even more. Additionally, most of these policies are continuously changing (Dwyer T et al., 2018).

When zooming in on Europe, the European Commission in 2008 declared that 50% of market share belongs to vitamins and minerals. Other than vitamins and minerals, there are over 400 substances used in dietary supplements in Europe whereas fish oil, probiotics and herbal ingredients accounts for the most commercially significant. As for fish oil, the market share depends a lot on which country one looks at. For instance, it holds for over 50% of market of other substances in Denmark and only less than 3% in Spain and Italy (Export.gov, 2017).

In January 2002, the European Food Safety Authority (EFSA) was created in order to provide the European Commission with opinions as scientific advisor. EFSA has since then been asked to look into addition of minerals and vitamins and analyse different proposals to the Food Supplements Directive. They have also been asked to evaluate nutrition- and health claims and helped the European Commission to determine a maximum limit on the amount of vitamins and minerals that should be legal in food supplements. EFSA also supported the European Commission with questions about substances other than vitamins and minerals (Export.gov, 2017).

In Directive 2002/46/EC, one can read about the Food Supplements Directive (FSD) which contains a definition for food supplements and a list of approved vitamins and minerals as well as sets labeling requirements. The definition of food supplements goes “foodstuffs the purpose of which is to supplement the normal diet and which are concentrated sources of nutrients or other substances with a nutritional or physiological function, alone or in combination, marketed in dose form, namely forms such as capsules, pastilles, tablets, pills and other similar forms, sachets of powder, ampoules of liquid, drop dispensing bottles, and other similar forms of liquid and powders designed to be taken in measured small unit quantities.” (Export.gov, 2017).

Access to distribution channels

The existing distribution channels at Fresenius Kabi could be considered as in small extent be useful to the product segment of yolk oil as dietary supplements due to the current

product portfolio consisting nutritional supplements such as energy-, fiber- and protein drinks. These nutritional supplements is today distributed by pharmacies and hospitals. As for dietary supplements, the distribution channels can be everything from retail establishments to pharmacies to service providers directly and indirectly involved with the product (Anything Research, 2019).

From own perceived experience, dietary supplements are easiest attainable at health food shops or pharmacies. These are channels that correlates good enough with Fresenius Kabi's distribution channels today to say that the access is satisfied.

Rivalry among existing competitors

Diversity of competitors

The diversity of competitors inside fish oil supplements market is i.a. difference in marketing and source of raw material, wild caught fish or raised fish. Difference between the existing products of supplements derived from egg oil is not that distinctive.

It seems like it is positive to combine yolk oil with garlic oil due to a broad range of healthy aspects. Otherwise, a lot of supplements containing yolk oil are aimed for beauty aspects such as improved hair or skin.

Industry growth

To continuously compare the yolk oil market with the fish oil market, in order to forecast a potential future, one can realise that it has been an incredible rapidly growing market. In 1990, there were some articles published indicating that if people started to eat fish pills, they would experience increased heart health. Nine years later, in 1999, the GISSI study had results that proved it (Siska, 2018). Fifteen years after that, in 2014, the global fish oil market was valued at US\$ 2.25 billion.

There are a number of published articles today that pays attention to all the benefits of consuming egg yolk. And if that market can experience anything closely related to what the fish oil market has experienced, it would absolutely be a product segment worth considering.

Quality differences

It has been questioned if the nutritional value on egg yolk differs depending on the living situation of hens, if free-range hens gets affected by eating for instance insects and plants. That could perhaps lead to a different nutritional content of the egg since forage like that would change the nutritional intake for the hens comparing to caged hens. On the other hand could perhaps some housing system increase stress levels of the hens and therefore decrease the nutritional value (Rains, 2018).

However, it has been determined by several studies during recent years that “there were no difference in any of the minerals tested between caged hens and free-range hens” (Rains, 2018).

The color of the yolk oil, however, indicates the status of the hen’s diet and is especially coupled on the presence of carotenoids. Carotenoids are the reason why yolk has this yellow-orange color, it is an organic pigment and has expressed correlation with brain and eye health in humans. The forage of hens can be enriched with carotenoids which leads to a darker color on the yolk but whether or not that influence the human health is not established yet. Moreover, hens that have been fed with nutrient enriched food, such as vitamin D or omega 3, have experienced nutritional changes of the eggs (Bassler, 2018). The potential quality differences of egg oil supplements could therefore be dependent on the forage of the hens, where the presence of vitamin D and omega 3 are desirable.

Brand loyalty

As briefly described earlier, there are no significant brand loyalty when it comes to oil supplements. There is big differences in all the best-sellers lists where purity and marketing are more appreciated than specific brands. However, in Asia-Pacific where Orihiro almost offers the only single product within egg oil supplement, one could suppose that customers in need of egg oil supplement choose them in lack of other options. To create a brand loyalty, it is a good thing to do a first entrance and keep on developing the product in order to face the customers needs.

4.5 Evaluation; Egg oil in hair care products

Power of buyers

Number of customers

The global hair care market is a huge multi-billion dollar market that has witnessed many changes over the past decades. People in all parts of the world uses hair care products for various styling, nourishing, colorant and hair regrowth purposes(Mordor Intelligence, 2018). In 2018, the US hair care market alone was worth US\$ 95.45 billion and is expected to be valued at US\$ 116 billion in 2024 (Mordor Intelligence, 2018). In other words, there is an extremely large pool of customers within this product segment and the number is expected to face a substantial growth in coming years. Today and in the forthcoming future, Asia-Pacific, Middle East and Africa are expected to increase their shares due to emerging economies and industry development (Grand View Research, 2018).

One reason for the suggested growth of consumption in the future is the fact that the global population of 65 years or older is expected to rise, from 7% in 2000 to more than 16% in 2050. Since aging can cause hair dryness, loss of hair volume and grey hair, the sales of products against these kinds of problems will intensify as the number of customers are growing (Grand View Research, 2018).

Organic and natural products are expected to generate substantial revenue in coming years. The rising awareness about all the benefits natural ingredients offer has created a trend in the hair care industry and consumers are switching from chemical products to organic ones (Market Watch, 2018). Egg yolk oil is generally regarded as a natural source of vitamins and nourishing fats, hence holds great potential to be a competitive alternative amongst organic hair care products.

The organic hair care market will face largest growth in Asia-Pacific, which indicate that the majority of customers for egg yolk oil would be in these countries in the nearest future (Market Watch, 2018). The population in this part of the world have used natural components as hair treatments for years hence, organic products are already present in their cosmetic routines. Even if 50% of the Asian population is urban, this is a huge

customer pool considering that the Asian population accounts for about 59% of the total world population (Worldometers, 2019).

Price sensitivity

The price sensitivity vary depending on what customer segment the supplier chooses to target. Some manufacturers diverge themselves from the rest in terms of price point, hence can create a rather niched group of customers (Franchise Help, 2019).

For middle income household e. g., a competitive price is important. They do not want to put a lot of money on hair care products when they know that it probably will run out pretty fast, since the whole family will use it. Such supermarket brand products generally contain cheaper materials and plenty of detergents in order to keep the price low (Hair Rocks, 2019). There are many such alternatives on the store shelves and if the supplier rises the price - the customers will simply buy the product next to it that is cheaper.

Then, there are producers that puts more resources into developing products that offer e. g. hair UV protection, color fade preservation and thermal protection. Such products are often called “professional hair care products”, mainly because these products generally are sold in salons exclusively. Since they are marketed as high performance formulas and are often said to include essential ingredients to repair hair from the roots to the tips, customers are willing to pay a lot more for them (Hair Rocks, 2019). The producers of such professional products does generally not put their focus on large family households or the everyday shopper in supermarkets.

Their main target group are people that can, and are willing, to spend a bit more money and time in order to get high performance products. These suppliers might therefore not experience price sensitivity to the same extent.

In conclusion, for hair care products sold in general supermarkets, price is top priority. Hence, there is a high price sensitivity in this specific segment of products. For the professional hair care products, performance is the top priority rather than price setting.

Buyer's ability to substitute

Since hair care industry is such a huge market, there are a wide range of products for the buyers to choose from. In the year of 2012, about 10 000 products were launched and this

number have grown year by year (Persistence Market Research, 2014). Therefore consumers most certainly have the ability to substitute. Many companies today launch an entire collection of products at once, that all offer different benefits.

This strategy increase the sales since many customers are seeking for several benefits, which mean that they have to buy two or three products in order to get the desired effect.

Since there is an evident demand for organic hair care products on the market, many big companies are putting resources into developing organic and natural hair care alternatives. Conventional formulas that might contain both alcohols and silicone are substituted to products containing e. g. botanical ingredients derived from plants or fruit (Mordor Intelligence, 2018). This has been clear in China and Africa where there has been a big shift from conventional shampoos to organic ones due to increased awareness (Grand View Research, 2018).

In conclusion, the growing organic trend in hair care have caught the major manufacturers attention and consumers seeking for a natural alternative have the ability to choose from a wide range of products. The sortiment of products containing natural ingredients is expected to grow even larger hence, the probability of buyers to substitute between different brands are even bigger in the future.

Difference between competitors

The hair care market is an extremely fragmented, dynamic and competitive market. The constant change of the market is driven by changing lifestyles, superficial standards, global demography and economic growth (Persistence Market Research, 2014). The players on the market have to change their portfolio of products very often in order to keep up a competitive position. The products covered in the industry of hair care include different kinds of hair cleaners, conditioners, serums, styling gels or spray, hair growth enhancers, colorants and hair accessories. In recent years, there has also been a growth explosion of products to control damaged hair and split ends, such as oils (Persistence Market Research, 2014).

The companies diverge based on what kind of hair care products they offer. While some manufacturers have their main focus on shampoos and conditioners others are specialized in nourishing oils or hair colorants. They also differentiate themselves by targeting different demographic markets, using different distribution channels and by using certain manufacturing processes (Persistence Market Research, 2014). One way to attract a loyal following is e. g. to adopt the manufacturing process to ensure that the products are free from animal testing. Products on the market also vary in terms of base material. Conventional hair care products often contain some kind of synthetic ingredient such as surfactants, emulsifiers or preservatives. New and modern products does instead strive to be “all natural” and contain e. g. herbal ingredients or natural oils (Persistence Market Research, 2014). One example of such natural oil is egg yolk oil so the bonus product of Fresenius Kabi could work as a natural hair care ingredient.

One existing hair care product based on egg oil is Eyova®’s Hair Nutrient with egg oil. Eyova® is a company located in Mumbai, India, focusing only on this product which is marketed as a multi-purpose remedy for damaged hair, dandruff, hair loss and dry scalps. In other words, an organic and effective treatment against all kinds of hair problems (Eyova, 2019). It contains OLEOVA (egg oil), canola oil and fragrance and has grown interest amongst customers worldwide but mainly in the US for its short list of ingredients and its organic content. This is one of few established hair care products on the market, hence it is hard to identify some kind of diversity amongst egg oil competitors on the hair care market. To sum it up, the hair care manufacturers diverge in terms of product type, distribution channels and geography - all of which results in different target customers (Mordor Intelligence, 2018).

Threat of substitute products

Buyers propensity to substitute

In a constantly changing market with a great amount of suppliers, it can be rather complicated to maintain customer loyalty towards one single brand. There are products specifically formulated to suit every different type of hair, allergy or gender which in some extent can create a customer loyalty. However, new improved individualized products are

launched every year which makes it difficult to maintain a unique and desirable product formula that the customer will stick to.

Buyers in China and Africa have a proven propensity to substitute from conventional hair care products to organic and more natural ones due to increased awareness about the benefits organic formulations offer (Grand View Research, 2018). This is a trend that is suggested to expand towards Europe and the US in a near future.

Hence, one can expect a high level of substitution from existing brands to new, organic products (Grand View Research, 2018).

Looking into hair oils more specifically, India has the greatest market for hair oil products. In 2016 the country had approximately 49% of the global market share (Grand View Research, 2018). Hair oils are, just as organic hair care products, getting more popular in the west world as well due to the great demand of products that control damaged hair and split ends. The majority of customers as well as manufacturers are however still positioned in India (Grand View Research, 2018; Persistence Market Research, 2014).

Major companies have acknowledged these facts and launched hair care products to boost their sales in India and neighboring countries. One example is Marico Limited who created a fruit hair oil in 2017, addressing both the natural product- and hair oil demand amongst the Indian customers (Grand View Research, 2018). With new products entering the market of hair oil, both in Asia and western countries, buyers find more alternatives to choose from which increases the likelihood that they will substitute from their earlier preferred brand to another. Especially if the product offers natural and organic ingredients.

Number of substitute products available

New haircare products are launched every year, both by large and small suppliers. As a result of a growing demand, there are more natural hair care products now than ever on the market (Transparency Market Research, 2018). Some of which are regarded as natural even if they instead should be considered as “nature-inspired” since they contain detergents and synthetic additives in addition to botanical extracts or natural oils.

Ingredients such as olive-, coconut, or avocado oil are some popular components in above mentioned products (Transparency Market Research, 2018). Much due to their high content of nourishing fats but also the fact that they are taken from nature. Avocado oil in particular has a composition of monounsaturated fats, vitamins and antioxidants, features that egg oil also offer (Transparency Market Research, 2018).

The bonus product of Fresenius Kabi could hence be a promising alternative amongst these natural oils.

There is a jungle of natural hair oil products and they are generally categorized as light-, heavy-, and cooling hair oils where the segment of light hair oil seems to be the most desirable (Transparency Market Research, 2018). What appears to be a selling feature of these products is plant-derived oils like argan-, jojoba- or almond oil. These oils have been used in cosmetics for very long, mainly in skin care due to their many physiological effects, but have boomed the hair care industry during the past decade (Lin et al., 2017). The estimated number of natural hair oil products is very large. They come at different price range and with a focus on different target groups of customers. What derives egg yolk oil from the above mentioned ones, is the fact that egg oil is animalic. That is a unique feature but whether it is a desirable feature can be discussed.

As of now, there are at least one egg yolk hair oil, Eyova®'s Hair Nutrient with egg oil. Its greatest market is currently in Asia-Pacific but the popularity of this product is spreading in western countries as well. Then there is also Rausch, a herbal cosmetics brand from Switzerland, who launched a nourishing shampoo containing egg oil. In this product, egg oil is only one of several ingredients, hence not the “base” of the product (Rausch, 2019).

In conclusion, there are a great number of substitute products which means that a new entrant need to have a unique selling point in order to match the competition. The egg yolk oil does stand out by being an animalic ingredient but the rising awareness about what consequences animal derived ingredients have on environment and health could be an obstacle when launching such a product on a market dominated by plant-derived products. The popularity of similar products on the hair care market of Asia does however shed light to the potential of egg yolk oil as hair treatment.

Power of suppliers

Estimated number and size of suppliers

As previously mentioned, there are a large number of suppliers in the hair care industry. Since this analysis is done to bring light on the competitive position of egg yolk oil on the hair care market, we will focus on organic- or natural hair care suppliers when evaluating this specific force.

Organic hair care products are predicted to propel industry growth. The rising awareness about the environmental- and health related benefits natural ingredients offer will generate revenue from 2017 to 2024 (Market Watch, 2018). Various manufacturers are already launching new organic products to increase their market share. Their main target customers are as of today the young population. By presenting these customers to innovative and holistic products, they hope to gain customer loyalty and hence, increase market share (Market Watch, 2018) .

According to the market analysis made by Market Watch in 2018, the global organic hair care market is dominated by large suppliers such as Avalon, Bentley labs, Kao, Colgate-Palmolive, The Body Shop and Bentley labs (Market Watch, 2018).

These are however just some of many existing suppliers of organic hair care products. As developing countries in Asia are improving their economies and getting better living standards, the awareness about health and hygiene in these regions increase. Hence, these populations are a promising target to focus on to increase market share in the future (Persistence Market Research, 2014). The majority of hair care manufacturers are therefore now launching lines of nature-inspired products to attract customers in these countries (Mordor Intelligence, 2018). L'Oréal, Marico limited and Wella are just a few of such manufacturers and these are some of the leading companies on the market of cosmetics and beauty (Grand View Research, 2018).

Hence, introducing a natural egg yolk oil product on the hair care market means that one has to compete with several large size suppliers in addition to smaller, more niched suppliers.

Uniqueness of each suppliers product

As previously mentioned, the global hair market is segmented based on product type,

distribution channels and demographics. All of which contributes when creating a unique selling point (Mordor Intelligence, 2018) . When it comes to the actual product it is mostly ingredients and how the product is marketed that creates uniqueness. By adding certain exotic or botanical ingredients, manufacturers can build up a good selling point by saying that they are using rare ingredients that are all natural. It will however be hard to argue that this is unique characteristics in the future since the natural trend is spreading amongst both small and big manufacturers (Grand View Research, 2018) .

In terms of being unique when it comes to demographics, that can be quite difficult on this competitive market. As previously mentioned, manufacturers in India dominated the hair oil market for several years and had about 49% of the market share (Grand View Research, 2018). They were the first manufacturers of hair oil in that region, hence one could argue that they are unique in that manner. Major companies are now launching specific hair oil products in these countries to gain market share (Grand View Research, 2018), meaning that what once was unique in the year of 2016 are now becoming mainstream. This is also one of the markets where existing egg yolk oils have highest sales.

Threat of new entrants

Brand loyalty

The generation of people born between 1980 and 1995, also called millennials, are one of the most important target groups of today's cosmetic market. This segment is not only large in size, it is also full of heavy buyers (Hellsten, Kulle, 2017). With a constantly changing perception of what is beautiful and new trends evolving all the time, it is hard to gain loyalty from these heavy buyers. This is something large manufacturers are aware of though and the majority of brands launch new products on regular basis to follow the latest trends (Hellsten, Kulle, 2017).

The chance of getting brand loyalty is higher with niche products specifically formed to suit a niche group of customers. In the US for instance, some brands are empathizing with people with African descent and have launched specific hair care products to be used for the African traditional form of hairstyles (Mordor Intelligence, 2018). Another example of niche products could be a completely vegan, organic, no animal-testing product. Such eco-friendly products generally attract customers with a high level of awareness, who are

careful with what they are buying. In the jungle of hair care products, it can be tricky to find an alternative that matches the characteristics mentioned. Hence, the customers will keep on buying that specific product because it is too much of a struggle to find a new alternative that offers all those benefits.

The trend of creating natural and individualized product will however make it hard to maintain such loyalty for a longer time. Furthermore, with new distribution channels such as social media and E-commerce, customers don't have to look for a product of their preference (Hellsten, Kulle, 2017), it will be presented to them automatically. Brand loyalty will hence be harder and harder to obtain as the hair care market grows, the economies are improving and new technologies are developing.

Government policies

To ensure that customers get confidence in the products they are buying, the hair care industry works really hard to provide good information about the product ingredients. Inside of EU, which would be Fresenius Kabis primary market, the labels of cosmetic products have to include facts about what the specific product are used for, how the product is used safely and how it is supposed to be used to obtain the best result. Hair care product goes under these cosmetic regulations. The specific labeling or packaging requirements are described below (Cosmetics Europe, 2019).

- What the product is, if it is not obvious by appearance
- The responsible person for the product (company name and address).
- List of ingredients in a decreasing order based on weight/amount of the ingredients.
- The nominal net, meaning the quantity of the product at the time it was filled into the package, shown in grams or millilitres.
- The country of origin (mainly for products that are imported into EU).
- Date of minimum durability which shows how long the product can be used.
- The batch number or reference for product identification.
- The warnings that might be necessary to ensure product safety (Cosmetics Europe, 2019).

Note that these are the label requirements for products in EU, these might be slightly different in other countries.

Access to distribution channels

Some common distribution channels of hair care products are Pharmacies, E-commerce, Hypermarket & Retail Chain and salons (Mordor Intelligence, 2018). Depending on product price and target group of customers, companies diverge themselves by using different distribution channels. A luxurious and expensive hair mask would not have high sales in e.g a supermarket. If the hair mask is sold in a exclusive salon on the other hand, the price is no longer a big problem as long as the product promises performance. So, by choosing the distribution channels carefully, companies can also control what group of customers they want to attract.

In terms of accessible distribution channels for Fresenius Kabi, pharmacies are the main retailers selling their products within clinical nutrition. Hence, pharmacies could be a potential and accessible distribution channel for an egg oil hair product.

A problem that rises however is the fact that the hair care market of Asia, which is dominating in terms of hair oil, is already full of manufacturers launching natural oil products. Some of these manufacturers have well established distribution channels to reach the broad mass of customers, something that Fresenius Kabi currently are lacking.

Rivalry among existing competitors

Diversity of competitors

The competitors mainly diverge themselves in terms product type, distribution channel and demographics. These categories have been described in earlier factors/forces. Another aspect that is worth mentioning is the fact that suppliers can diverge themselves in terms of cost and thereby exclusivity. By offering a more expensive product, companies can diverge themselves from the brands sold in regular supermarkets. Such product require however proof of high performance which means that they are more expensive to produce.

In addition, such professional products are most often sold at salons or limited beauty shops which means that the products are not available for the broad mass of customers. Hence, to keep up good sales of such professional hair care products, good marketing techniques and unique selling points are required.

As previously mentioned, it is hard to identify how egg yolk oil products out on the market diverge from each other since there are very few existing products. One clear difference that can be distinguished however is how much the products vary in amount of egg yolk oil. Eyova®'s Hair Nutrient with egg oil consists mainly of egg oil while the Shampoo launched by Rausch only have egg oil as one of many nourishing ingredients (Rausch, 2019; Eyova, 2019).

Industry growth

The global industry of hair care is looking at a bright future. The global hair market had a worth of US\$ 95.45 billion in the year of 2018 and is expected to register a CAGR of 3.35% in the forecast future of 2019-2024. According to a market analysis by Mordor Intelligence made in 2018, the global hair care market is expected to reach US\$ 116 billion by the year of 2024 (Mordor Intelligence, 2018).

As previously mentioned in this chapter, Asia-Pacific, Middle East and Africa are expected to increase their shares due to emerging economies and industry development. This is the main force driving industry growth along with growing e-commerce (Grand View Research, 2018).

Quality differences

Even if there are differences between almost all hair care products on the market, some product types have more quality differences between brands than others. Shampoo is one such product type which really vary in terms of quality and safety. Most shampoos that we find in the supermarkets today contain from 10 up to 30 different ingredients. Even if cheap shampoos that we normally buy are regarded as safe, many of them contain allergens such as parabens, benzophenones and formaldehyde-releasing preservatives which can cause contact dermatitis (Gavazzoni Dias, 2015). Hence, when buying shampoos it is often a clear correlation between cheap price and low quality.

The most interesting product type for fresenius Kabi is hair oil since products within this category most resemble their bonus product. The oils used for hair care are normally derived from plants or minerals and they differ in terms of hydrophobicity. Depending on if

the oil is saturated, monounsaturated or polyunsaturated, it shows different ability to diffuse into the hair. Coconut oil for example, mainly consist of saturated fats which make it diffuse easily into the hair while mineral oil, on the other hand, is a hydrocarbon and does not penetrate the hair as good (Gavazzoni Dias, 2015). If quality can be measured in the ability of diffusing the hair, plant-based oils are hence the better option.

Currently the Moroccan Argan oil is a very popular hair care ingredient. This oil is generally seen as a high quality oil. Partly due to the fact that it is the most expensive edible oil in the world, but also due to its rich content of antioxidants polyphenols and tocopherols. There is however little data or research regarding the beneficial effects it has on hair but its high social value in addition to its exclusivity makes it a desirable ingredient that customers are willing to pay for (Gavazzoni Dias, 2015).

Brand loyalty

As discussed earlier in this chapter, the chances of getting brand loyalty are substantially higher when launching niched products, meaning products that are specifically formed to suit or attract a niched group of customers (Mordor Intelligence, 2018). It is however getting more difficult to maintain such loyalty on today's market since many manufacturers are focusing on creating individualized products. This gives the niched customers more options to choose from hence, customers propensity to substitute increase.

In order for an egg yolk oil product to gain loyal following, one have to find unique benefits that other common hair oils do not offer. The fact that it contains antioxidants, vitamins and essential fats such as omega 3, makes egg oil advantageous over other common hair oils in terms of nutrients. This could be a strong selling point that have potential to attract loyal customers. However, one also have to consider the fact that egg oil differs from other hair oils by being an animalic oil. Even if this is a unique aspect, it can be hard to argue that a customers should substitute from a plant-based product to an animalic one.

However, using egg oil from Fresenius Kabi's bonus product would mean a circulating economy and environmental sustainable alternative which could be an argument for such substitution.

4.6 Evaluation; Egg oil in skin care products

Power of buyers

Number of customers

The skin care industry is a multibillion dollar market and is expected to grow even larger in the future due to i. e. the growing demand for sunscreens, body lotions and face creams. Hence, there is a large number of customers for skin care products in general (Market Research Report, 2019).

In terms of revenue, Asia-Pacific had the lead of the global market in 2018 followed by Europe. In other words, there is a large number of buyers as well as suppliers in these regions. The improving economies and better living standards in developed countries in Asia will boost the sales, hence the number of customers will grow even further in these countries. Face creams are currently the type of products that holds the largest market share, and are expected to continue to be so over the forecast period (Market Research Report, 2019). Many skin care consumers are changing their preferences towards more natural and environmentally safe products. This has lead to that manufacturers are putting more resources on R&D in the development of organic products (Market Research Report, 2019). This holds strong indications that there will be a large number of customers for natural skin care products in the future. Since egg yolk oil serves as a natural ingredient alternative, these are positive facts for Fresenius Kabi and their bonus product.

Price sensitivity

The price setting of skin care products are very affected by the selling format. A large part of the total sales volume of cosmetic products go through e-commerce. Much due to the fact that the prices for products are lower in online cosmetic stores than physical stores (Zhang, 2015). This creates a price sensitivity. If physical retailers take too high price, customers have the habit of looking up the price online before they buy the product and oftenly find a better price online.

Another aspect that might affect the level of price sensitivity is the fact that customers rarely purchase skin care products such as face creams spontaneously. Therefore they have more time to compare different prices and product formulas which in turn can make the

price setting even more important. The variety of these face creams are big. There are face products for i. e. sunblock, anti-aging, brightening and tanning all of which require certain ingredients that rises the overall price for the product (Mychaskiw, 2015). With strong regulations regarding the ingredients and safety, it can be hard to keep the prices low when offering a product with particular performance capabilities.

One should however not neglect the fact that the average woman spends about US\$ 15,000 on face cosmetics in a lifetime (Mychaskiw, 2015). We generally have a propensity to pay a bit more money for products that are intended to be used directly on our skin. In addition, natural ingredients often are perceived as exclusive and an environmental friendly option, which manufacturers can take a higher price for. Egg yolk oil might therefore be sold at a higher price and still be competitive.

Buyer's ability to substitute

It is a very wide variety of available skin care products on the market (Market Research Report, 2019). They come at different price range and offer different kind of effects hence, the likelihood that a customer finds exactly what she or he is searching for is high. In recent years there have been an escalating demand for organic, herbal and natural skin care products. This is due to the increased awareness about environmental- and health benefits that nature-based products offer (Market Watch, 2019). This resulted in a situation where many customers substituted conventional products to more nature-inspired, which they definitely have the ability to do. Many manufacturers are launching new and specific lines of products to meet this customer demand, hence the shelves in stores around the world are today often rich of natural or organic body lotions and face creams. Since this trend is expected to continue over the forecast period, the customers a likely to have a high ability to substitute to new products in the future as well.

Difference between competitors

The competitors on the market diverge in several aspects such as product applications, manufacturing processes, raw materials, cost etc. The most evident difference between competitors is however their size. The market is dominated by large multinational companies such as L'Oreal S.A, Johnson and Johnson and Unilever. Smaller companies are however gaining more share by launching natural, organic products (Market Research Report, 2019).

In terms of products, the market is generally segmented into body lotions and face creams. These two categories are then further sub-segmented. Face creams are often divided into anti ageing, sun protective and skin brightening while body lotions often are divided into premium- and mass market body lotions. These products also diverge further in terms of ingredients.

In the year of 2018, face creams held the largest market share and are predicted to continue to do so over the forecast period (Market Research Report, 2019). This brings indication of that face creams is a highly competitive segment with many substitute products of different variants. As earlier mentioned, natural face treatments or creams are rising in popularity, especially in Europe and Asia, and companies are currently investing in R&D to expand their product portfolio with such alternatives (Market Research Report, 2019). These products diverge in terms of ingredients and application areas. Natural plant-based oils are above all generally a very popular components in serums or creams and can assist manufacturers to create a good selling point.

Regarding the more specific competitors for egg yolk oil, the existing products mainly diverge in amount of egg oil content and treatment area. As can be seen in table 13, Crème du CIEL launched by Charismon® contain 4.5% egg oil and is used for prevention of premature aging and increased elasticity and firmness of the skin (Charismon, 2019). Natural Sourcings product on the other hand, contain 100% egg oil and is used for healing of dry skin apart from reducing wrinkles (McDougall, Andrew, 2013).

Threat of substitute products

Buyers propensity to substitute

Depending on what kind of product the customers are buying, they have more or less propensity to substitute.

As earlier mentioned, body lotions are sub-segmented into mass market body care lotion and premium body care lotion (Market Research Report, 2019). For the former one, customers do generally not pay too much time on comparing against other products. In that case price is more decisive hence customers have a propensity to buy cheaper alternatives of mass market body care products.

Buyers seem to have different habits when it comes to substituting products depending on what brand they use. Later on in this chapter, the factors that influence customer loyalty will be further discussed. One of these factors is however brand association, which is related to the perception customers have of a certain brand. Consumers seem to have less propensity to substitute products when using products from large brands such as Neutrogena and L'Oreal (Corra Research, 2017). Much due to the credibility of the products and the fact that they are easy accessible. A lifelong loyalty towards one single brand or product is however extremely rare and most consumers change their preferences along with changing fashion trends (Corra Research, 2017).

Number of substitute products available

There is an extremely high amount of skincare products out on the market, not the least face creams. In recent five years, the number of new launches have increased year by year due to the rising awareness about the benefits of using personal care products.

At the same time, natural and organic skincare products have risen in popularity and the demand for holistic products is today very large (Market Research Report, 2019).

As for egg yolk oil products specifically, there are some substitute products, but far from as many as plant-based oil products. There is much information and research regarding what benefits egg oil offers as a skin treatment but surprisingly few launched products.

Some of these products can be seen in table 12. The fact that there are such few egg oil products out on the market is positive for Fresenius Kabi. It rises however some concern, since it indicates that there might be limited demand or interest for an egg yolk oil

substitute. Especially since there are so many studies of egg yolk oils beneficial effects on skin.

Power of suppliers

Estimated number and size of suppliers

Since the cosmetic market is a great multibillion dollar market, there are a very large amount of suppliers globally. There are both large multinational- and small, local suppliers. The key players on the skin care market are large multinational companies including Olay, Estee Lauder, Nivea, L'Oreal, Lancome and Neutrogena among others (Bahsin, 2018).

These leading players have the ability of adopting their products after changing trends and can upgrade their sortiment after customer preference. Such companies are often focused on the multi-functionality, safety and advancement of products, hence can launch products that suits as many different consumers as possible over wide demographic areas (Markets and Markets, 2019). The smaller players of the market does not have the same advantage but on the other hand they might seem more appealing for nished consumers that search for uniqueness and local producers (Markets and Markets, 2019).

In conclusion, there are a great number of both large and small suppliers that have certain advantages respectively. One should therefore have in mind that the skincare industry is a highly competitive market with established leaders.

Uniqueness of each suppliers product

Uniqueness can be hard to obtain on such a big market with many suppliers that all are influenced by each other and occuring fashion trends. It is important for companies to stay tuned to the changing preferences of the customers and come with new and innovative products to meet their demand in order to be competitive (Bahsin, 2018). Even though many companies are investing time and money on creating individualized products to fit certain skin types specifically, it can be hard to create a completely unique selling point.

Over the last decade, holistic products have boomed the market of cosmetics (Markets and Markets, 2019). Natural ingredients such as herbs and fruit extracts that once was unique,

are today very common components in skin care products along with natural oils. Egg oil on the other hand, which is a natural oil, still exist in limited amount on the market. As previously mentioned, there are some launched products containing egg oil already but those are very few compared to the number of products containing plant-based oils. Hence, egg oil still have the ability to be regarded as a unique ingredient feature.

Threat of new entrants

Brand loyalty

In the competitive market of cosmetics, companies are always trying to find new ways to gain brand loyalty amongst their customers. Many factors decide on whether a customer will keep on buying products from the same brand or not. According to a study made by Usman Yousaf et al. on the University of Sargodha, where they investigate the brand loyalty in the cosmetic industry, there are some factors that decide the intensity of loyalty amongst consumers. These are brand association, brand credibility, brand awareness, product knowledge and perceived quality (Yousaf et al., 2012).

Brand association, refers to how the customer sees the brand, their overall perception of the supplier. The belief of the customer is decided based on how the brand is marketed and what products the brand have in their portfolio already. Brand credibility is related to the reputation of the brand. Brand credibility is high if the customer have used their products before and are happy with the overall performance of the product. Brand awareness can be seen as the foundation or beginning of customer loyalty. If the consumer has the information and knowledge about a brand and their products, the possibility of a product purchase increase. Product knowledge makes it possible for customers to differentiate the product from others. It is related to how the consumer evaluate the brand and what information the consumer have in their mind about the brand and its product already. Lastly, perceived quality is the consumers general judgement of a product or the brand value. It is set by how the customer experience the product quality and superiority over other substitutes (Yousaf et al., 2012).

Hence, brand loyalty on the market of cosmetics is much about marketing and reputation. Yousaf et al. found for instance that a well established brand like L'Oreal have a higher chance of gaining loyalty in consumers. This means that it can be problematic for small or

new entrants to create a loyal following, even if their products might be more cost-effective or niched to a certain group of customers.

A natural face cream containing egg yolk oil would have the benefits of being both quite unique and natural. Whether it would be competitive enough to keep customers from choosing other products is unclear. Same as for hair care products, there is a statistically proven preference amongst consumers for plant-based ingredients in skin care products. Since Fresenius Kabi is currently a stranger on the cosmetic market, it might be hard to create a brand loyalty due to the above mentioned factors.

Government policies

As already mentioned, both hair care and skin care goes under the cosmetic regulations in EU (Cosmetics Europe, 2019). For skin care products however, the required information when packaging or labelling a product could be more beneficial. Since the level of information a consumer have of a certain product increases the chance of product purchase, complete information about what the product contain is a positive thing to increase sales. The specific labeling or packaging requirements are described below.

- What the product is, if it is not obvious by appearance
- The responsible person for the product (company name and address).
- List of ingredients in a decreasing order based on weight/amount of the ingredients.
- The nominal net, meaning the quantity of the product at the time it was filled into the package, shown in grams or millilitres.
- The country of origin (mainly for products that are imported into EU).
- Date of minimum durability which shows how long the product can be used.
- The batch number or reference for product identification.
- The warnings that might be necessary to ensure product safety (Cosmetics Europe, 2019) .

Access to distribution channels

The distribution channels of cosmetics such as skin care products are many, including supermarkets, department stores, e-commerce, pharmacies & drugstores and beauty salons (Markets and Markets, 2019). Many of which are foreign to a company like Fresenius Kabi

which generally has their distribution channels in pharmacies or hospitals. Depending on the type and price of the product, the companies use different distribution channels. While exclusive or premium body care brands limit their sales to specific cosmetic shops, internet websites or salons, mass market body lotions can be bought at i. a. regular hypermarkets. A natural egg yolk oil product offering a rich source of vitamins, antioxidants and nourishing fats could be regarded as an exclusive alternative for face cream. Hence, potential distribution channels for such a product would be salons or cosmetic shops in addition to E-commerce which is one of the leading sales platform.

Rivalry among existing competitors

Diversity of competitors

The competitors on the skin care market diverge in terms of product type, distribution channel and demography (Markets and Markets, 2019). The global market is generally divided into Europe, Asia-Pacific, North America, Latin America and Middle East and Africa (Market Watch, 2019). The leading players on the market are well established multinational companies which operate globally while other suppliers are smaller, operating in limited regions of the world. Hence, a strong diverging factor is the size and resources each supplier have.

Within each category of skin care products, the competitors diverge in terms of ingredients and price. High performance face creams e. g. that offer both sun protective agents and anti-aging effects are generally more expensive than a regular face moisturizers. Depending on distribution channel, brands have different target customers. Mass market body lotions e. g. targets the everyday shopper in hypermarkets while a luxurious, holistic face serum that is sold in specific cosmetic shops and salons, targets the customers that are willing to pay both time and money for a high performance product.

Industry growth

In 2018, the global skin care market was valued at US\$ 134.8 billion and is suggested to register a CAGR of 4.4% in the forecast period of 2019-2025 (Market Research Report, 2019). The main driving forces of market growth are the increasing demand for personal care products in developing countries with improving economies and improving living standards along with a growing e-commerce sector (Market Research Report, 2019).

In terms of revenue, Asia-Pacific has the greatest market share of the global market followed by Europe. The skin care industry is predicted to continue to grow larger, especially in Asia due to industry growth and customer demand (Market Research Report, 2019). Companies offering skin care products hence are looking at a bright future. It would however mean that by entering such a big market, one will have to deal with hard competition.

Quality differences

The level of quality of a certain skin care product is hard to decide. As mentioned several times before in this section, skin care products all diverge in terms of ingredients. Some ingredients are more expensive and offer better effects than others, which often affects the selling price of the product (Market Research Report, 2019). For mass market body lotions, the ingredients might not be in focus since price competitiveness is very important in order to keep up good sales for the suppliers. For exclusive brands using limited distribution channels on the other hand, a high price, unique and high performance ingredients are preferred. A higher price for the product often indicates that the product promises performance and the majority of the customers going to e.g. salons are often prioritizing performance before a low price.

There are some tricks that the suppliers can use in order to give the impression of a high qualitative product. Skin care products can e. g. be labelled with “Dermatologist Tested” or “Dermatologist Approved” and customers are tricked to think that these two labels have the same meaning. The term “dermatologist-tested” simply states that the product was reviewed or tested by a dermatologist, it does not mean that they would recommend it or use it (Falletta, 2013). Same thing goes for products that are labelled “All-natural” or “Organic”. A product does not have to be 100% organic or natural in order to use these labels. A product can have just 20% natural content but the consumer might get the impression by looking at the “All-natural” label that he or she is buying a completely holistic and synthetic-free product (Falletta, 2013).

Brand loyalty

As previously discussed in the the force “Threat of new entrants”, there are some factors that decide the intensity of loyalty amongst consumers. These are brand association, brand credibility, brand awareness, product knowledge and perceived quality (Yousaf et al., 2012). Hence, brand loyalty on the market of cosmetics is much about marketing and reputation. Well established and multinational brands like e. g. L’Oreal have a higher chance of gaining loyalty in consumers. This means that it can be problematic for small or new entrants to create a loyal following, even if their products might be more cost-effective or niched to a certain group of customers (Yousaf et al., 2012). The skin care consumers does however very rarely stay loyal towards one single brand or product for a longer period of time (Yousaf et al., 2012).

5. Components of P080

The values in table 2 are taken from analysis done by representatives from Fresenius Kabi.

Table 2. Some ingredients and properties of the bonus product P080.

Er beteckning	DEYP 959					
Labnummer	F10003464					
Parameter	Resultat	Osäkerhet (\pm)	Enhet	Metod	Utf	Sign
vattenhalt	9.50	0.10	g/100g	1	1	JECE
askhalt	2.00	0.060	g/100g	1	1	JECE
energivärde (kcal)	579		kcal/100g	1	1	JECE
energivärde (kJ)	2420		kJ/100g	1	1	JECE
energivärde från fett (kcal)	405	28	kcal/100g	1	1	JECE
energivärde från fett (kJ)	1700	119	kJ/100g	1	1	JECE
protein	43.2	2.16	g/100g	1	1	JECE
kolhydrat	<0.3		g/100g	1	1	JECE
fruktos	<0.1		g/100g	1	1	JECE
glukos	<0.1		g/100g	1	1	JECE
maltos	<0.1		g/100g	1	1	JECE
laktos	<0.1		g/100g	1	1	JECE
sackaros	<0.1		g/100g	1	1	JECE
sockerarter, summa socker*	<0.25		g/100g	1	1	JECE
fett	45.8	2.3	g/100g	1	1	JECE
mättat fett	13.4		g/100g	1	1	JECE
enkelomättat fett	24.0		g/100g	1	1	JECE
fleromättat fett	8.3		g/100g	1	1	JECE
fiber	<0.3		g/100g	1	1	JECE
Na	0.0712	0.01	g/100g	1	1	JECE
salt	0.178		g/100g	1	1	JECE