ProZea

"Nourishment for the eye"

Business Plan

2011

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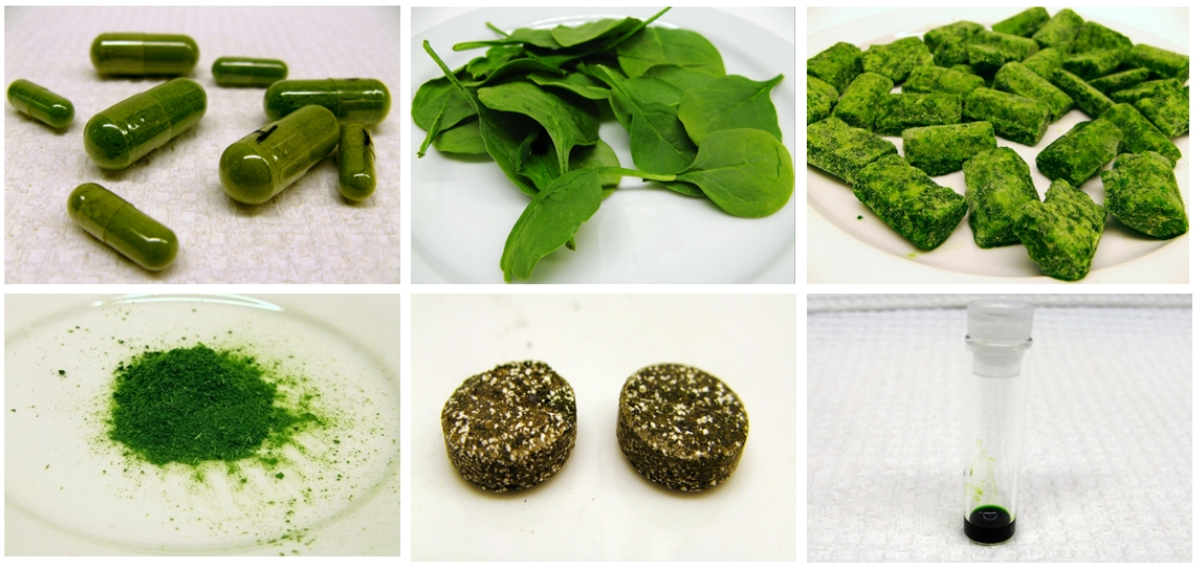

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This business plan is submitted to Professor Tomas Karlsson, for BUSP01 Degree Project, Entrepreneurial Project-Master Level, School of Economics and Management, Lund University, Sweden.

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1. Executive Summary

Age-related Macular Degeneration (AMD) is a progressive disease that is characterized by a loss of central vision due to degeneration of the macular. AMD has grown to be the biggest cause of blindness over the age of 65 in the western world. Evidence continues to show that oxidative stress contributes to AMD and consuming appropriate antioxidants such as zeaxanthin may protect against this condition.

Recent research has established that daily intake of 2-4 mg of zeaxanthin is required for the maintenance of optimum eye health. However, the average daily intake of zeaxanthin in an EU diet is less than 0.5 mg. Thus, a dietary gap of about 1.5-3.5 mg exists which is an indication for the supplementation of Zeaxanthin.

PoZea will provide affordable, assorted natural zeaxanthin based eye health care products that protecting the eyes to against high energy blue light and harmful free radicals. ProZea products contain Zeaxanthin concentrate from spinach. A novel, proprietary process has been developed to obtain increased levels of Zeaxanthin in spinach up to 20 times.

ProZea will focus on R&D and the new applications of zeaxanthin as a natural eye health ingredient. For the start-up phase, ProZea will be active in dietary supplement sector, including product development, marketing and sales. The product can be sold as pills/tablets via nutritional supplement chains or via specialized channels such as opticians. Production and distribution will be organized in outsourcing or joint-ventures. ProZea will generate income from two streams, sales of ProZea products and licenses to sectors outside its core-business.

The growth forecasts of ProZea predict a break-even in the 5th operational year, with sales revenue and other operating revenues reaching 3.7 million SEK. Net income is expected to reach 0.5 million SEK in year 5. The start-up equity of 2.3 million SEK will be sought from non-diluting fund sources. Once we enter the growth phase, venture capital will be attracted for new product development and marketing activities into different markets.

To sum up, ProZea will operate on a substantially profitable business model with a potential to become a leading player in the Zeaxanthin-based eye health products market in Sweden as well as in Europe.

2. Background

Age-related Macular Degeneration

Age-related Macular Degeneration (AMD) is a progressive disease that is characterized by a loss of central vision due to degeneration of the macular. It is one of the most damaging diseases in terms of severe, irreversible vision impairment and it is the most common cause of legal blindness in developed countries. Visual loss from this condition is uncommon among persons under the age of 50, but its prevalence is likely to increase in absolute numbers globally as a consequence of the increasing ageing population.

Normal vision

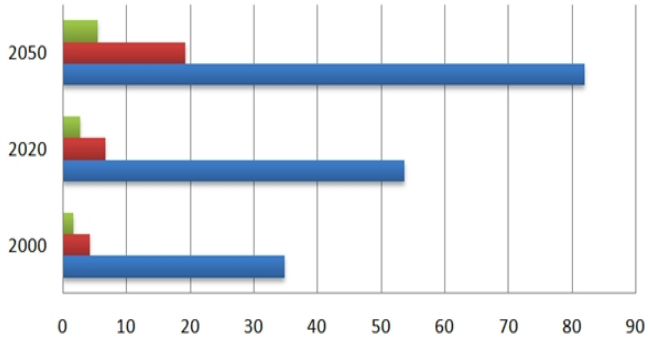
The same scene as viewed by a person with age-related macular degeneration

Current situation

Globally, AMD is responsible for 8.7% of all blindness (3 million persons) due to eye diseases (1). Approximately 10% of the population between 66 and 74 years of age will have early signs of AMD. The prevalence increases to 30% in the population 75 to 85 years of age (2). In 2020, the number of AMD cases worldwide is expected to reach 53.7 million individuals over the age of 65 (Figure 1)**. Until recently, no effective medical or surgical treatment is known for AMD. Only a few therapeutic options are available, but these treatments are very expensive**

Figure 1: AMD- Numbers

ARVO 2002:
AMD Predictive Study



	2000	2020	2050
Advanced AMD (million)	1.6	2.7	5.5
Age >85 &/or (million)	4.3	6.7	19.3
Age >65 &/or (million)	34.8	53.7	81.9

and time-consuming. For instance, the cost for medical treatment for those who are afflicted with AMD in the U.S. can reach $24,000 per person per year. Current options for prevention are limited, however, a series of scientific studies have established that antioxidants such as Zeaxanthin and Lutein can slow the progression of the condition. Zeaxanthin and Lutein have been suggested by the National Eye Institute (NEI) and others to slow the progression of AMD (3).

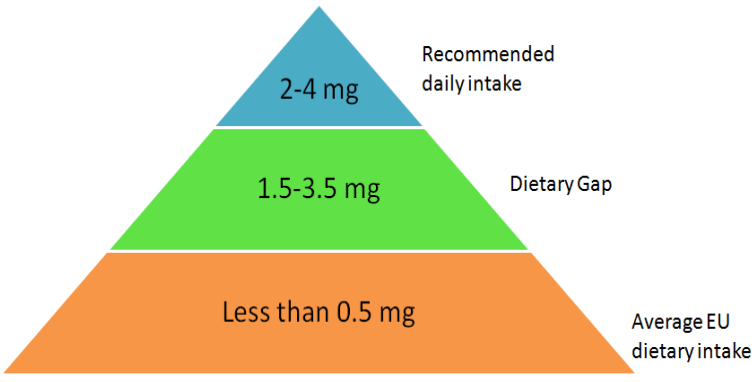
There is Hope and Help to Avoid Getting AMD

ProZea focuses on health benefits of natural Zeaxanthin from green leafy vegetables and the development of novel vision care products for prevention of AMD. The project is based on research carried out in Lund and is currently run by 3 entrepreneurship students from Lund University. The project is under the cooperation between the researcher, Lund University, and LU Innovation.

About Zeaxanthin

Zeaxanthin is naturally found in certain foods like dark green leafy vegetables and fruits. It is a powerful antioxidant that protects the eyes from oxidative stress and high energy light (similar to internal sun glasses). Zeaxanthin is the key component of macular pigment in the retina; however, since it cannot be synthesized by the human body, it is beneficial to supplement the nutrient.

Figure 2: Scarcity of Zeaxanthin in EU Diet



Source: European Eye Health Ingredients Market, M2E4-88, 2008 Frost & Sullivan

Notably, today's typical diet does not include enough amounts of zeaxanthin. Recent research has established that a daily intake of 2-4 mg is required for the maintenance of optimal eye health. However, the average daily intake of zeaxanthin in an EU diet is less than 0.5 mg (2008 Frost & Sullivan) which is an indication for supplementation.

Who Else Will Benefit?

As an antioxidant, zeaxanthin could also benefit many other groups of people that may have a certain lifestyle, such as those who smoke or drink excessively, use computers frequently, drive automobiles regularly, outdoors hunters or sportsmen, and active military personnel.

3. Business Idea

3.1 Our Business

Fundamental Idea

PoZea provides high quality, assorted natural zeaxanthin based eye health care products made exclusively from spinach to improve the quality of life.

Our Mission

Our philosophy is simple, "prevention is better than cure". We are committed to serve people to optimize their eye health and prevent the onset of Age-related Macular Degeneration through the development of innovative vision care products based on Swedish research.

Our Technology

Dr. Hans-Erick Akerlund from Lund University has developed a unique post-harvest optimization technology that significantly improves the Zeaxanthin content in green leafy vegetables under low pH conditions. Particularly tested in spinach, this technology allows up to 20 fold increase in zeaxanthin concentration without compromising the natural integrity of the plant. Thus, our products can be produced at significantly reduced cost thereby enabling us to introduce new applications to improve the market prospects.

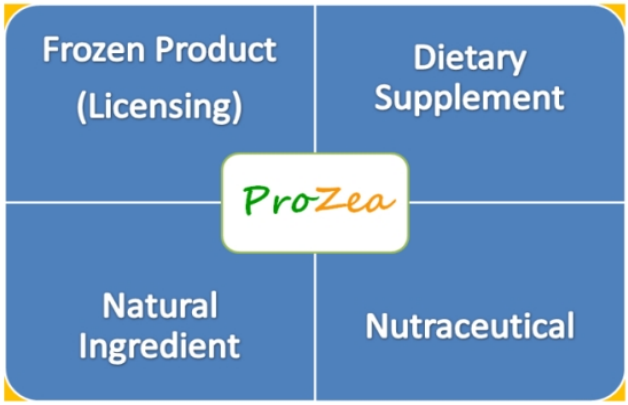
Figure 3: Comparison between normal and treated spinach

Technological Strengths

- **100% natural process - based on Generally Recognized as Safe (GRAS) materials**
- **No Genetic Modification**
- **Simple process – operational convenience**
- **Cost effective – dramatically increase the production efficiency**
- **Environmental friendly- no generation of hazardous waste**
- **Patent pending – the only method for increasing zeaxanthin content in green plants**

3.2 Offers & Revenue Models

Zeaxanthin-enriched extract or dried form is ideal to be used as a natural ingredient for nutraceutical, pharmaceutical and food industries. There are many possibilities for ProZea products including: dietary supplement, natural ingredient, and nutraceutical (such as beverage) sectors. In addition, ProZea can sell licenses to sectors outside its core-business (e.g. frozen products).



In the revenue models, ProZea will generate income from two streams:

- **Sales of ProZea products**
- **Licenses to sectors outside our core-business**

3.3 Value proposition

We intend to help people avoid the severe consequences of suffering from AMD and cut down the high expenses on the pharmacotherapy for AMD.

Although no effective treatment is known for AMD, currently there are two major pharmacotherapy for advanced AMD patients - photodynamic therapy (PDT) and anti-vascular endothelial growth factor treatment. Both of these treatments are very expensive and time-consuming. Referring to United States, the PDT treatment costs US$18,000 for 2 years (4). The anti-vascular endothelial growth factor treatment costs more than US$2,000 per treatment (4). This price could be a significant economic constraint for people who have limited or no health insurance coverage. According to the estimation from the Lewin Study in 2008, daily intake of 6 to 10 mg/day of zeaxanthin and lutein could save Medicare US$3.6 billion over five years by helping people with AMD avoid the transition to dependence (5).On top of that, a retained vision for extended number of years will certainly improve the quality of life for those helped.

3.4 Uniqueness and competition

Zeaxanthin is one of the emerging stars of the eye health segment. Currently, the majority source of Zeaxanthin-based products on the markets is extracted from a flower called "Marigold". So far, we haven't found any Zeaxanthin-based products that are made from

spinach as the raw material.

The uniqueness of ProZea products is that we are the only company that provides natural Zeaxanthin from one of the most common vegetable sources--spinach.

ProZea foresees four major competitive advantages:

- **Lower production cost. By utilizing our optimization technology to 20-fold increase the Zeaxanthin content in spinach, our products thereby gain from reduced production costs for at least 30% compare to other similar products.**

- **Better raw material. One of the greatest competitive advantages we have is the raw material we are working with. We are the only company who makes use of zeaxanthin from natural spinach. Spinach is one of the common vegetables consumed by humans since a long time. Compare to Marigold, Spinach has a higher nutritional value and is extremely rich in antioxidants. Apart from Zeaxanthin, it is a rich source of lutein, various vitamins and minerals such as iron and zinc.**

- **Novel applications. It enables us to develop much cheaper and affordable new application formats to improve the market prospects, such as dietary supplement tablets/capsules made by dried treated spinach powder. According to our calculation, the production cost for pills made by dried treated spinach powder is at least 2 times cheaper than the normal Zeaxanthin extract based tablets or capsules, but still allows people to reach the daily minimum intake of Zeaxanthin which is 0.5mg/day (0.5mg/pill). We value that such a product will be very competitive on the market, and our aim is to develop more novel applications in different sectors through the growth of the company.**

- **Patent pending technology. Scientific research is the core behind our business. Another important competitive advantage is our patent pending technology – the unique and innovative optimization process.**

4. Team

The Start-up Team

The ProZea start-up team consists of a management team and a principal researcher. Besides that we get substantial supports from our steering committee and external business advisers. The organization structure is shown in Appendix 3.

Management Team

Hina Hauck *(Head of Marketing and Communication)*

***Hina is from the United States and* holds an undergraduate degree in Biochemistry from George Mason University. She has a strong multidisciplinary academic and 10 years of professional background which includes biochemical research and international marketing. She has assumed leadership positions on many professional and academic projects. Currently, she is reading for the master program in entrepreneurship at Lund University. She intends to remain dedicated to the growth of the Prozea project after graduation.**

Jinming Fan *(Head of Business Development and Control)*

Jinming is from China and holds a bachelors degree in International Agri-business and Trade from Van Hall Larenstein University in Wageningen, the Netherlands. He has worked in several Dutch agricultural companies and he is familiar with food and fresh produce markets in Europe. Currently, he is studying in the master program of entrepreneurship at Lund University. Jinming will remain dedicated to the success of the project after graduation.

Janitha Liyanage *(Head of Product Development and Production)*

Janitha is from Sri Lanka and holds a bachelors degree in Food Science and Technology from Sabaragamuwa University of Sri Lanka. He has a strong background in food process engineering, food analysis and food quality/safety. He possesses 4 years of work experience as a lecturer/researcher with a focus on product development and quality management. He is currently reading for the master's in Food Technology and Nutrition at the LTH and a student in the Entrepreneurship program at LU as well. Janitha intends to remain actively involved in the development of the project after graduation.

Research Team

Dr. Hans-Erik Åkerlund *(Principal Researcher)*

Dr. Hans-Erik Åkerlund is a professor in the department of Biochemistry and Structural Biology at Lund University. He has conducted extensive scientific research with Spinach and photosynthetic system in plants for over 30 years. He has also participated in over 80 scientific publications since 1976 to present. His most recent research (2010) output on

post-harvest improvement of zeaxanthin content in vegetables is patent pending.

Steering Committee

Helena Ljusberg ***(Senior Business Developer and Advisor, LUIS)***

Helena is Associate Professor at the department of food technology, Lund University. Her industrial experience comes both from startup companies and multinational enterprises. Helena has extensive experience of product development in both the food and pharmaceutical industry, is an important asset for ProZea.

Tomas Karlsson (*Business Advisor)*

Tomas is an Associate Professor and Director of Entrepreneurship Program at the Lund University. He has coached master students from previous years to successfully launch and manage new ventures. He has extensive networks of many professionals and access to alumni, venture capitalists, and business angels to name a few.

Rolf Bjerndell *(External Advisor)*

Rolf was CEO of Skånemejerier during the period 1994-2005 and has served as a board member or CEO for many prominent companies such as Probi and Oatly. He has an extensive experience in marketing and sales in the food industry. His networks and knowledge will be central to the development of ProZea.

Additional External Advisors

Benedicte Kristoffersson (BK Consulting), Suzanne Richter (Neuhauser & Falck), Stefan Hjelmqwist (Awapatent), and Mats Johnsson (Entreprenörskompetens i Lund AB).

Missing competencies

Research Assistants for R&D: R&D is crucial for our business; we need to hire additional personnel to conduct R&D due to the fact that we have only one researcher who is fully working on the product development at this moment.

Legal counsel: We need legal advices at many different intervals of business development including regulations of related industries, financing and business contracts with institutional and private investors.

Trade mark specialist: Trade mark development is yet another aspect for which the project needs assistance during the startup phase since related activities are linked with patent protection, which would require continuous monitoring to maintain intellectual property rights.

5. Marketing Plan

5.1 Market Analysis

The market for eye health ingredients addressing various eye diseases is in a stage of growth, spurred by increasing life expectancy, modern urban lifestyles and unhealthy diets. The European market for eye health ingredients is primarily dominated by antioxidants. Lutein and beta-carotene were the key eye health ingredients in use in the market in 2007. Additionally, there are a variety of emerging ingredients such as Zeaxanthin. Indeed, Zeaxanthin, being an emerging star of the eye health segment, has only been introduced on the market as an ingredient since 2001. According to Frost & Sullivan report 2008, there are less than 30 Zeaxanthin products in the European market today, and none of Zeaxanthin-based product has been found in Swedish market. Currently, the market for Zeaxanthin is in a product development and differentiation phase as 95% of its applications are limited to dietary supplements. The market is thus aiming at premium application segments of the functional food and beverage market. In 2007, the eye health Zeaxanthin market in Europe was worth US$2.3 million, with a volume of 2.7 tons, and was expected to reach US$3.8 million revenue with a volume of 4.9 tons by 2014 (8).

The eye health Zeaxanthin market has the potential to grow strongly drive by a number of factors, such as the increasing demand for natural ingredients, increased application profiles, ageing population in Europe, rising healthcare costs and improvements in technology for methods of ingredient extraction. The United Kingdom is emerging as a key European market for Zeaxanthin products accounted for 32% of the European eye health Zeaxanthin market. France is another significant market for zeaxanthin with 26% of the the total market share. The rest-of-Europe is still an emerging market for zeaxanthin and accounts for 42%t of the European eye health zeaxanthin market.

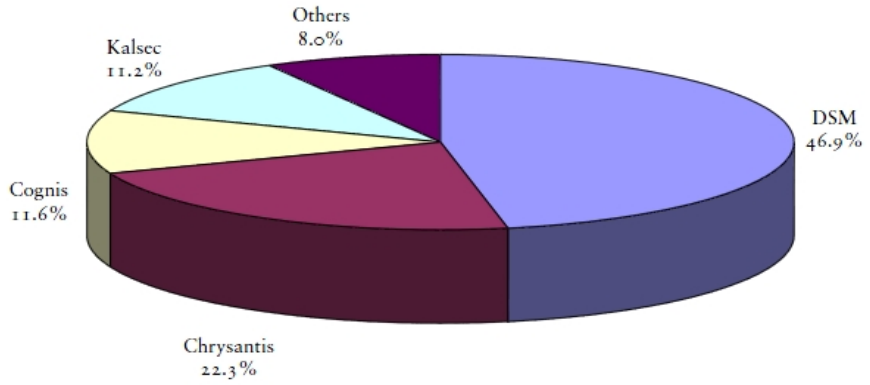
5.2 Competition

Major Market Players

According to Frost & Sullivan report 2008, in 2007, there were 5-10 companies active in the European eye health Zeaxanthin market. The market, however, is dominated by DSM, Chrysantis, Cognis and Kalsec. DSM is currently the only major supplier of synthesized Zeaxanthin that is supplied to the food and pharmaceutical industries under the brand Optisharp. In 2007, the market share of DSM is 46.9%. Chrysantis is a Florida-based supplier of natural Zeaxanthin from Marigold. With the launch of its consumer website and its branded products, the company became a major participant in the market with market

share of 22.3%. Cognis produces Zeaxanthin as part of the Xangold® product line through an alliance with Anixa, a producer of Zeaxanthin esters from marigold. The company accounted for 11.6% of the European eye health Zeaxanthin market. Kalsec is emerging as a major zeaxanthin supplier from its paprika extracts. The company's zeaxanthin is supplied under the brand Zeagold. Kalsec® Inc is a privately held producer and marketer of natural extracts for use in food, beverage and pharmaceutical applications. In 2007, Kalsec accounted for 11.2 per cent of the European eye health zeaxanthin market.

Eye Health Zeaxanthin Market: Market Share of Major Market Participants (Europe), 2007



Note: Others include Piveg, aquapharm and ZMC

Note: All figures are rounded; the base year is 2007. Source: Frost & Sullivan

Figure 4

Competitive Factors

In 2007, the competitive factors in this market included brand strength, customer service, quality, delivery and price. Branding is considered as a key source of competitive advantage, with manufacturers offering extensive co-marketing support, such as formulation data and advice. Branding creates market and mind share which are the key requirements for Zeaxanthin at present. Focused branding on eye health is a major strategy for Zeaxanthin. Technical and formulation support are also important as they enable customers to take advantage of labeling and health claims while developing their products.

There were two tiers of competition in this market.

- **Tier One: Large manufacturers of Zeaxanthin such as DSM, Kalsec, Cognis and Chrysantis through licensing contracts with Zeavision as a formulator.**

- **Tier Two: Medium-sized manufacturers such as PIVEG and Aquapharm, just emerging and looking at alternative Zeaxanthin sources.**

5.2 Marketing Approach

ProZea has four possible approaches to enter eye health Zeaxanthin market including frozen product (licensing), dietary supplement, natural ingredient, and nutraceutical (functional food and beverage). We have conducted a feasibility and desirability study to assessing above four potential sectors based on six criteria: profit potential, technology adaptability, contacts, feasibility, market trends, and desirability in terms of the best fit, medium fit, and low fit.

Table1: Market Feasibility & Desirability of ProZea Applications

	Profit potential	Technology adaptability	Contacts	Feasibility	Market trends	Desirability
Frozen Products (licensing)	⊕	◎	⊕	◎	◎	◎
Dietary supplement	◎	◎	◎	◎	◎	◎
Natural ingredient	⊕	⊕	⊗	⊕	◎	⊕
Nutraceuticals	◎	⊕	◎	⊗	◎	◎

LEGEND: ◎ BEST FIT ⊕ MEDIUM FIT ⊗ LOW FIT

Option 1: Frozen Products (Licensing)

One of our options is selling licenses to frozen products manufacturers. Essentially, they are able to increase the competitive advantage by adding a new product category of enhanced frozen products. According to CBI market survey 2009, apparent consumption of frozen fruit and vegetables (largely industrial demand) in the EU in 2008 was €6.5 billion with a volume of 5.6 million tons. Around 75% of the consumption consists of frozen vegetables and 25% of frozen fruit. Italy, Germany and UK are leading consumption markets in EU. The rising of health conscious to food products and increasing demand of value-added convenience foods makes our technology promising to frozen food manufacturers. Our target customers will be the well-known brands that produce and market frozen food, especially frozen vegetables in the EU market, such as Findus. It is the most direct way to

commercializing our technology, so it has the best fit regarding technology adaptability and feasibility. The revenue stream will come from licensing fees. In general, we have high a desire to sell license outside our core-business, and regard it as our backup option.

Option 2: Dietary Supplement

Our second option is to produce and market nutritional dietary supplement. Dietary supplements are the major applications for eye health ingredients. The overall European dietary supplement market is growing at a rate of 4.0 to 5.0 per cent in revenue with volume growth rates of less than 5.0 per cent (Frost & Sullivan report 2008). Germany, Italy, The UK, and France dominate the segment and account for 67 per cent of the total consumption in Europe (Frost & Sullivan, 2008). We have noticed that Asia-Pacific is showing a double digit growth rate. China is one of the major players in terms of production and consumption of dietary supplements; Japan and South Korea are the leading consumption countries of dietary supplements. The dietary supplement represents a highly profitable segment and has been driven primarily by growing elderly population and the wellness trend. Consumers seek an alternative or complement to pharmaceutical drugs and modern healthcare. The increase in demand for `natural′ supplement is also strongly related to the rise of the green consumption movement. We assess that dietary supplement sector has the best fit with our technology, and it is the most feasible product that we are able to produce at this moment since we have developed product prototype as dried spinach powder tablets and Zeaxanthin extract based capsules. We have good contacts with plant extraction companies, pharmaceutical companies and few local opticians (read more in part 5). On top of that, we have a high desirability to enter into this market.

Option 3: Natural Ingredient

Our third option is selling Zeaxanthin as natural eye health ingredient for nutraceuticals and for the food industry. The product can be sold either as raw herb (dried spinach leaf or powder), or extract. Global demand for herbal medicines has increased dramatically during the last ten years. There certainly is a market for natural ingredients for botanicals in Europe. According to Nutrition Business Journal, the major market is Europe, accounting for some 38 percent of the world market. The leading European market is Germany, accounting for over 42 percent of the European market, followed by France 25%, Italy 9% and the UK 8% (CBI and SIPPO, 2005). Despite an increased prosperity within the EU, the food market in the EU is highly competitive, since consumers are not going to eat more, but will only, at the very most, switch to other products. Furthermore, European consumers increasingly set higher demands regarding convenience, ethnic, safe, health and organic food. Therefore, it can be expected that the market for natural ingredients for industrial use will continue to

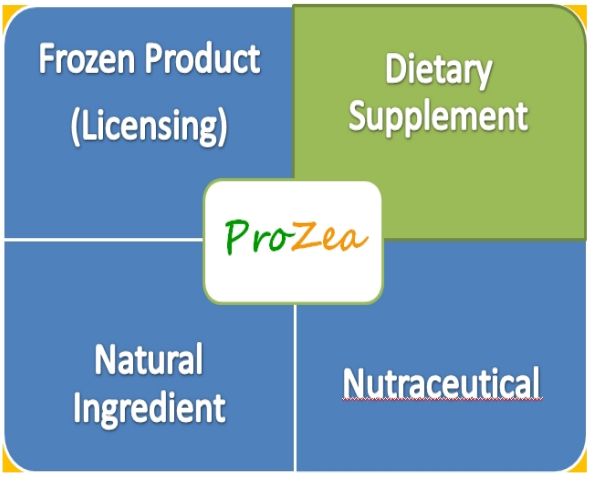
increase, particularly for the use in these kinds of food products. The profit potential for entering as selling natural ingredient is medium, as the trade for ingredients is a business-to-business trade. We assess that the adaptability and value of our technology is medium, however, we have very limited contacts within the industry although production is rather feasible. Since it seems to be difficult to compete successfully in the marketplace by providing one single product, our desirability of entering this market is low.

Option 4: Nutraceuticals (Functional Food & Beverage)

Due to the fact that Zeaxanthin and Zeaxanthin-rich extract are intended for use as colors and as nutrient supplements in foods. To produce and market nutraceutical products, including functional food & beverage is our fourth option. The idea is to develop novel products such as baked goods and baking mixes, beverages and beverage bases, breakfast cereals, chewing gum, noodles, tea, dairy product analogues, salad dressing, and soups and soup mixes. We look forward to go into alliances with existing nutraceutical or food manufacturers to co-create, produce, and market these novel products. The profit potential and market trends are pretty much the same as dietary supplement. However, technical innovation, necessitating a high level of spending on R&D, is seen as critical to compete successfully in the marketplace. Companies need to be highly innovative, formulate and bring new products to the market quickly, while focusing on customers′ applications and processes, investing in manufacturing capability, culinary resources, technical advances and sensory services to meet the demands of the market. Thus, we assess that the feasibility of entering nutraceuticals sector at the start-up phase is rather low, but we do value the market as promising and we are highly anticipating entering this market in a later stage.

5.3 Marketing Strategy

Combining our initial market research with feasibility and desirability analysis of each option, our focus for the first stage—the start-up phase will be the dietary supplement sector. We are expecting to step into and focusing on nutraceutical sector for the third stage – the expansion phase. Besides that, we will actively seek opportunity to sell Licenses to frozen product manufacturers that will not influence our core-business.



I. The start-up phase

During the start-up phase, we intend to enter the dietary supplement market with specific focus on the Swedish market. Based on the functions and benefits of Zeaxanthin, the target consumers are the following groups of people:

- **People over the age of 50, running the risk of AMD**
- **Heavy smokers and drinkers**
- **Frequent computer users, drivers, outdoor workers, hunters, and outdoor sportsmen**

The target customers are: local opticians, local health food stores, and sports stores.

The marketing strategies for this phase are:

- **Focus on offering products that are competitive in terms of price, stability, bioavailability and feasibility in the manufacturing process of supplements**
- **Focus on branding, register a trade mark for our products**
- **We have not found any Zeaxanthin-based supplement so far in the Swedish market, which means that we will give full play to "first-mover" advantages.**
- **Developing clear and comprehensive labels and packages according to different target group and segmentation**
- **Establishing sales infrastructure and distribution channels, with main focus on local opticians, health food stores and sports stores.**
- **Marketing activities at low costs, such as pay attention to build tight relationships with optometrists and opticians, keep updated about the latest progress of relevant researches, publications in newspapers and magazines, social media, and workshops to local elderly union/nursing homes.**
- **Educating and communicating the benefits of incorporating Zeaxanthin and its impact on the web portal.**

II. The growth phase

During the growth phase, we intend to remain with our focus on the dietary supplement market if everything goes well in the first phase. The mission for this phase is to further refine the products, scale up the production volumes and expand our market to Denmark and Norway. When we are ready for the second generation products (refined) and have larger production scale, we are going to expand the distribution channels to bigger pharmaceutical and health food store chains, and possibly to supermarket chains. We will launch our own web shop as well.

The marketing strategy for this phase will be:

- **Building strong brands with clear eye health concepts**
- **Further developing distribution channels within Sweden**
- **Market expansion, primarily Scandinavian countries (Denmark and Norway)**
- **Continuous marketing activities, more towards to final consumers**
- **Focusing on new product development, at least have 2-3 varieties**
- **Arranging for consistent raw material supply by joint ventures or backward integration**

III. The expansion phase

During the expansion phase, we intend to go expansion in two ways: market expansion and product expansion. On the one hand, we will enhance and keep looking for new potential markets for our supplement products. On the other hand, we would like to create alliances with existing food and beverage manufacturers to co-create, produce and market novel nutraceutical products.

The marketing strategy for this phase will be:

- **Further market expansion for dietary supplement within EU, and possibly outside EU**
- **Further enhance the brands with clear eye health concepts**
- **Developing new and easy-to-use ingredient formulations, in addition to technical support in terms of formulation and marketing of products containing eye health ingredients**
- **Go into alliance with EU food and beverage manufacturers, and focus on new products and markets**

5.4 Exit strategy

The product portfolio and business model for ProZea has the potential to become a very interesting acquisition for a major supplier of nutraceutical industry. Eventually, direct sale or merger will be an ideal exit strategy for ProZea and the VC-shareholders.

6. Business System & Organization

6.1 Business System

ProZea will focus first on the proof-of-concept in collaboration with a plant extraction company and Lund University, using a small group of experts in the fields of biochemistry, pharmaceutical technology, and plant extraction technology. Once the proof-of-concept is demonstrated and product prototypes fit the requirements, ProZea will quickly look at scaling up the production volume from lab scale to industrial scale. Relevant networks from our steering committee and business advisors will be leveraged to establish our market as fast as we can. Strategic partnerships are envisaged with supplier of raw material (spinach), a plant extraction company and pharmaceutical technology companies, who will be keen to team up with ProZea as this breakthrough technology will establish new markets for them as well. On the production side, the small production runs can be outsourced to e.g. the plant extraction company "Swepharm". Full-scale production will be outsourced to companies who have major tablets/capsules production facilities, e.g. Galenica.

Our initial step is to sell own branded dietary supplement through opticians, health food retail chains, sports stores and web shop. Aside from that we will actively seek opportunity to sell licenses to sectors outside our core-business (e.g. frozen products). For start-up phase, ProZea will generate two forms of revenue:

- **Sales of ProZea dietary supplement products**
- **Licenses to sectors outside our core-business**

Table 2: ProZea's business system

Research & Development	Production	Marketing & Sales	Distribution	Service
In-house	Outsourced, once scale is reached	In-house Optometrist	In partner-ships with suppliers of equipment	In-house

6.2 Customers and Strategic Partners

A number of partners are now signed on or are subject to negotiations. They will be paramount for the proof-of-concept phase:

- **Lund University**
- **Swepharm**
- **Lund Innovation**
- **We are currently running the project at IDEON Incubator**

We have initiated many contacts with potential partners and customers as well, the possibility of future collaborations include:

- **Galenica (pharmaceutical technology company with GMP facility)**
- **DocMorris Apotek Lund**
- **Specsavers Lund(Optician)**
- **Smart Eye (Optician)**
- **Halsokost (Health food store)**
- **Snabboteket (Non-prescription drugs and pharmacy retailer)**

6.3 Investor relationships

We are excited about the fact that ProZea has caught the attention of a few private investors in the past few months. The investors listed below showed a strong interest in our business, further discussions are expected in the near future:

- **Peer Kølendorf, CEO & Owner of Comitel**
- **Unni Trolle, Trollenas Gods AB**
- **Pernilla Gustlin, Rosengård Invest AB**
- **Elisabeth Duivens, Duivens**
- **Claes Kinell, Muirfield Invest**

6.4 Honors & Awards

In February 2011, ProZea won both the First Prize and the Audience Choice Award during Dragons′ at University 2011.

7. Implementation Plan

This plan will be executed in three phases (I) start-up, (II) growth, and (III) expansion.

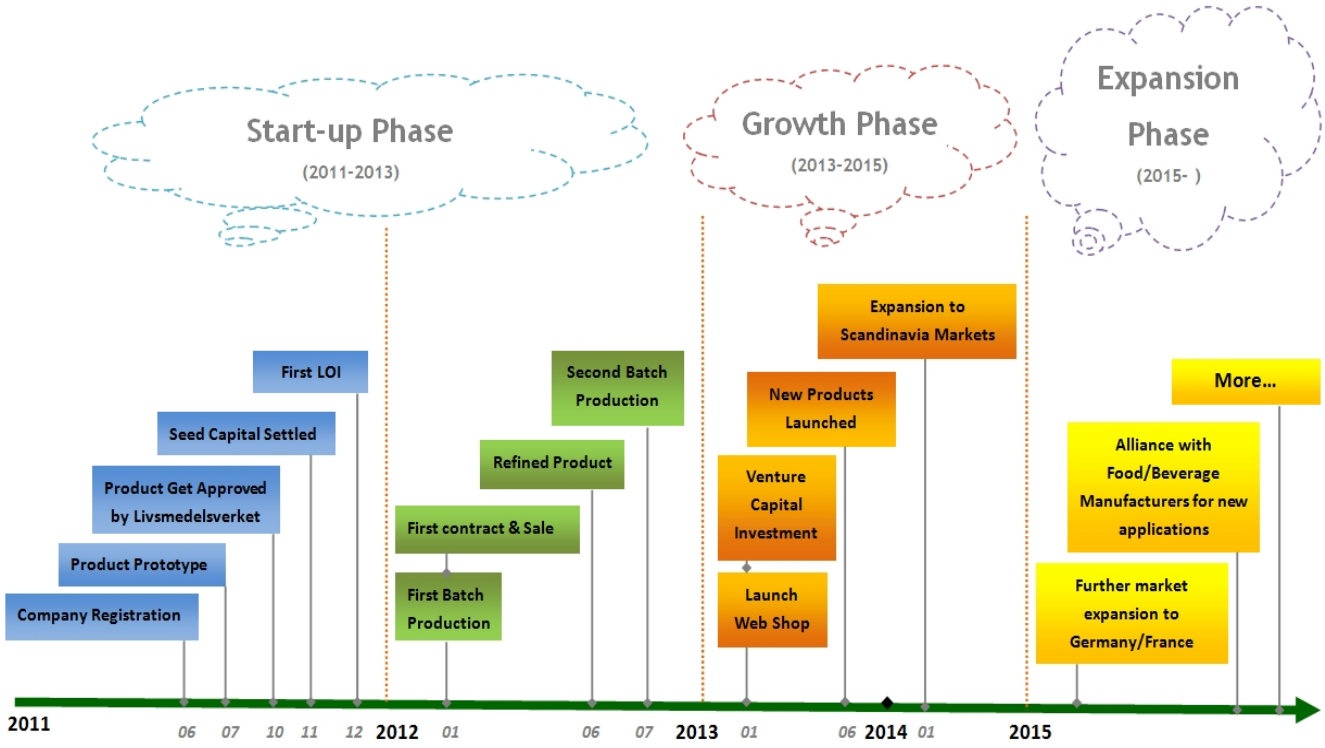


Figure 5: ProZea's critical points line

I. The Start-up Phase

During the start-up phase, our operation will be based in Lund. The company is expected to be registered no later than June 2011. Procurement of seed capital, Proof-of-concept (POC), product prototype development, and establish customer relationships and get customers Letter of Intent (LOI) are the main focuses for 2011. POC and product prototype development will be operating at Lund University leading by Prof. Dr. Hans-Erik and Prof. Marie Wahlgren, with cooperation with Swepharm. Once proof-of-concept has been shown promising, we expect to send product to Livsmedelsverket and get approval as soon as possible. Regarding seed capital, we prefer to acquire seed capital from non-diluted funds, grants and soft loans for this phase. Investment from business angels will be the backup option. We will apply for grants from Innovationbron and Vinnova, and soft loans from ALMI. Sales infrastructures and local distribution channels are expected to be established. Opticians in Lund and Malmo will be our initial focus for the test selling. If everything goes well, we expect to start our first batch production with collaboration with Galenica and test selling in early 2012. Refined products are expected to be launched in the beginning of third quarter of 2012 after the test selling of first batch products.

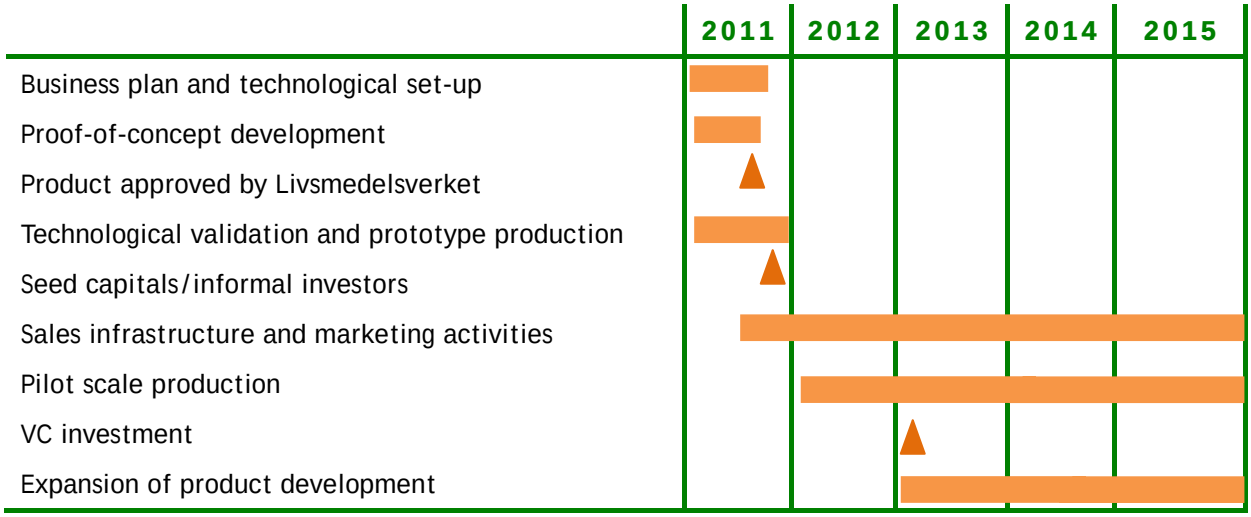
II. The Growth Phase

If all goes well with phase I, our main focus for the growth phase will be expansion of products in volumes and varieties, further establishment of sales infrastructures and distribution channels within Sweden, and expansion of markets to Scandinavian countries. We expect to have 2-3 kinds of products by the end of 2013 through our continuous R&D. In order to scaling up the production volumes, further investments are needed. At this phase, we will focus on venture capital investments from either venture capitalists or organizations. Further establishment of sales infrastructure and distribution channels will be realized by launching web shop and collaboration with bigger health food stores and sports stores. Once our production volume allows us for the further expansion, establishment of customer relationships and distribution channels within Scandinavian countries will be keys to enter into the markets. In addition, build up strategic relationship with our raw material suppliers is crucial for this stage.

III. The Expansion Phase

During the expansion phase, we plan to expand our products into Germany and France. Apart from maintain the healthy growth with our dietary supplement sector. We expect to go into alliance with food & beverage companies to develop novel Zeaxanthin-based products, and expect to expand our business into nutraceutical sector.

Planning and Milestones



8. Financial Plan

Summary of Financials

Detailed financial data relevant to ProZea are presented Appendix 1, includes:

- **Key financial assumptions**
- **Profit and loss statement**
- **Cash flow statement**

Profitability

Once ProZea's proof-of-concept is achieved at the laboratory and pilot plant level, the industrial scale production of ProZea products will commence. As per the current arrangements, ProZea will be able to launch the first product in the form of dietary supplements in the first quarter of 2012. The production costs will be retained at a minimum with process optimization which will enable ProZea to generate a percentage profit margin of 250% approximately. Sales of ProZea products can generate a high profit margin for retail customers (estimated to be around 150% -200%), which is a motivation for them to sell our products.

Table 3: Key financials for ProZea (million SEK)

	2011	2012	2013	2014	2015
Total operating revenues	-	0.85	1.43	2.00	3.70
Total operating expenses	0.78	1.82	2.37	2.51	3.20
Net Profit (after tax)	-0.74	-0.97	-0.93	-0.51	0.50

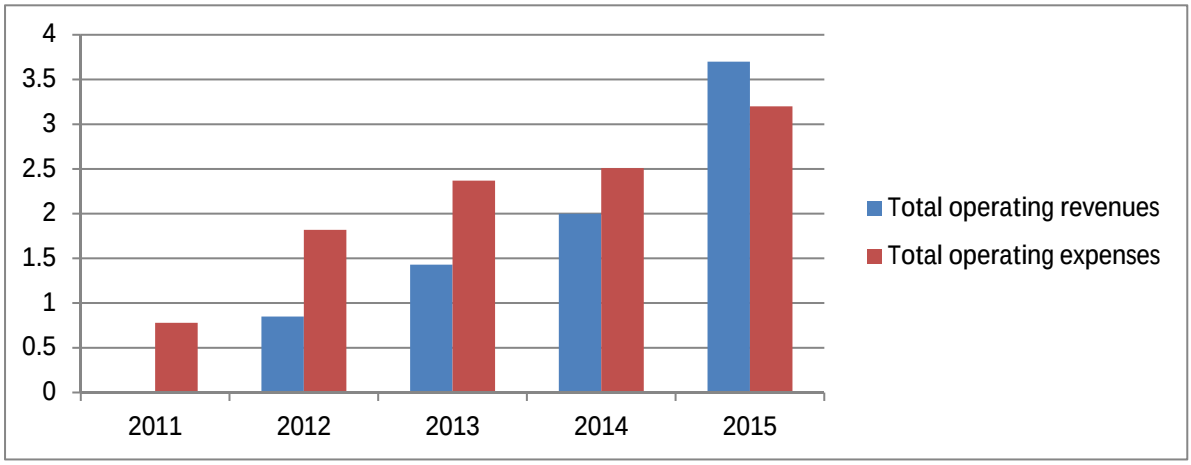
With a total operating revenue of 3.7 million SEK, the fifth year will be the where a net income before tax will be obtained (Table 3). The profitability for the following years will be at a high rate due to the refinement of existing products and the introduction of new products such as nutraceutical beverages to the market. Geographical expansion of the market to Scandinavian and other European countries will also contribute to increased sales. It is also envisaged that the operating expenses per unit sold will be decreased as a result of the decreased production costs for bulk quantities achieved through continuous product research and process optimization.

Revenue Assumptions

The product will be initially available in two pack sizes i.e. 60 capsules and 30 capsules and will be priced 250 SEK and 130 SEK respectively. The ultimate consumer price of the capsules will then approximately be 4 SEK (with 25% tax). As a basis for the revenue

forecast, the growth estimates given above will be realized with an initial sales volume of 180,000 capsules/tablets in the first quarter of 2012. The expected profit margin is 0.7 SEK per capsule/tablet. A growth rate of 20% in sales is expected during the second half of 2012 and it will be 50% and 100% in the next two years. The number of units sold will be gradually increased by approaching a wide array of clients such as health supplement stores, pharmaceutical stores and opticians/optometrists. In addition, the sales are expected to increase with the launch of the web shop in the beginning of year 2013. On the longer term, we expect to sell a combination of products. ProZea will also consider the possibility of licensing the technology to for food processors for the production of Zeaxanthin enriched products from spinach and this will be one of the revenue generation schemes. Potential clients such as Findus AB, who have been identified already, will be approached for this.

Figure 6: Key financials for ProZea (million SEK)



Most Significant Cost Factors

The highest cost factors for ProZea will be personnel expenses (salaries and wages) and R&D costs. However, production costs will be relatively low compared to the other costs. Appointing one of the management team members as a product development assistant for aiding R & D will be one strategy to cut down R&D and salary costs. One of the management team could be appointed as CEO to apply a limitation on salary levels during the growth and expansion phases. Marketing personnel will be outsourced during the first two years and company's own marketing staff will be recruited in the third year. Other operating costs include expenses for office space and general & administrative costs, including travel expenses for management and marketing personnel.

Utilization of Subsidy Schemes

ProZea will address the high cost factor associated with a food/biotech based start-up by using some subsidy schemes. Financial bootstrapping and other financial incentive schemes will be adopted. Co-operations with entities such as Ideon Business incubator and Venture Lab will be sought. Access to free incubator facilities provided at the Medeon Science Park could be utilized during the second half of the first year and subsidized rate of office space thereafter.

Investment Requirements & Financing Sources

The seed capital required for ProZea is 0.8 million SEK during the early start up phase (2011-2012). This will cover the expenses related to prototype development and research in the first year. The prospective sources will be non-diluting fund/grant schemes/soft loans available with VINNOVA, Innovationsbron, ALMI, etc. For the later start-up phase (2012-2013) and growth phase (2013-2015), equity investment and venture capital will be sought from private investors and the amount required will be approximately 1.5 million SEK.

Worst Case Scenarios

A worst case scenario will be encountered from a failure in the proof-of-concept process which will result in a product lacking competitive features and efficacy. This will delay the marketing and obstruct the openings for capital investment for more research and development. Another scenario will result due to a delay in sales income and when license agreements are not reached as envisaged. This may delay the break-even point further up to one year and more venture capital investment will be required.

9. Risks

There are a number of factors that could influence the success of ProZea. The most important risks are summarized with the measures we will take to minimize them.

Technical Risks

The proof-of-concept requires outsourcing and the prospective collaborator for tablet/pill production in the start-up phase might not be able to run the whole production process at their premises. Thus, technological outsourcing will be required in different stages during production. The postharvest treatment of spinach and extraction will have an influence on the final product quality in a consumer safety perspective. The treatment and extraction process needs optimization to avoid any consequences. All the additives used for the processes will have to be Generally Recognized as Safe (GRAS) and the operations need to be performed under Good Manufacturing Practices (GMP) to avoid any risks. If dried spinach is used to produce powder it might be necessary to wash the spinach more extensively before drying. This will remove the residuals of additives. Degradation of product due to exposure to extreme conditions (heat, light) must be addressed through optimized packaging and distribution chain.

Organizational/Staff Risks

A co-ordination and decision implementation between research, management, sales and marketing teams of ProZea will be required through the appointment of a board of directors and a CEO for the company. Conflicting situations may arise with regard to company structuring. Shareholder agreements and equity distribution will need to be formulated prior to this to avoid any such risks.

Market Risks

Zeaxanthin is a comparatively new ingredient. As a result, awareness has been relatively low on its benefits. Another reason is that, unlike lutein, zeaxanthin, according to consumers, is a hard name to remember. In addition, the low awareness of AMD in the EU could pose a risk. This will be addressed through exclusive awareness campaigns including the zeaxanthin web information portal.

Patent Risks

There is a risk of failure in the granting of patent and there could be a time limitation on it. This will enforce a limitation on patent protection and consultancy is required to mitigate any risks.

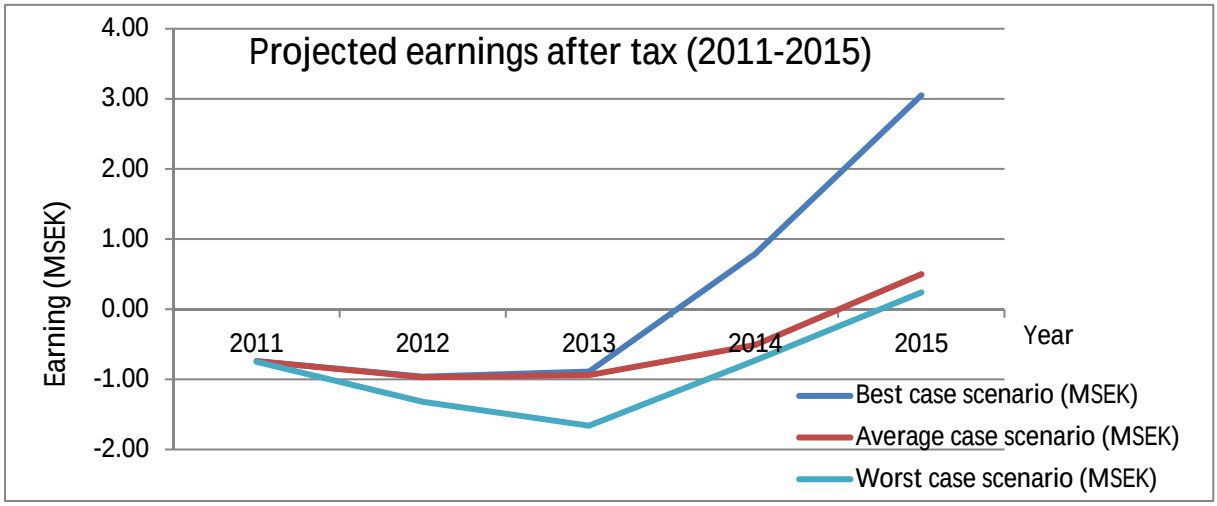
Regulatory Risks

Dietary supplement have medicinal properties, therefore claims regarding the beneficial effects of dietary supplement can only be "health claims" and not "medicinal claims." The critical areas of food regulation to be considered in relation to dietary supplement are those of labeling and advertising to avoid any product recalls from the market. This will be done according to the EU Directive 2002/46/EC which is related to food supplements containing vitamins and minerals.

Economic Scenarios

The worst case scenario will be encountered if the licensing is not successful until the fourth year (2014) and growths rates lower than expected are achieved. The cash flow will remain negative until 2015 and more investment will be required. The best case scenario will be achieved with a high growth rate in sales at the start-up phase (50%) and in this case the break-even will be reached in the fourth year (2014). These are summarized in Figure below.

Figure 7: Economic Scenarios for ProZea



	2011	2012	2013	2014	2015
Best case scenario (MSEK)	-0.74	-0.96	-0.89	0.79	3.05
Average case scenario (MSEK)	-0.74	-0.97	-0.94	-0.51	0.5
Worst case scenario (MSEK)	-0.75	-1.32	-1.66	-0.73	0.24

In conclusion, ProZea will operate on a substantially profitable business model with a potential to become a leading player in the Zeaxanthin-based eye health products market in Sweden as well as in Europe. Based on the value addition to a common food source and offers of products with superior qualities at extremely competitive prices which simultaneously generate a high profit margin for our customers, ProZea has a tremendous potential to be developed into a sustainable business.

References

1. **VISION 2020 Global Initiative for the Elimination of Avoidable Blindness: action plan 2006-2011, World Health Organization 2007 The Food & Beverage Industry in Germany 2010/2011, Germany Trade & Invest**

2. **AgingEye Times (2009-05-19). "Macular Degeneration types and risk factors". Agingeye.net. http://www.agingeye.net/maculardegen/maculardegeninformation.php. Retrieved 2011-01-11.**

3. **Tan JS, Wang JJ, Flood V, Rochtchina E, Smith W, Mitchell P. (February 2008). "Dietary antioxidants and the long-term incidence of age-related macular degeneration: the Blue Mountain Eye Study". Ophthalmology. 115 (2): 334–41**

4. **Clinical effectiveness and cost-utility of photodynamic therapy for wet age-related macular degeneration: a systematic review and economic evaluation, Health Technology Assessment 2003; Vol. 7: No.**

5. **COST IM ANALYS PACTIS FOR THE "HEALTH CARE FOR AMERICA" PROPOSAL, February 15, 2008, The Lewin Group, Inc.**

6. **Natural Ingredients for Pharmaceuticals and for the Food Industry: Overview and market access information for producers and international trading companies, CBI & SIPPO, 2005.**

7. **CBI MARKET SURVEY: THE EU MARKET FOR FROZEN FRUIT AND VEGETABLES, Publication date: October 2009**

8. **European Eye Health Ingredients Market, M2E4-88, 2008, Frost & Sullivan**

9. **NUTRACEUTIALS--GLOBAL DEVELOPMENTS IN DIETARY SUPPLEMENTS, D18F, 2009 Frost & Sullivan**

Appendixes

Appendix 1

Detailed Financials

Table 1: Financial Assumptions

ProZea Financial Assumptions (values given in thousand SEK)

	Year 1 2011				Year 2 2012				Year 1	Year 2	Year 3	Year 4	Year 5
Expenses	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	2011	2012	2013	2014	2015
Salaries and wages													
Managemet Team*			180	180	189	189	189	189	360	756	794	833	875
Consultancy (auditing,accountancy,etc)					20	20	20	20	0	80	80	80	80
Market & Sales							54	54	0	108	250	300	350
Total			180	180	209	209	263	263	360	944	1,124	1,213	1,305
Research and Develeopmnet													
Production costs			0	0	36	36	43	43	0	158	324	486	972
Prototype development and research **			210	40	100	100	150	150	250	500	500	250	100
Other external costs (IP,etc.)	0	0	0	0	10	10	10	10	0	40	50	50	50
Total	0	0	210	40	146	146	203	203	250	698	874	786	1,122
Other operating expenses													
Web development and hosting			55		10				55	10	35	10	10
Office space rental & infrastrcture facilities			0	0	8	8	8	8	0	32	32	105	96
Marketing/promotion			25	25	25	25	25	25	50	100	170	255	510
General and administrative***			55	5	10	10	10	10	60	40	50	50	60
Total	0	0	135	30	53	43	43	43	165	182	287	420	676

*Three Management team memebers, one member appointed as CEO, one member appointed as product development assistant; Annual slary increase: 5%
** Including consumables
*** Including travel expenses, company registration

Revenues													
Sales	0	0	0	0	126	126	151	151	0	554	1,134	1,701	3,402
Selling License & other	15	5	5	5	75	75	75	75	30	300	300	300	300
Total			5	5	201	201	226	226	30	854	1,434	2,001	3,702

Table 2: Profit & Loss Statement

ProZea Profit and Loss Statement (values given in thousnad SEK)

	Year 1 2011				Year 2 2012				Year 1	Year 2	Year 3	Year 4	Year 5
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	2011	2012	2013	2014	2015
Revenues													
Sales	0	0	0	0	126	126	151	151	0	554	1,134	1,701	3,402
Licensing and other	15	5	5	5	75	75	75	75	30	300	300	300	300
Total Operating revenues	15	5	5	5	201	201	226	226	30	854	1,434	2,001	3,702
Expenses													
Raw materials and consumables			210	40	56	56	63	63	250	658	824	736	1,072
Other external costs					10	10	10	10	0	40	50	50	50
Staff costs			180	180	209	209	263	263	360	944	1,208	1,297	1,389
Depreciation									0	0	0	10	10
Other operating expenses			135	30	53	43	43	43	165	182	287	420	676
Total Operating Expenses	0	0	525	250	328	318	379	379	775	1,824	2,369	2,513	3,197
Operating profit	**15**	**5**	**-520**	**-245**	**-127**	**-117**	**-153**	**-153**	**-745**	**-970**	**-935**	**-512**	**505**
Income after financial posts	**15**	**5**	**-520**	**-245**	**-127**	**-117**	**-153**	**-153**	**-745**	**-970**	**-935**	**-512**	**505**
Profit before tax	**15**	**5**	**-520**	**-245**	**-127**	**-117**	**-153**	**-153**	**-745**	**-970**	**-935**	**-512**	**505**
Income tax	4	1	0	0	0	0	0	0	0	0	0	0	0
Net Profit	**11**	**4**	**-520**	**-245**	**-127**	**-117**	**-153**	**-153**	**-745**	**-970**	**-935**	**-512**	**505**

Table 3: Cash Flow Analysis

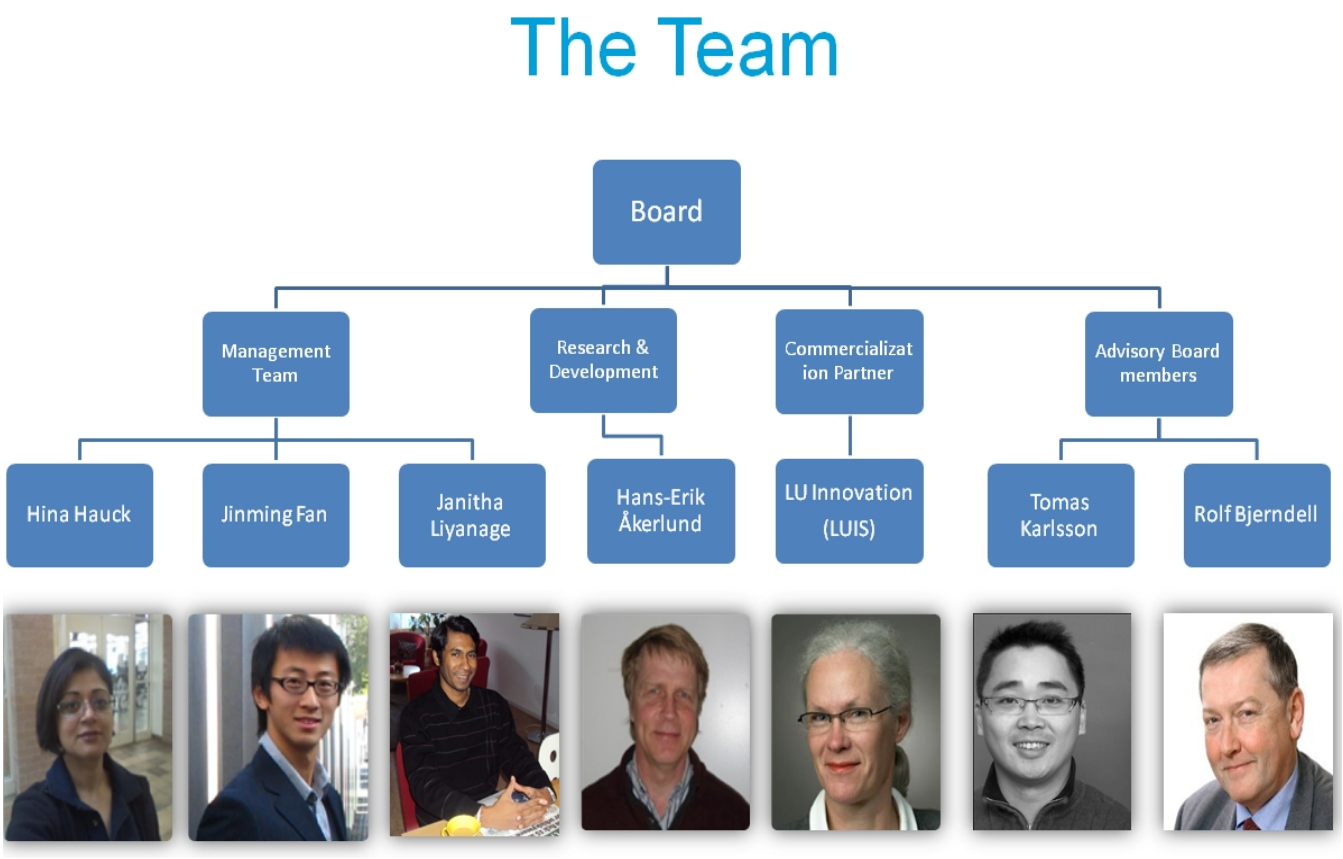
ProZea Cash Flow Statement (values given in thousand SEK)

	Year 1 2011 Q 1	Q 2	Q 3	Q 4	Year 2 2012 Q 1	Q 2	Q 3	Q 4	Year 1 2011	Year 2 2012	Year 3 2013	Year 4 2014	Year 5 2015
Cash Flow													
Operating profit	15	5	-520	-245	-127	-117	-153	-153	-745	-970	-935	-512	505
Depreciation	0	0	0	0	0	0	0	0	0	0	0	10	10
Stock appreciation	0	0	0	0	0	0	0	0	0	0	0	0	0
Increase in trade payables	0	0	0	0	0	0	0	0	0	0	0	0	0
Increase in receivables	0	0	0	0	0	0	0	0	0	0	0	0	0
investment/divestment real estate and machinery	0	0	0	0	0	0	0	0	0	0	0	-10	-10
Operating cash flow	**15**	**5**	**-520**	**-245**	**-127**	**-117**	**-153**	**-153**	**-745**	**-970**	**-935**	**-512**	**505**
Interest Income	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest expenses	0	0	0	0	0	0	0	0	0	0	0	0	0
Income tax	-4	-1	0	0	0	0	0	0	0	0	0	0	0
Net Cash Flow	**11**	**4**	**-520**	**-245**	**-127**	**-117**	**-153**	**-153**	**-745**	**-970**	**-935**	**-512**	**505**

Table 4: Sales volume forecast

Year		Sales volume (capsules/pills)
2012	Q1	180,000
	Q2	180,000
	Q3 (20% increase)	216,000
	Q4	216,000
	Total	792,000
2013	Q1 (50 % increase)	324,000
	Q2	324,000
	Q3 (50% increase)	486,000
	Q4	486,000
	Total	1,620,000
2014 (50 % increase)		2,430,000
2015 (100 % increase)		4,860,000
2016 (100 % increase)		9,720,000

Appendix 3: Organization Structure



Appendix 4: Main Studies about the Effects of Zeaxanthin on Eye Health

1. **Zeaxanthin & Age-Related Macular Degeneration: Risk of age-related macular degeneration (AMD) was significantly higher in people with low concentrations of Zeaxanthin in their blood. Lutein and Zeaxanthin Status and Risk of Age-Related Macular Degeneration Investigative Ophthalmology & Visual Science, June 2003, Vol. 44, No. 6**
2. **Zeaxanthin & Visual Performance under Bright Light:**
   Supplementation with 2 mg of zeaxanthin and 10 mg of lutein resulted in an increase in the Macular Pigment that was then directly related to improvements in glare disability and photo stress recovery times. Supplemented subjects could tolerate 58% more intense glaring light before losing their ability to detect a central target. They also had, on average, 14% faster recovery to photo stress. Macular Pigment and Visual Performance Under Glare Conditions. Optom Vis Sci 2008; 85:82–88
3. **Intake of Lutein and Zeaxanthin Differ with Age, Sex and Ethnicity**
   Among all age groups, both sexes and all ethnicities, lutein intake was greater than zeaxanthin intake. Relative intake of zeaxanthin to lutein decreased with age, with zeaxanthin to lutein ratios lower in females. Further, lower zeaxanthin to lutein ratios were seen in groups at greater risk for AMD—older participants and women. Of note, zeaxanthin to lutein ratios were significantly greater in Mexican Americans compared to all other ethnicities, including other Hispanics. The researchers concluded the relative intake of these carotenoids may be an important factor in AMD risk. Journal of American Dietetic Association. Volume 110, Issue 9, Pages 1357-1362 (September 2010)
4. **Zeaxanthin & Cognitive Function:**
   It is well recognized that an increase in brain oxidative stress is one of the leading causes of cognitive impairment. High Zeaxanthin concentration in the blood was found to be highly correlated with better performance in a series of cognitive tests (the Digit Symbol Substitution, the Finger Taping Test, the Word Fluency Test and the Trail Making Test Part A). Plasma Carotenoid Levels and Cognitive Performance in an Elderly Population: Results of the EVA Study. Journal of Gerontology. 2007, Vol 62A, No.3, 308-316
5. **Zeaxanthin, AMD & Cataracts:**
   A study involving over 2,500 participants found that people with high levels of zeaxanthin in their blood have 93% less risk of AMD and 75% less risk of developing a nuclear cataract. Plasma Lutein, Zeaxanthin, and Other Carotenoids as Modifiable

Risk Factors for Age-Related Maculopathy and Cataract: The POLA Study. Invest Ophthalmol VisSci. 2006; 47:2329–2335.

6. **Zeaxanthin & Blue Light:**
   Supplementation with zeaxanthin significantly increased macular pigment in the retina and reduced the damaging effects of blue light to the retina. The effects of supplementation with lutein and/or zeaxanthin on human macular pigment density and color vision. Ophthalmic and Physiological Optics, 2006 26: 137-147
7. **Zeaxanthin & Visual Performance:**
   Supplementation with zeaxanthin or lutein increases macular pigment at the fovea (the central part of the macula) and can also improve visual acuity. Supplementation with the carotenoids lutein or zeaxanthin improves human visual performance Ophthalmic and Physiological Optics, 2006 26: 362-371
8. **Zeaxanthin & Visual Acuity and Visibility:**
   Increased zeaxanthin supplementation improved visual performance due to changes in underlying biology and/or optical changes. Macular pigment: influences on visual acuity and visibility. Progress in retinal and Eye Research 21 (2002) 225-240
9. **Zeaxanthin & Diabetic Retinopathy:**
   Dietary carotenoids are significantly lower in diabetics. Zeaxanthin and lutein significantly inhibit the damage diabetes can cause to the retina Beneficial Effect of Zeaxanthin on Retinal Metabolic Abnormalities in Diabetic Rats. Invest Ophthalmol Vis Sci. 2008;49:1645–1651
10. **Cécile Delcourt 1 , Isabelle Carrière 2 , Martine Delage 3 , Pascale Barberger-Gateau 1 , Wolfgang Schalch 4 and the POLA Study Group 5**
11. **Lutein, Zeaxanthin, and the Macular PigmentJohn T. Landrum and Richard A. BoneArchives of Biochemistry and BiophysicsVol. 385, No. 1, January 1, pp. 28 – 40, 2001**
12. **Are lutein and zeaxanthin conditionally essential nutrients for eye health?R. D. Semba, G. DagneliMedical Hypotheses (2003) 61(4), 465–472**
13. **Macular pigment: New clinical methods of detection and the role of carotenoids in age-related maculardegenerationIvan Y-F. LeungOptometry (2008) 79, 266-272**
14. **Macular Pigment Density and Age-Related Maculopathy in the Carotenoids in Age-Related Eye Disease StudyTara L. LaRowe, Julie A. Mares, D. Max Snodderly, Michael L. Klein, Billy R. Wooten, Richard Chappell and CAREDS Macular Pigment Study Group Ophthalmology Volume 115, Issue 5, May 2008, Pages 876-883**

15. **Lutein and Zeaxanthin in the Eyes, Serum and Diet of Human Subjects Richard A. Bonea, John T. Landrumb, Zisca Dixonc, Yin Chenb and Cristina M. Llerenaa Experimental Eye Research, Volume 71, Issue 3, September 2000, Pages 239-245**
16. **Macular pigment optical density and its relationship with serum and dietary levels of lutein and zeaxanthin Stephen Beatty, John Nolan, Heather Kavanagh, and Orla O′Donovan Archives of Biochemistry and Biophysics 430 (2004) 70–76**
17. **Ocular Health- Function of Zeaxanthin**
    Oxidation products of zeaxanthin and lutein are found in the human retina suggesting an antioxidant role and photo-protective role protecting the macula from blue light damage. Identification of Lutein and Zeaxanthin Oxidation Products in Human and Monkey Retinas. Invest Ophthalmol Vis Sci. 1997 Aug;38(9):1802-11.
18. **Specific binding proteins exclusively bind zeaxanthin from the serum for transport into the macula and this protein (GSTP1) is found in the highest concentrations within the macula. Identification and characterization of a Pi is form of glutathione S-transferase (GSTP1) as a zeaxanthin-binding protein in the macula of the human eye. J Biol Chem. 2004 Nov 19;279(47):49447-54. Epub 2004 Sep 7.**
19. **Ocular Health - Age-Related Macular Degeneration (AMD) and Cataracts Dietary zeaxanthin intake decreased with age and this was associated with an increased risk of AMD based on a study of 828 men between the ages of 20 and 60. It was concluded that dietary zeaxanthin was the most important and universal risk factor for AMD. Diet and risk factors for age-related maculopathy. Am J Clin Nutr. 2008 Mar; 87(3):712-22.**
20. **A study at the University of Sydney (Blue Mountains Eye Study) of 3,654 residents concluded that dietary intake of lutein and zeaxanthin constituted a 65% reduced risk for neovascular AMD and 34% reduced risk for drusen damage in the population above the median for intake. Dietary antioxidants and the long-term incidence of age-related macular degeneration: the Blue Mountains Eye Study. Ophtalmology, 2008 Feb; 115(2):334-41.**


ProZea
"Nourishment for the eye"

LUND UNIVERSITY
School of Economics and Management

MSc Entrepreneurship

Course BUSP01

Theoretical Reflection

Innovation process of an early-stage life science oriented project at Lund University: implications based on experiences and observations of working at ProZea

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February 15, 2012

Abstract

This paper is a theoretical reflection about the time working with my final start-up project ProZea at Lund University during my study period in Master's program in Entrepreneurship. This study uses autoethnographical methodology to analyze the work of an entrepreneur on a new venture. The aim of this paper is to provide readers an insight of how product development takes place in an early stage life science oriented company, and how its innovation process looks like. I will discuss the theoretical researches within the fields of product development and innovation process. By applying the theories to ProZea case and the activities I have done within ProZea, I hope to draw a clear picture of a commercialization process of an early-stage life science oriented project.

KEYWORDS: entrepreneurship, innovation process, new product development, entrepreneurial autoethnography

1. Introduction

This paper reflects about my own learning outcomes from my study in Master's program in Entrepreneurship combined with my experience of commercializing start-up project ProZea. ProZea is a project under the collaboration between a researcher and three entrepreneurial students. Based on a patented invention from the research, we are working together from both sides, scientifically and commercially, to materialize our idea from sketch to reality.

Nowadays, innovation and creativity are the buzz words of rapidly changing business world. However, the innovativeness of the food industry remained low. On the other hand, the demands from consumer are becoming more dynamic. People prefer to eat safer and healthier food, and are adapting to a healthy lifestyle with some modification of their dietary habits to stay healthy, fit and disease free. Understanding the needs of the consumer, the companies in the food industry have a huge space to develop newer and better products by utilizing scientific outcomes. The key for future success lies in the development and new products that treated as novel and interesting by consumers. As we know that, there are a large number of new technologies and patents are published every day, from companies, research institutes and universities. However, most of these novel technologies are still far away from the reality or do not applicable to the current market. Only few percent of new inventions have commercial values, and it takes long time and a complex process to convert new inventions to high value-added innovative products.

Based on the above background described, the question then becomes, how's the innovation process looks like when you look at an early-stage life science oriented project, and ultimately, what factors stimulate the dynamics of innovation process? In this paper, I will demonstrate the answers through autoethnographical approach based on my start-up project ProZea.

2. Frame of Reference

I have chosen to base the frame of reference on already established theories within the area of business innovation. As previously mentioned the main themes are product development and innovation process.

Product development

Product development is a demanding activity (Magnus Lagnevik et.al, 2002). Numerous studies have been performed on this subject, leading to the following general advice (Harmsen 1996, ch.3; Grunert et al., 1996): product development is an important part of a company's strategy. According to Magnus Lagnevik et.al (2002), with regards to the successful product development process, the three elements should be dynamically interacted among each other (figure 1).

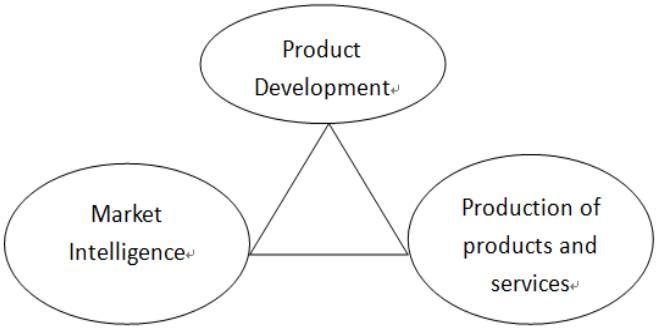


Figure 1: The golden triangle of product development

A successful product development needed a good cooperation between product development and marketing. The new product development should be in line with customer demands or their future expectations, that's where the "market intelligence" should be involved to provide the most updated information right from the market, including consumers, regional and local trends, competitors and retailers, etc. Therefore a network is needed for the company in the regional or local cluster (Magnus Lagnevik et.al, 2002, pp.20). Through the cluster, the company can ensure the interactions necessary with suppliers of products, technologies and supplementary knowledge (Kristensen, 1992, p.107-108). In order to maintain the dynamics of the golden triangle, it is necessary for the company to balance their interaction with the two networks (Magnus Lagnevik et.al, 2002, pp.21).

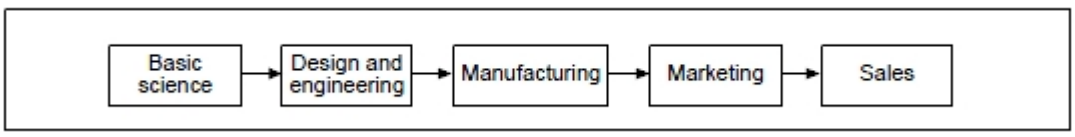
Innovation process

"An innovation is a new way to do things commercially" (Porter, 1990, p.780). Indeed, we acknowledge that innovation must have commercial value. It is therefore innovations are different from good ideas or new inventions. By using the quote from Afuah (1998), "the innovation process cannot be separated from the company's strategic and competitive context". We all know that innovations are significant for the company from a strategic point of view. Today manufacturing companies are faced with intensifying competition and a turbulent economic environment (Rothwell, 1994). To some extent technology is seen as a means by which firms can strive to adapt to the requirements of this difficult and uncertain environment (Rothwell, 1994). According to Roy Rothwell's *Towards the Fifth-generation Innovation Process*, we will first review the evolution of the innovation process in the past sixty years.

The First-generation Innovation Process (1950s – Mid - 1960s)

During this period attitudes in society at large were generally favorable towards scientific advance and industrial innovation, and science and technology were seen to have the potential for solving society's greatest ills (Rothwell, 1994). The industrial innovation process was generally perceived as a linear progression from scientific discovery, through technological development in firms, to the marketplace (Rothwell, 1994). This first generation, or technology push, concept of innovation (Figure 2) assumed that "more R&D in" resulted in "more successful new products out" (Rothwell, 1994). With one or two notable exceptions, little attention was paid to the transformation process itself (Carter and Williams, 1957) or to the role of the marketplace in the process (Cook and Morrison, 1961). The first generation is generally pushed by scientific discovery.

Figure 2: Technology Push: First Generation

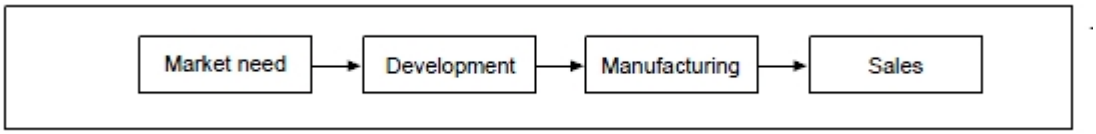


Source: Roy Rothwell, International Marketing Review, Vol. 11 No. 1, 1994, pp. 7-31

The Second-generation Innovation Process (Mid 1960s — Early-1970s)

During this period of intensifying competition, investment emphasis began to switch from new product and related expansionary technological change towards rationalization technological change (Clark, 1979; Mensch *et al.*, 1980). Rothwell (1994) argues that perceptions of the innovation process began to change with a marked shift towards emphasizing demand side factors, i.e. the market place. This resulted in the emergence of the second generation or "market-pull" (sometimes referred to as the "need-pull"), model of innovation shown in Figure 3.

Figure 3: Market Pull: Second Generation

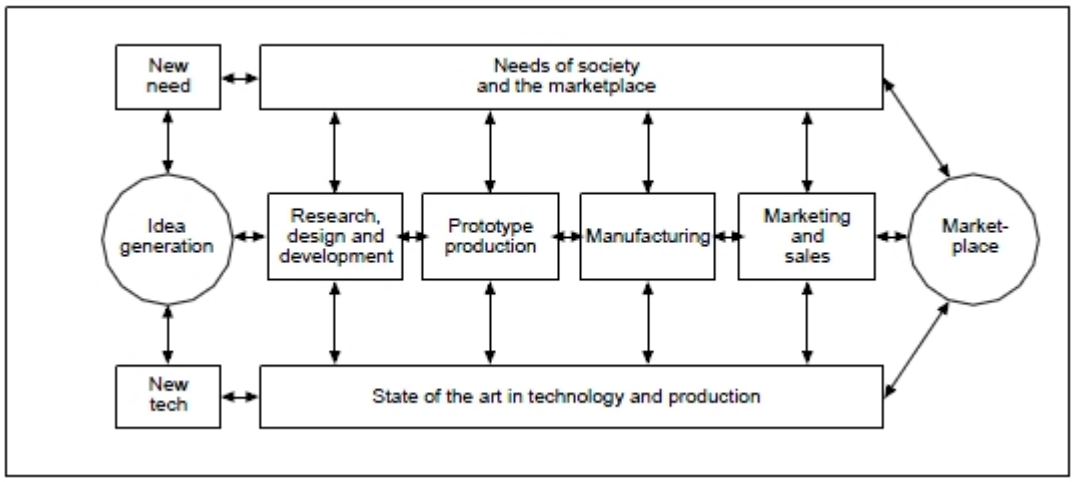


Source: Roy Rothwell, International Marketing Review, Vol. 11 No. 1, 1994, pp. 7-31

The Third-generation Innovation Process (Early 1970s — Mid-1980s)

The technology-push and need-pull models of innovation were extreme and atypical examples of a more general process of interaction between, on the one hand, technological capabilities and, on the other, market needs (Mowery and Rosenberg, 1978). This third generation interactive, or "coupling", model of innovation is illustrated in Figure 4. The coupling model can be regarded as: "*a logically sequential, though not necessarily continuous process that can be divided into a series of functionally distinct but interacting and interdependent stages. The overall pattern of the innovation process can be thought of as a complex net of communication paths, both intra-organizational and extra-organizational, linking together the various in-house functions and linking the firm to the broader scientific and technological community and to the marketplace. In other words the process of innovation represents the confluence of technological capabilities and market-needs within the framework of the innovating firm.*" (Rothwell and Zegveld, p. 50)

Figure 4: The "Coupling" Model of Innovation: Third Generation

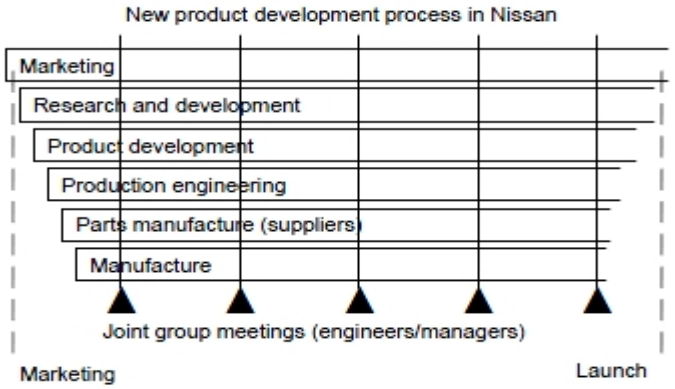


Source: Roy Rothwell, International Marketing Review, Vol. 11 No. 1, 1994, pp. 7-31

The fourth-generation Innovation Process (Early 1980s—Early 1990s)

The basis of the fourth-generation innovation model is integration and parallel development. The two features of innovation are leading by Japanese companies. Innovating Japanese companies integrate suppliers into the new product development process at an early stage while at the same time integrating the activities of the different in-house departments involved, who work on the project simultaneously (in parallel) rather than sequentially (in series) (Rothwell, 1994). This so-called "rugby" approach to new product development (Imai et al., 1985) is one of the factors contributing to high Japanese production efficiency through the process of "design for manufacturability" (Figure 5) (Rothwell, 1994).

Figure 5: Example of the Integrated (Fourth Generation) Innovation Process

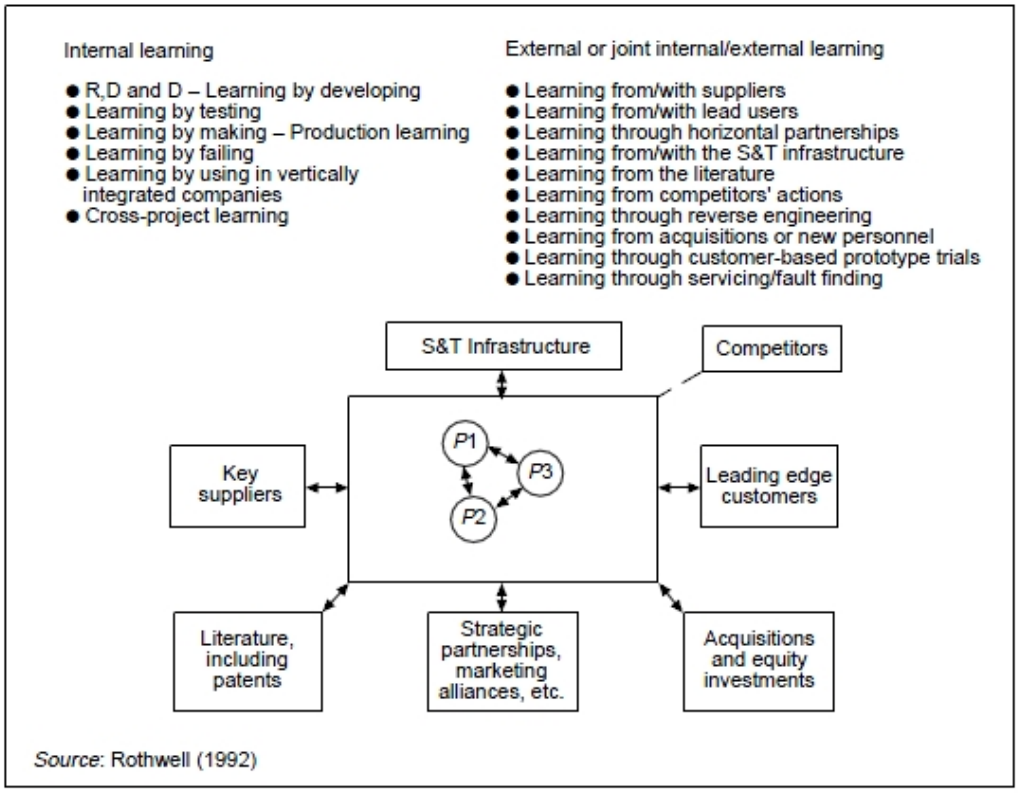


Source: Roy Rothwell, International Marketing Review, Vol. 11 No. 1, 1994, pp. 7-31

The fifth-generation Innovation Process

Based on the fourth-generation innovation process (4G), Rothwell (1994) came up with the fifth-generation innovation process (5G). Many of the features of 5G are already in place in innovators that have mastered the 4G process: parallel and integrated operations, flatter structures, early and effective supplier linkages, involvement with leading customers and horizontal alliances (Rothwell, 1994). 5G represents a more comprehensive process of the electrification of innovation across the whole innovation system (figure 6) (Rothwell, 1994).

Figure 6: Innovation as a Process of Know-how Accumulation: fifth-generation



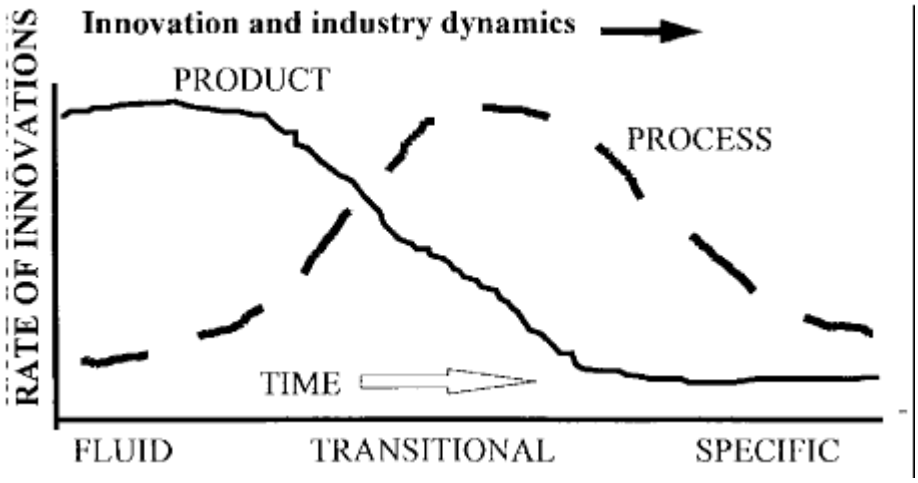
Source: Roy Rothwell, International Marketing Review, Vol. 11 No. 1, 1994, pp. 7-31

By having a good understanding of the evolution of the innovation process from the simple series technology-push model of the 1950s to the market-driven model of the 1960s, then to the parallel and integrated model of the 1980s. The reality becomes more complicated, that even today all types of innovation processes still exist in various forms. Covering this evolution, more wide views of modern innovation

process have brought by James M. Utterback "*Mastering the Dynamics of Product Innovation: How Companies Can Seize Opportunities in the Face of Technological Change*" (Boston: Harvard Business School Press, 1994, 253 pp.).

According to Utterback (1994), the innovation process has three stages- fluid, transitional and specific phase. This shows how the innovation rate differs between the product and process types of innovation at different stages of the industry. Utterback (1994) has demonstrated how technological forces determine the rules of the competition among the firms. The level of innovative activity related to the innovation process is first high in the product innovation (see figure 6). In the fluid phase of innovation process, the major innovation is presented through many innovated ideas, product applications and technological solutions. In the transitional phase, the innovation of process becomes more important, the major product solution has completed and a dominant product design (Utterback, 1994) has taken over, and there is a close connection between product and process innovation. In the final phase, specific phase, products are targeted for specific users or segments, and the process is focused on maximizing value and cost efficiency for users in the segments (Magnus Lagnevik et.al, 2002, pp.27).

Figure 6: Illustration based on information from Utterback's "Mastering the Dynamics of Product Innovations"



Source: IEEE TRANSACTIONS ON ENGINEERING MANAGMENT, VOL. 44, NO. 1, FEBRUARY 1997, 100 pp.

In this part I have reviewed some of the fundamental researches in the area of product development and innovation processes. They both have given us some general points of view with regards to how product development takes place in the company, and how its innovation process looks like. Now, when we look at an early stage bioscience-oriented project, how can we succeed in converting scientific research into marketable products through new product development and the innovation process?

3. Methodology & Data

The method adopted in this paper is the method of autoethnography. I am using autoethnography to highlight the experiences and self-observations I have gathered data from my start-up project during my study period within the Master's program in Entrepreneurship at Lund University. I would like to provide the insights into the area of innovation process using an empirical study approach. However, I also would like to emphasize that the analysis is highly based on my personal experiences, and therefore my analysis is purely subjective that could be a major limitation of this paper. According to Leon Anderson (2006) in his research paper "Analytic Autoethnography" argues that "one of the advantages of autoethnography involves the access that it provides to "insider meanings"." I hope that by utilizing this method, I could help the readers to understand how the innovation processes are being led through different phases of development.

During my working period at ProZea, I have documented the major occurrences in the development of ProZea under the form of weekly learning journal. This data was collected and recorded during a time period from December to May by which will be used as the main source of this paper. On top of that, the analysis will combine with my personal knowledge and experiences of ProZea as well as some relevant literatures to help me better illustrate the topic.

4. Analysis

In this chapter, I am going to capture the dynamics of the development process by analyzing early stage bioscience based project ProZea. I will follow the process to understand the essential features and will show you the important decisions that have been made during the journey of commercialization. Of course, it contains a lot of trials and errors.

A researcher in Lund found a new way of obtain Zeaxanthin (2008-2010)

Dr. Hans-Erick Akerlund from Biochemistry Department at Lund University has developed a unique post-harvest optimization technology that significantly improves the Zeaxanthin content in green leafy vegetables under low pH conditions. This technology allows up to 20-fold increase in Zeaxanthin concentration without compromising the natural integrity of the plant.

Spinach- a new ideal raw material for Zeaxanthin extraction

The most popular raw material for Zeaxanthin extraction is Marigold, a flower with orange color that contains a lot more Zeaxanthin compares to other sources. However, Zeaxanthin extracted from Marigold can be hardly utilized into food products since Marigold flower is not edible. Moreover, it requires relatively high standards during production process, namely to produce Marigold is not cheap. Based on Dr. Akerlund's optimization process (increase Zeaxanthin content up to 20 times), he realized that it might have a huge commercial space behind this technology, since at this moment nobody is extracting Zeaxanthin from green leafy vegetables due to the economic reasons. But the question is then which green leafy vegetable is suitable for extraction? He conducted several experiments with over 20 species of green leafy plants, even with sugar beet leaves and grass, and finally find out spinach has the highest volumes of output. The advantages of using spinach are: an edible vegetable, easiness of grow and cheap production. Therefore, spinach can be an ideal substitute of Marigold.

Where to start? Start-up fund and patent application (2009)

Dr. Akerlund was very excited about his invention. However, he was excelled at research works but has no clue about business perspectives. Therefore, he found Lund University Technology Transfer Office (LU Innovation) to give him some business and legal advises. LU Innovation is an organization that helps researchers to convert their inventions to products, and bridges the networks between scientists and entrepreneurs. Under the help of LU Innovation, Dr. Akerlund has applied start-up research fund from Innovationsbron for 200,000 SEK and started his patent application. The patent was regarded as a key asset of the project.

The starting point of the collaboration between the researcher and entrepreneurial students (2010.09)

In late September of 2010, the project was introduced through Lund University Technology Transfer Office (LU Innovation) to students from Master's program in Entrepreneurship at Lund University. Together with another two entrepreneurial students, we were chosen to work together with the researcher to commercialize his invention. We named our project "ProZea", an inspiration from another successful food business born in Lund ten-years ago "ProViva".

First phase: technology-pushed innovation process (2010.10 – 2010.11)

Our first task as entrepreneurial team is to find out the possible commercial applications for this optimization process. Together with researcher, I would say our mindset were more towards technology-pushed thinking. The technology-pushed innovation process was generally perceived as a linear progression from scientific discovery, through technological development in firms, to the marketplace (Rothwell, 1994). Our initial idea is to utilize the method to produce nutrients-enhanced frozen vegetables, particularly product of frozen spinach. The reason why we have thought of frozen vegetables is that it is the most direct and feasible application can be used based on our technology. Thus we were more looking at the invention itself rather than the demand from the marketplace.

First contact with Findus AB (2010.10 - 2010.11)

After we all have agreed on go for the "enhanced frozen vegetables" concept, we did massive market research with regards to frozen vegetables market in Europe. To start with, we talked to one of the largest players in Frozen food industry, Findus AB. Under the help of Helena Ljusberg, a business advisor from LU Innovation, we contacted a manager from marketing department of Findus. They have evaluated our "frozen vegetables with enhanced-Zeaxanthin" concept and came back to us with "no" answer. The reason was that the public knowledge of Zeaxanthin still remained low, therefore, how can we ensure that consumers will get enough awareness of Zeaxanthin, thus are convinced to spend more money on a healthier Zeaxanthin-enhanced frozen product. In other words, Findus thought the market was not ready for our concept. According to the feedbacks we received from Findus, we as a team realized that only focus on the feasibility of applying the research work will not work, unless we keep an eye on the marketplace. However, on the other hand, we also realized that "the large companies do not appear to have an open mind about new ideas, the "not invented here syndrome"" (Szulanski, 1996).

Second phase: moving towards the "Coupling" Model of Innovation (2010.12)

Based on the frame of references I have discussed in the previous chapter, when I look back on a series of actions we have took after the Findus case, I could summarize that our innovation process was been adjusted from technology-pull model to the coupling or interactive model of innovation. *"The overall pattern of the coupling model of innovation process represents the confluence of technological capabilities and market-needs within the framework of the innovating firm*" (Rothwell and Zegveld, p. 50). The coupling model is a rather complex process that requires wide net of communication paths, both internally and externally. It is therefore requires us as entrepreneurial team go out and make contact with experts from both technological community and marketplace.

Connection to the industry: Rolf Bjerndell has joined on board (2010.12)

We realized the importance of building a network with the whole industry. We then started to spread wide range of interests to the surroundings. To reach the goal, we need to find an influential expert in the food industry who has equipped with broad networks and reputation. We were successfully got Rolf Bjerndell on board. Rolf Bjerndell is the chairman of entrepreneur council of Swedish Food Academy. He was CEO of Skånemejerier during the period 1994-2005 and has served as a board member or CEO for many prominent companies such as Probi and Oatly. He has an extensive experience in marketing and sales in the food industry. The networks and knowledge from him will be central to the development of ProZea.

A broader view to look at our commercial applications (2010.12-2011.03)

Rolf Bjerndell was a key contact we have made. Combined with his networks and advises together with our own resources, we pitched our project to many companies, governmental organizations and investors. As a result, we have identified the potential of our technology in different market applications. The selected areas of interest are: food ingredients, functional foods & drinks, nutraceuticals/dietary supplements.

Fluid phase: high product innovation vs. low innovation process

At that moment, we were standing in the center of crossroad. We, as major decision makers, have experienced the tough time to make the most likely right decision. I would like to particularly reflect this matter based on Utterback (1994)'s theory of innovation process. According to Utterback (1994)'s research, we were exactly experiencing the first phase of innovation process- Fluid Phase. In the fluid phase of innovation process, the major innovation is presented through many innovated ideas, product applications and technological solutions (Utterback, 1994). We have figured out many potential product applications, but yet found out a "dominant design". Our next step will be narrow down the potential applications, confirm a "dominant design" (transitional phase), and focus on materialize and industrialize a specific product from lab-scale level to industrial-scale level.

Connection to the technological partners: Swepharm & Galenica (2011.01-2011.05)

To materialize our next step- find out a "dominant design", we conducted several profitability and feasibility studies regarding to our potential applications. According to the "coupling" model of innovation from Rothwell (1994), profitability study aims to find out the needs of society and the marketplace, while the feasibility study aims to find out the state of the art in technology and production (figure 4, pp.7). Therefore, we started to select partners who can develop the ProZea concept into value-added products that match identified consumer needs.

Swepharm

"*In the very beginning of the week, Janitha and I together with Hans-Erik have met Dr. Malin Olbe and Dr. Gostalilius from Swepharm. The major topic of the whole meeting is about the cooperation between us. The meeting goes quite well. We have brought a great interest to them, although we still not 100% sure about which direction we should heading to and how much it requires.*" (Learning Journal_2011_03_04)

Galenica

"Henri Hansson is director R&D at Galenica, a pharmaceutical company began in 1999 and the GMP facility opened three years later. We have contacted Henri to help us with cost calculation, product formulation and industrial production." (Learning Journal_2011_04_08)

From "Fluid Phase" to "Transitional Phase" (2011.02)

Based on our feasibility and profitability study and several meetings with key potential partners, we decided to prioritize the nutraceuticals/dietary supplements segment as our "dominant concept "area during the start-up phase.

Winner of Dragons' at University & Second place at Venture Cup Syd (2011.02-2011.05)

During this period of time, we were working hard on further shaping our dietary supplement concept while at the same time looking for key partners who can implement the concept. On top of that, we were also positively seeking for financial supports that pushed us to get more publicity. Participation of start-up competition is indeed a great way to get free publicity, besides that it is an effective way of gaining legitimacy, attracting investments and making contacts. According to "golden triangle of product development" study (Magnus Lagnevik et.al, 2002), a network is needed in the regional or local cluster in order to maintain the dynamics of the golden triangle, it is necessary for the company to balance their interaction with market intelligence and production of products (Magnus Lagnevik et.al, 2002, pp.21). Both Dragons' at University and Venture Cup have attracted different parties within the region to participate. We propose that join such activities has certainly enhanced the dynamic atmosphere within our team by embracing more external feedbacks, and thus further helped us with the new product development.

Entrepreneurial team was frustrated over the slow product development process (2011.05)

Apart from arrange meetings with two pharmaceutical companies: Swepharm and Galenica, we also talked to experts in research field of biophysical technology and food technology such as Prof. Marie Wahlgren and Prof. Pre-Ake Albertsson. We were mainly discussed product formula, product prototype and production process, etc. ProZea was certainly moving from "fluid phase" forward to "transitional phase", namely we have to optimize ProZea's optimization process and develop a product concept within dietary supplement sector. However, this part can be only driven by the research team. The fact was that more problems occurred when the research team started to optimize the process. The speed of product development remained extremely slow and the commitment from researcher was unclear. The entrepreneurial team started to feel frustrated and complained that the project was being delayed. Until May 2011, ProZea still didn't come up with its product formula nor product prototype.

Although the future of ProZea is yet to be determined, in the past seven-months we are happy to see that ProZea has walked a long way, from an original concept of "enhanced frozen vegetable" to "dietary supplement concept", from a "technology-pull" innovation model to a "coupling" model, from "fluid phase" to "transitional phase". The table below summarizes the innovation process of ProZea over the past seven months.

Table 1: Innovation process of ProZea (2010.10-2011.05)

	The problem	Innovation	Applications
1.	Marigold is the major source of extracting Zeaxanthin, but it is expensive and doesn't applicable to food applications	Optimization process that could increase Zeaxanthin contents in green leafy plants up to 20-fold	Patented process
2.	Which green leafy plants can be an ideal replacer to Marigold?	Spinach shows the highest outputs after the post-harvest process	Zeaxanthin-enriched Spinach
3.	Connection of life science research to marketable applications	Entrepreneurship in the interface between researcher and entrepreneurial students	Formation of ProZea team
4.	Which application is most feasible to our technology?	"Technology-pushed" innovation process at "fluid phase"	Zeaxanthin-enriched frozen Spinach
5.	Which applications are meet both the technological capabilities and the market needs?	"Coupling" model of innovation process	Functional food & drinks, food ingredients & dietary supplements
6.	Getting connection to the industry	Leadership from the industry	Rolf Bjerndell joined on board of ProZea

7.	Finding a suitable technological partner	A small/medium-sized regional pharmaceutical company with GMP production standards	Swepharm and Galenica
8.	What is our first “dominant design” concept?	Feasibility and profitability study, from “fluid phase” to “transitional phase”	Dietary supplement as our first-stage “dominant concept”
9.	Product formula & product prototype	Through further development, where a combination of the pharmaceutical and food technology, resulted in new product formulation	Not done yet

5. Conclusion

The innovation process of an early-stage life science oriented project can be well understood with the help of the general innovation theory. In principle, the start-up case ProZea in this paper supports those of Rothwell (1994) and Utterback (1994).

According to Rothwell’s study of *Fifth-generation Innovation Process*, I have learned that the innovation processes have been developed from the simple series technology-push model to the parallel and integrated model over the past six-decade. However, I have realized that although the innovation processes are getting more and more complex, still all types of innovation process continue to exist in various forms. As Rothwell discussed “to some extent this diversity is a result of sectoral differences, i.e. innovation in certain consumer products has a strong market-pull flavor, innovation in assembly industries is becoming more integrated and parallel in nature, while innovation in science-based industries such as pharmaceuticals leans more towards the “science discovers, technology-pushes” mode”. ProZea has indeed

experienced a pure technology push mode – the first generation of innovation process at the beginning. But later on we soon found out that the coupling model with its feedback loops and market linkages, applies the best to our case.

From Utterback's research, my learning outcomes are stated as follows:

- Innovations are born in the fluid phase, where many technologies compete and many different applications of the technologies are being tested. "In this foggy landscape it is important to find the technology with the highest peak. In the long term and in the establishment process for a dominant design, only those innovations based on the premium technology will survive the competition" (Magnus Lagnevik et.al, 2002, pp.160). Besides that the openness to new ideas will help us to find new opportunities and resources, that's why we were all the time pushing ProZea to get free publicity (participation of business plan competition, meetings and conferences, etc.) and actively raising interests to our surroundings.

- When the project has entered into the second phase – transitional phase, quite a few important decisions need to be decided by entrepreneurs. Potential product applications need to be carefully selected under the feasibility and profitability study. The key technological features of the innovation have to be decided and the technology should be upgraded to a certain level (lab-scale to industrial-scale). The wide range of partners and competitors will have been narrowed down to a few, and the contribution to the product from all the actors will have been clarified (Magnus Lagnevik et.al, 2002, pp.162).

- When the innovation process enters to the final phase – specific phase, the concepts of the basic product are well defined (Magnus Lagnevik et.al, 2002, pp.164). The production process is specified based on cost and efficiency evaluation and the investment have been made. The ProZea case is yet to enter this phase; therefore I couldn't give more reflections on that.

- With regards to where the ProZea case ends, I propose that it is in the borderline between the fluid phase and the transitional phase. The basic technological problems have been solved, and the key direction of the innovation has been identified. However, uncompleted optimization process of the technology, slow speed of new product development, and unclear long-term commitment from the research team caused the delay of project progress, and brought many uncertainties to the future development of ProZea.

In general, this paper has documented the innovation process of a seven-month old project developed from “fluid phase” to “transitional phase”. With regards to the development circle of life science research based project normally takes at least three to five years of development, ProZea still has a long journey to go. As outlined in this paper, entrepreneurs indeed can take the general theories of innovation process as references. It will definitely help them with making critical decisions and drawing a whole picture of a commercialization process of their own businesses.

6. References

Anderson, L. (2006, August). *Analytic autoethnography*, Journal of Contemporary Ethnography, 35(4): 373-395.

Magnus Lagnevik, Ingegerd Sjoholm, Anders Lareke and Jacob Ostberg, (2002). *The Dynamics of Innovation Clusters: A Study of the Food Industry*, Edward Elgar Publishing, Inc.

Kristensen, P.S. (1992), *Product development strategy in the Danish agricultural complex: global interaction with clusters of marketing excellence*, The International Journal of Food and Agribusiness Marketing, pp.107-118

Roy Rothwell, (1994). *Towards the fifth-generation innovation process*, International Marketing Review, Vol. 11 No. 1, 1994, pp. 7-31

Cook, L.G. and Morrison, W.A. (1961). *The Origins of Innovation*, Report No. 61-GP-214, June, General Electric Company, Research Information Section, New York, NY.

Clark, J. (1979), *"A Model of Embodied Technical Change and Employment"*, mimeo, Science Policy Research Unit, Sussex University, Falmer Press, Sussex.

Mowery, D.C. and Rosenberg, N. (1978), "*The Influence of Market Demand upon Innovation: A Critical Review of Some Recent Empirical Studies*", Research Policy, Vol. 8.

Imai, K., Nonaka, I. and Fakeuchi, H. (1985), "*Managing the New Product Development*", in Clark, K. and Hayes, F. (Eds), the Uneasy Alliance, Harvard Business School Press, Boston, MA.

James M. Utterback, (1994). "*Mastering the Dynamics of Product Innovation: How Companies Can Seize Opportunities in the Face of Technological Change*", Boston: Harvard Business School Press, 1994, 253 pp.

Other:

Hina Hauck, Jinming Fan, Janitha Liyanage, (2011). "*ProZea Business Plan*", Lund University, Sweden

Jinming, Fan. (2011), Learning Journal_2011_03_04, Unpublished manuscript
Jinming, Fan. (2011), Learning Journal_2011_04_08, Unpublished manuscript