Co-siting feasibility study and business plan of a sustainable shrimp farm in Rotterdam

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Preface

The concept of Agroparks, clusters of food production and industrial activities in an ecological symbiosis, was first launched by Innovation Network in 2000, and has inspired many initiatives. Happy Shrimp Farm (HSF) is one of them. The idea of producing exotic Shrimps in a harbour area, using waste heat from an electricity plant on the same site, should be regarded as a first step in the formation of a symbiosis of food and other industries in the Rotterdam Harbour area.

In this report which has a very down to earth entrepreneurial character, the benefits and risks of co-siting (two or more companies in an ecological symbiosis on one site) are described. On the basis of criteria such as access to energy and utilities, waste treatment, efficient spatial use and last but not least, the perception of the location by the public a choice was made for a location and a host company for the HSF. The final concept of the HSF is an integrated shrimp algae farm. The first stage is to realise a shrimp farm in the port of Rotterdam and utilise the co-site benefits. In the second stage, an algae reactor is plugged on to the shrimp farm. The different processes in the HSF are explained in the business plan section and in the last B&G report.

The HSF has certain unique selling points; the freshness/quality and the socially responsible way of farming will create its own niche market. A new production chain is set up with outlets to high quality markets.

The start of the HSF project in 2004 was facilitated by The Port of Rotterdam. The initial set up was a B&G incubator, which could use the existing infrastructure and network of the Port of Rotterdam N.V. The Happy Shrimp Farm attracted interest from many public and

private parties; it won the royal KIVI NIRIA price for innovation and entrepreneurship.

Dr. G. Vos,
Director
InnovationNetwork

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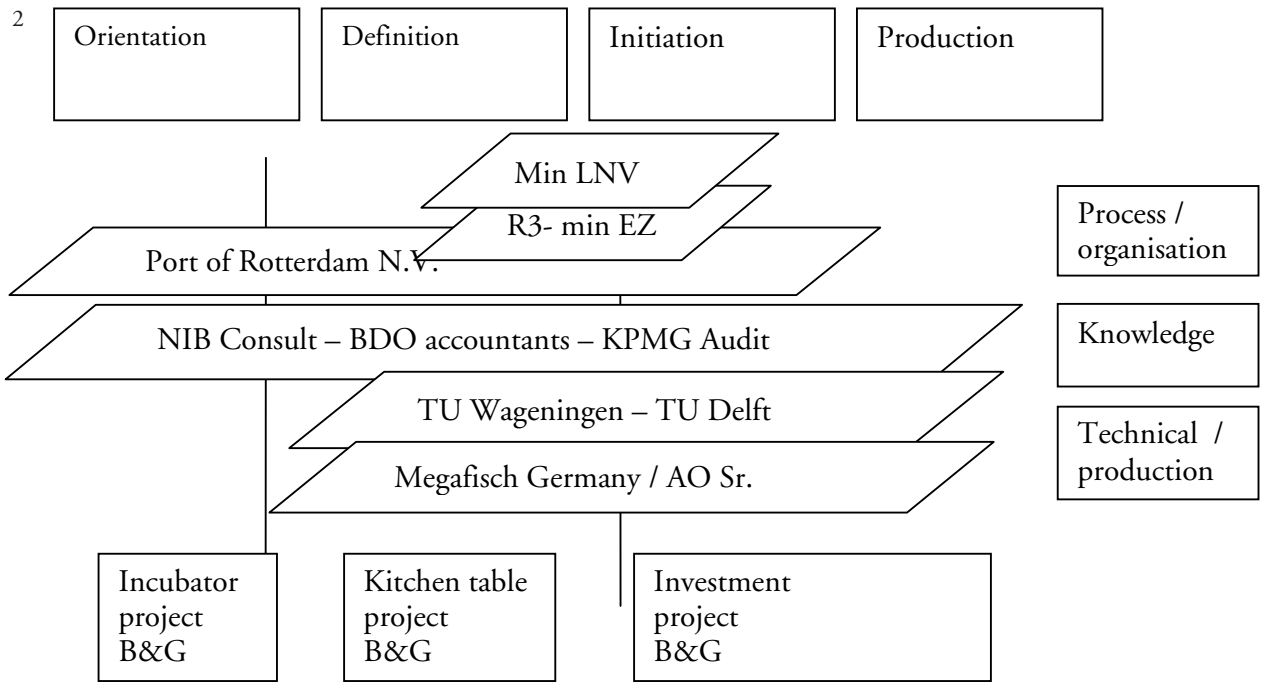
Management summary

The Happy Shrimp Farm is the result of an incubator project initiated by Bass & Gill (B&G). The incubator was setup and facilitated by the Port of Rotterdam to investigate the possibility of an agro-industrial concept in the port and industrial complex. The first phase of the project set out to achieve advantages by applying the co-siting approach. This co-site approach has been developed by the Port of Rotterdam and partners in the past. B&G compared the available co-sites, which were both technically and strategically approachable. The co-site locations that participated in the first phase of the research project were Nerefco BP, Odfjell Terminals, Caldic Chemie and E.On powerplant Maasvlakte. The researched co-site aspects are wasteheat, utilitilties, spatial aspects, waste management infrastructure and the availability of the specific sites. Before and during the incubator, B&G has engaged in many interviews and developed much knowledge about both industrial development through co-siting, aquaculture and of course, shrimp in general. Right from the start, the aim of the incubator was to set up a new agro-industrial company within the available infrastructures of the Port of Rotterdam. The first phase seemed very promising on the technical side (this was the focus of the first phase), and also on the organisational side, which involved cooperation with the four host companies.



Schematic overview incubator

From 1 September 2004 to 1 February 2005, the technical, organisational and contractual feasibility of the shrimp algae farm was assessed at the chosen location in the first phase of the incubator research project. Within the second phase, the prior conditions of one co-site location were further assessed in detail. This is of further importance towards development of SME companies, which use the co-site approach. As in the first phase, The Port of Rotterdam N.V. facilitates the second phase of the project. The coalition to work out the second phase has already been formed during the first phase. Non-disclosure agreements have been signed with the technology partners and further development of a memorandum of understanding is ongoing.

Based on the results of the first phase, the partners submitted a request to further develop the Happy Shrimp Farm at one specific site. The usual factors for assessing a site for a new company were important, such as room for expansion, availability of site, rent of site and conventional infrastructure like roads, parking and transport features. In addition, access to energy and utilities is important, these being waste heat, utilities such as oxygen, carbon dioxide and compressed air. Waste treatment, efficient spatial effects and last but not least, the perception of the location are further prerequisites to consider for the production of quality food.

B&G is at its best when focusing on one site and making progress in developing the total concept of The Happy Shrimp Farm. B&G started with the second phase after having convinced two parties who were both strongly involved with transition towards sustainable energy and agro-industrial development. We had to prove our integrity and seriousness by attracting solid partners and developing a strong belief

in the success of the Happy Shrimp Farm. Next to this, the small scale approach, compared to the grand scale approach a few years ago, made it easier to convince and get new perspectives in the development of agro-production near industrial sites. We have certainly found out that agro-production near conventional industry has its pro's and con's. With this second research report about the development of the Happy Shrimp Farm, we will further look at the co-site advantages and disadvantages influencing the B&G HSF concept.

Shrimp farm technology in Urumqi, China. December 2004.

Introduction

The second assignment – performing a feasibility study – focussed on one of the sites that has participated in the first phase of the project. The E.On site was chosen in further investigations into the feasibility and possibility of cooperation, as it has a positive effect on both parties. The image and sustainability of the co- and host companies are important drivers for further industrial development in the area of Rotterdam. In the past, when the Europoort and the Botlek were set up, environmental issues were not as important as they are these days. The development of the Maasvlakte, and in particular the second Maasvlakte, makes it very important that the industries also achieve a license to operate from the population of surrounding municipalities, policy makers and universities.

Shrimp farm technology in Urumqi, China. December 2004.

The stand-alone shrimp algae farm uses technologies developed by committed project partners. The shrimp farm design is from Megafisch Germany and the algae reactor is developed at the Faculty of Bio-technology at the University of Wageningen. Both parties have developed patents concerning the processes and technologies used.

In the first phase, the production systems were assessed by comparing different raceway and reactor systems. For the second phase, it was important to assess the feasibility of a HSF design which was projected on one site. The practical boundaries needed to be clarified, and the contractual aspects and precise financial figures, which the concept is confronted with at the final chosen site, needed to be defined.

In this report, you will find an organisational and technical feasibility study of the specific co-site location and the overall feasibility of the HSF. This is structured in two parts, the first part (pages 8 to 20, indicated without chapter numbers) is about the incubator. The second part is the business plan of the HSF (pages 21 to 38, chapters 1 to 8). The incubator and co-site analyses are more generic. The business plan of the HSF is still a dynamic document, which will be redefined after this report has been evaluated by peer reviewers. The latest developments within the organisation of the HSF are expressed in this part.

Research question

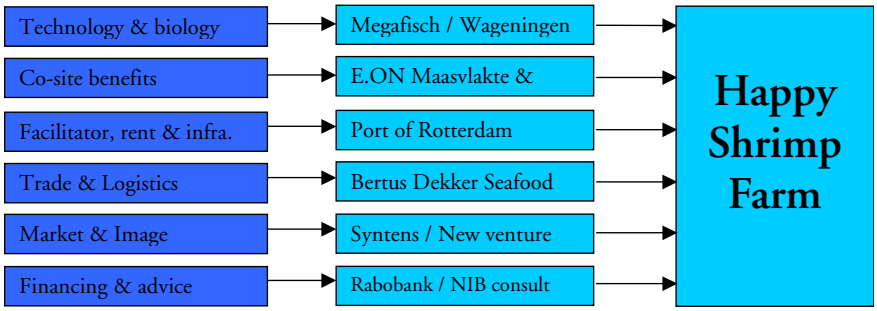
"Is the sustainable shrimp algae farm a feasible agro-industrial concept to set up near a co-site host company?"

The tasks arising from from this research question are:
- The set-up of the technical and operational design
- Organisation of the business process (Market)
- Projection of the production volume and quality
- Description of the distribution and supply channels
- Calculations concerning turnover and investment
- Overview of contractual and judicial relations among the partners

The first sub-task is explained in chapter 2. The other sub-tasks are described in the business plan of the HSF.

In the first phase of the research project, a model was developed for the assessment of different co-sites and a green field location. The approach and the co-site tool were developed because they can help entrepreneurs who see opportunities in the Rotterdam Industrial Complex. Such start-up companies can be supported in assessing the possible co-siting benefits for their own small and/or medium size industrial enterprise. The co-site factors that have been assessed for integration in the SME company, "The Happy Shrimp Farm" are: energy, waste, spatial factors and utilities. The financial parameters obtained from the model give a good indication of the advantages on the specific co-site at the Maasvlakte. The cooperation between the host company and the incubator company is crucial in the realisation of the HSF.

The feasibility study has been brought about by the following aspects and partners:



Aspects which influence the concept

Result

The target is to develop a business plan integrating the benefits the Happy Shrimp Farm will gain from the co-siting approach. While the first phase focussed on the overall benefits gained by co-siting, the second phase adds new dimensions like organisation, regulations, permits, market and image to the concept of the co-site approach. The co-site Happy Shrimp Farm concept is subjected to economical, technical and environmental constraints which need to be considered at all times. The target of this final research phase is a solid preparation for the realisation of the Happy Shrimp Farm in the Port of Rotterdam or even better, along the beach of Rotterdam.

Coherence with other projects

This project is a follow-up of the case-based co-site research assignment of the Port of Rotterdam N.V. The further facilitation of the B&G incubator has resulted in the Port of Rotterdam being a partner in the project. The Industry and Bulk Unit is the source of knowledge for the development of the project. This unit, together with the Department of Strategy, R3 and LNV are involved because of similar interests, these being the use of so-called useless waste heat and efficient use of utilities and land for sustainable (agro-) industrial development.

Success and risk factors of incubator

Success factors	Risk factors
Co-siting results 1st Phase research incubator	Cooperation of host company
Continuing contacts within the Port of Rotterdam organisation	Biological knowledge, animal diseases
Development of knowledge and partnerships	Animal welfare
The complementary nature of the B&G team	Synchronicity of planning within incubator
The HSF received positive reactions and exposure from media and public.	Acceptance of a new product

Description of timeline and tasks during incubator

The feasibility study support the incubator in the second phase from 1 August 2004 to 1 February 2005. From February until operation, BDS finances further development.

Organisation

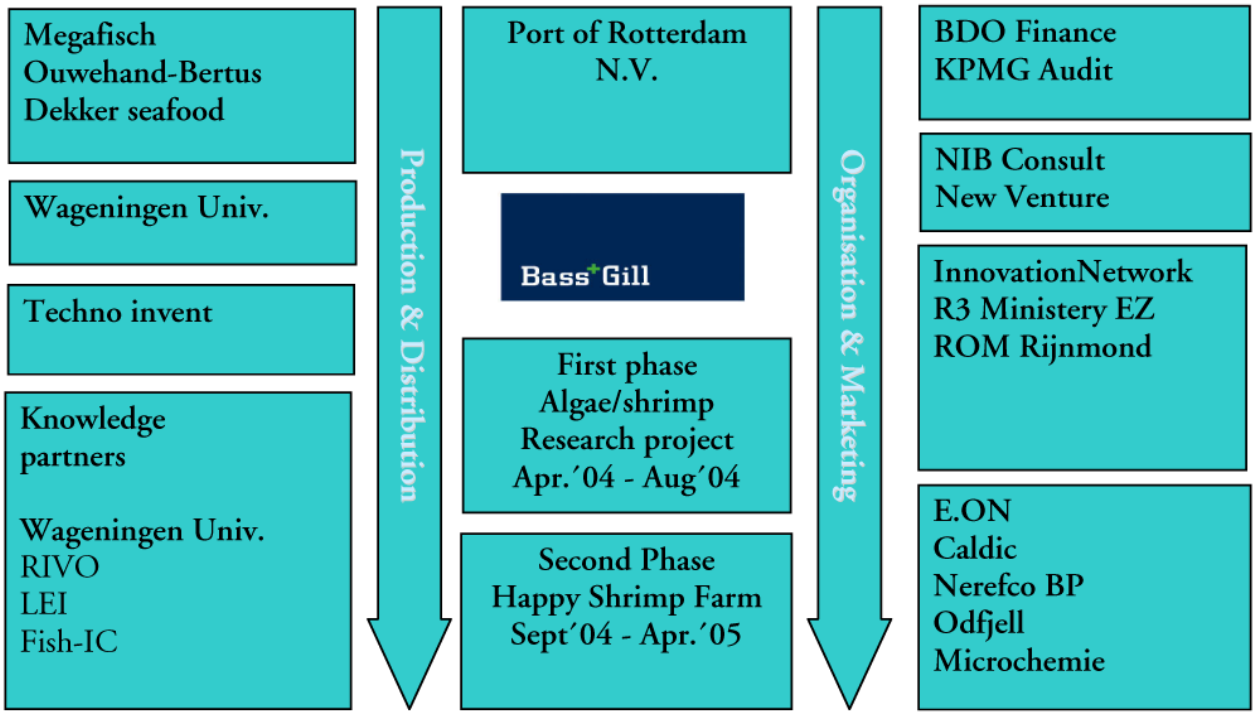
The management of the incubator project is the full responsibility of B&G. Any engagements to be made by B&G are first discussed during the monthly evaluation sessions with the programme manager Co-siting - Wasteheat, Chris Jordan, of R3 – ROM Rijnmond/ Ministry Of Economic Affairs, and with Dr. Ir. Jan de Wilt from 'Innovation Netwerk Groene Ruimte en Agroclusters' The feasibility study assignment has been given partly to research into co-siting and for the development of the B&G incubator company. From August 2004 to January 2005, the Port of Rotterdam had provided B&G with office space and means of communication. From February 2005, B&G has been situated in a new office at the Van Vollenhovenstraat 29 in Rotterdam.

Background of Bass & Gill
Sebastian Greiner studied Industrial Engineering and Management Science at the Eindhoven University of Technology. He carried out his final assignment at the faculty of Energy and Environment. The site where the assignment took place was the Rotterdam Port Authority. The assignment was to develop a tool, which could give an insight into the influences of different economical, technical, and environmental variables on the profitability of a 150 MW wood gasifier in the Port of Rotterdam. For this purpose, an exploitation model was developed. The expertise from modelling the gasifier concept is now applied to the shrimp algae concept.

Gilbert Paul Curtessi finished his thesis project at the Rotterdam City Development Corporation. This was an evaluation of the recycling-industry in the region of Rotterdam. During his trainee period under SITA, he worked on the development of a waste prevention programme at the BP-Nerefco refinery site in Rotterdam. Before the start of the B&G incubator, he was a researcher at the Industrial Development Unit at the Port of Rotterdam involved in industrial development, sustainable energy, recycling industry and agro-industry in the port and industrial complex of Rotterdam. This was followed by a HBO (dual) course involving geographical and environmental studies, various courses and conferences on industrial development, agro-industry and sustainable energy en technologies.

Project members and partners

The principal partners and patent holders continue to be committed to the project and are engaged in meetings and knowledge transfer. New partners have entered the incubator, adding new competences in marketing, food quality, subsidies, tax, finance and distribution.



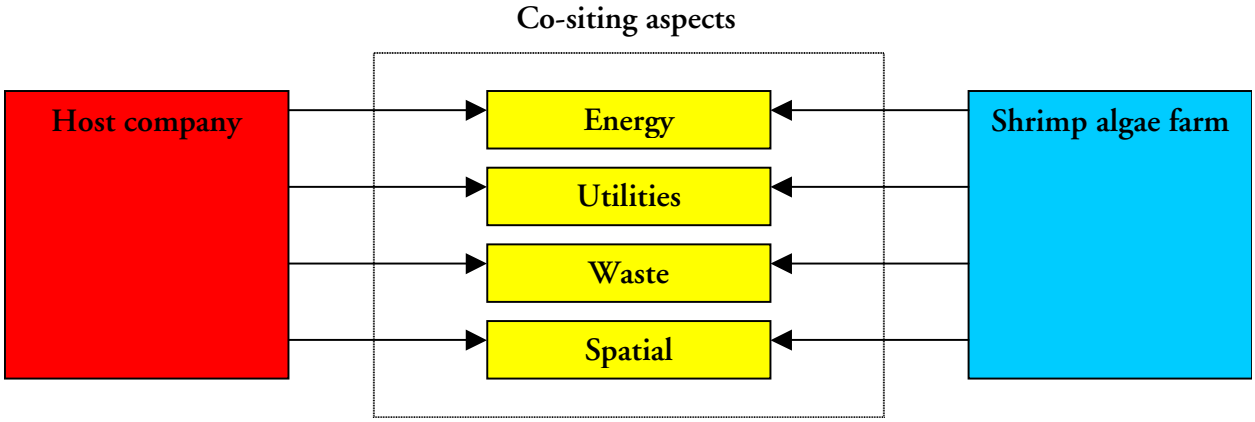
Knowledge development

B&G is the owner of the knowledge that is developed during this project. This feasibility study has been assigned with the understanding that all generic information will be made available to strategic partners R3, Innovatienetwerk and the Port of Rotterdam. Both R3 and Innovatienetwerk will be represented according to prior agreements.

Both organisations will receive their contribution in supporting this incubator, be rewarded and will be given public exposure when the shrimp farm becomes a reality. The shrimp algae concept is developed in close cooperation with the University of Wageningen and Megafisch, the German system developer. Confidentiality agreements have been signed with these two partners. The knowledge required for integrating two concepts is gained from interviews, literature and internet where an abundance of shrimp and algae farming information is present. A list of persons interviewed and organisations visited is attached at the end of the report. The different technical, environmental, biological and economical parameters can be found on several websites. During the study, B&G developed the required knowledge on different aspects of shrimp algae farming. This knowledge will grow further and will be integrated into an organisational, technical and economical feasible concept.

Co-siting benefits

In the first phase of the B&G report 'The co-siting analyses of a sustainable shrimp algae farm in the industrial complex of Rotterdam, The Netherlands', four co-siting benefits were identified on four different locations. The benefits were calculated by comparing the operational costs on a Greenfield location with the costs on each of the four co-site locations. The benefits gained on the four different co-site locations in the Port were of similar nature. This pointed out that a suitable location can be found for the HSF almost anywhere in the industrial area of the Port of Rotterdam. It might even suggest that a location in a different industrial area could be beneficial.



Co-siting at the Maasvlakte area

In September 2004, the E-On location was chosen for the feasibility study, because E.On was willing to facilitate further research on its site. The co-siting benefits present at the E.On location are energy, utilities,

waste treatment facilities and space. E.On also has an infrastructure on its site for delivery of the utilities, which can be used by the HSF. During the second research phase, we discovered that co-siting at the E.On location has its difficulties. Due to strategic factors, the location is no longer available for co-siting a new company.
E.On has pointed out, however, that the Breekwater site on the other side of the road was still available and moreover, E.On was willing to facilitate the realisation and delivery of utilities and energy to the Breekwater site.

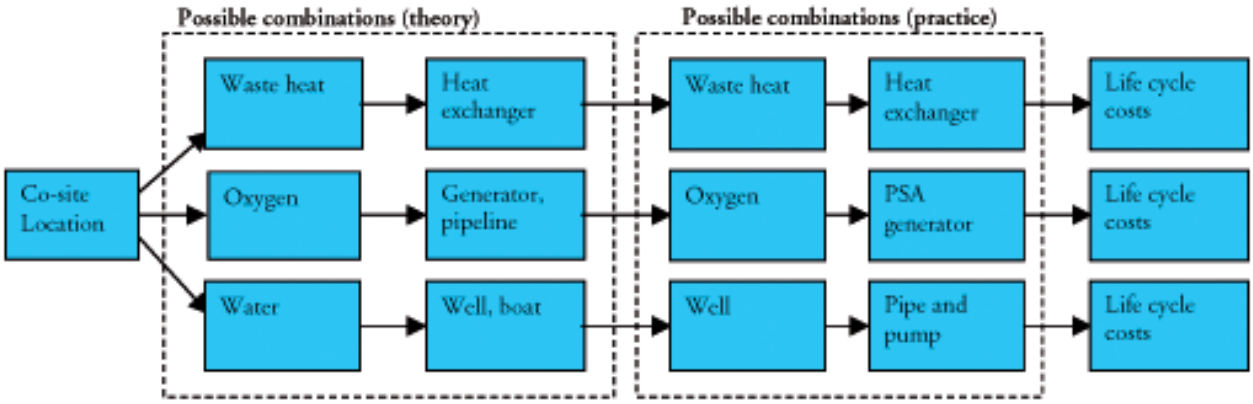
Available waste heat at E.ON

The E-On power station produces a large amount of waste heat. This heat is available at different parts in the process.

01. The cooling water outlet near the North Sea has water of 20° C, which can be used by applying a heat pump.
02. The cooling area for the stack gas cleaning process produces water of 50° C. This is high quality waste heat for the HSF.
03. Large pipelines which run from E.On to Lyondell, transport steam towards Lyondell and condensate of 100 ° C back to E.On.
The pipelines run trough the Total Utility Centre (TUC). At the TUC, there is the possibility of tapping the condensate and transporting it towards the HSF. This increases the overall efficiency of the cluster by applying the principles of cascaded energy use.

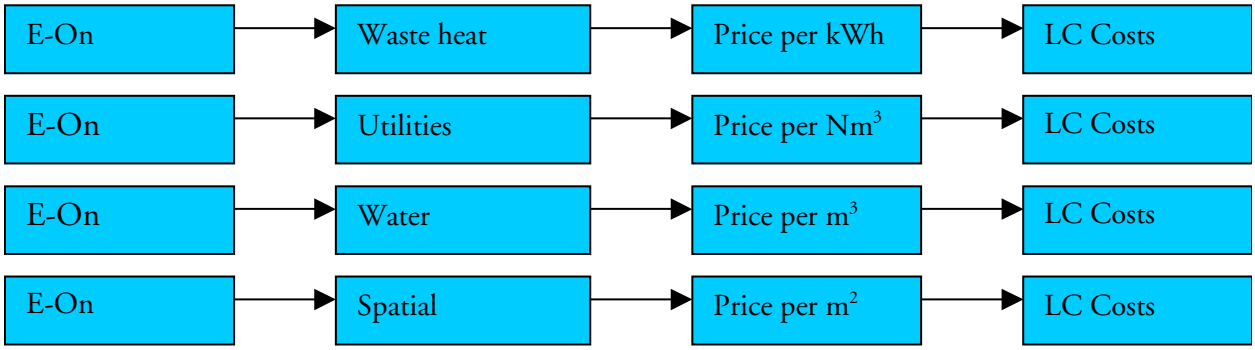
Co-site possibilities for the HSF at the E-On site

The figure below shows that a certain location offers access to e.g. waste heat, oxygen and water. The transfer technologies or sustainable infrastructure, which can theoretically transfer these utilities and energy to the HSF, are stated. However, after some technical assessments and financial calculations, it is expected that only a few of these possibilities are actually feasible in practice. The financial feasibility is calculated by determining the life cycle costs of the different sustainable infra-structures.



System life cycle costs on the E-On co-site location.

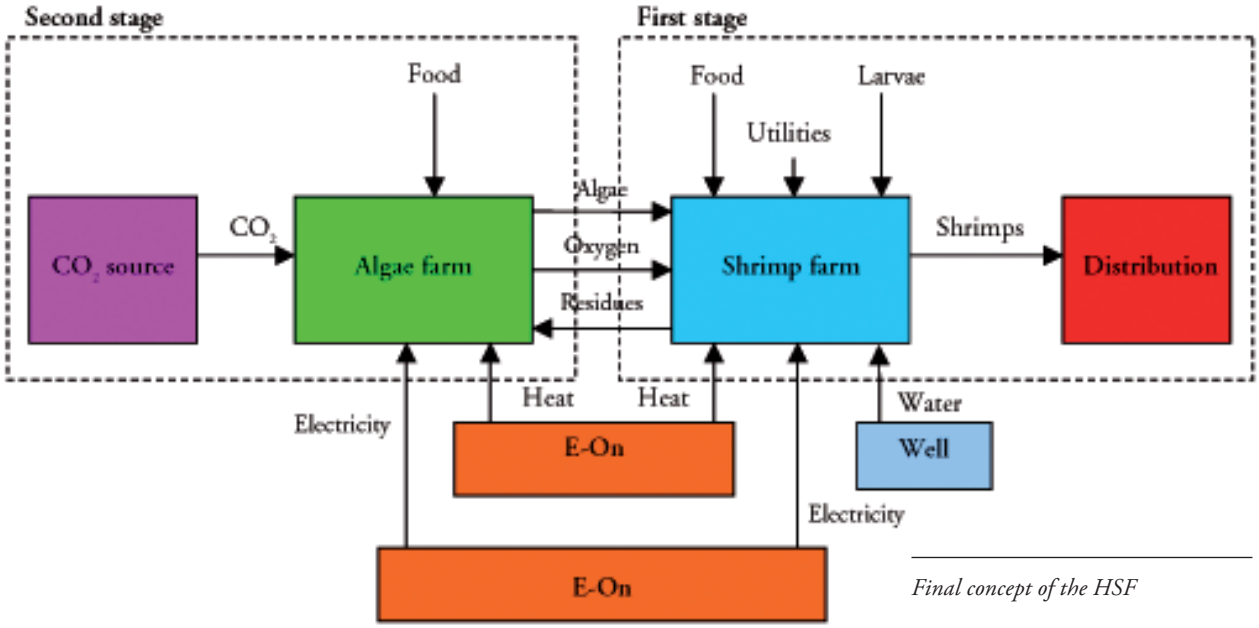
The life cycle costs are determined by the investment costs of the transfer technology and the yearly costs for operating the transfer technology. These total costs over a period of e.g. 10 years are related to a common denominator. The denominator for waste heat is the price per GJ.
The heat requirements of the farm over a period of ten years are known. The life cycle price per GJ is calculated by dividing the total cost over the ten-year period for the heat transfer technology by the total amount of energy transferred with that technology over that period. This life cycle price per GJ of transferred energy is then compared with other life cycle prices per GJ from other transfer technologies. The option with the lowest costs is implemented.
For the access to utilities at a certain location, the same calculations are made and compared. The optimal overall yearly exploitation costs per location for all utilities, waste disposal, space and energy are calculated. The location with the lowest overall costs is chosen as the best location for the particular business concept.



Determining the life cycle costs

Concept of the HSF

To calculate the life cycle costs on a certain location, it is necessary to get a proper understanding of the requirements and building blocks of the HSF. The final concept of the HSF is an integrated shrimp algae farm. The first stage is to realise a shrimp farm in the port of Rotterdam and utilise the co-site benefits. In the second stage, an algae reactor is plugged on to the shrimp farm. The different processes in the HSF are explained in the business plan section and in the last B&G report.



Final concept of the HSF

Requirements of the HSF

The HSF shrimp farming process requires certain utilities with the appropriate infrastructure. The different utilities are:

Utility	Demand /year	Demand /day	unit
Water	100,000	353	m^3
Food	225,000	616	kg
Oxygen	400,000	1100	Nm^3
Electricity	890,000	2500	kWh
Heat	28,000	77	GJ
Compressed air (8 bar)			Nm^3

Water

The farm requires 100,000 m^3 of water per year. The raceways are filled with 8000m^3 of salt water. Fresh salty water from the exterior, equalling 2-3% of the total water volume in the farm, is added every day to compensate evaporation. The water will be pumped from a salt-water well, which is installed at the location.

Food supply

The food for the HSF comes from China in 20- or 40-foot containers. The food conversion ratio is set at 1.5, which amounts to 225,000 kg of shrimp food per year. The average daily food requirements of the shrimp are 616 kg. This is spread out evenly throughout the year, because of different shrimp grow out cycles. The simultaneous presence of small and large shrimps in the different basins keep total biomass in the farm constant at all times.

Oxygen

The oxygen required in the HSF is delivered by Hoekloos or Air Liquide, which have pipelines near the site. The pipeline is connected to the farm by a small oxygen tube; this guarantees the lowest price for the oxygen. The infrastructure is to be installed by the oxygen supplier, which has an interest in selling and distributing the oxygen. The daily demand is 1100 Nm^3. As back-up, there will be an emergency oxygen tank in the farm, which holds enough oxygen for a few days in case of oxygen supply failure. This tank can be bought or rented from the oxygen supplier.

Electricity

The required electricity for the pumps and other electrical appliances in the farm is delivered by E-On, which has a large coal-fired power plant near the farm site. The capacity of the farm is 80 kW, but on average, it runs at 60 % continuously. As back-up, there will be an electric generator, which will start in case of a blackout. Test runs of the generator will have to be performed periodically.

Heat

The heat requirements of the farm are 28.000 GJ per year or 77 GJ per day. This is equal to 2081 Nm3 of high caloric gas per day

(heating value, high caloric gas 37 MJ/Nm3). At the site, there is a possibility to connect the farm to the existing steam transfer pipeline between E-On and Lyondell, which delivers heat of 90° C. The required sustainable infrastructure for the waste heat exchange between the pipeline and the HSF is composed of 300-400 meters of piping and heat exchangers within the farm. Besides the sustainable infrastructure, a back-up boiler is needed, because the power plant has a maintenance stop every four years. The heat is used in two separate systems.
One system heats the six raceways and the other system heats the air within the farm building.
Heat is required for the compensation of energy losses, thereby maintaining a constant air temperature of 30-31° C within the building. About 50% of the air volume in the building is exchanged with air from the exterior every day; this air is heated as well.
The water is treated in the same way. There is water in the raceways which is kept at a constant temperature of 29° C and new water is added (2-3%) every day, which is heated also.

Four types of heating are distinguished:
- Heating the incoming air from the fresh air exchange
- Compensating the energy loss of the air through the farm building
- Heating the incoming water for water refreshment
- Compensating the heat loss of the water through the air and the underground

The air in the building is kept one degree above the water temperature, thereby creating a temperature buffer between the farm roof and the water. The water should not lose any heat through the air, because this will cause too much fluctuations in the water temperature.

Spatial

The spatial benefits of co-siting, for small and medium enterprises, concerning the available infrastructures and opportunities for utilising energy are very good. Further, there are benefits to be gained by sharing facilities such as: parking space, fencing, security, on-site engineering and maintenance crews, security personnel. However, the rent for the location is much higher than, for instance, a Greenfield location outside the Port, because it is scarce industrial land with a connection to the sea. The figure shows the location and the available utilities and waste energy sources.

Waste

Waste from the farm is almost zero. The manure from the shrimp will be packed into bags and sold to florist shops, because it is high quality fertiliser. Water with high nitrate content is first denitrificated within the farm then transferred to a septic tank where the solids are further removed, and then transferred to the exterior environment.

The co-site at the E-On power plant.

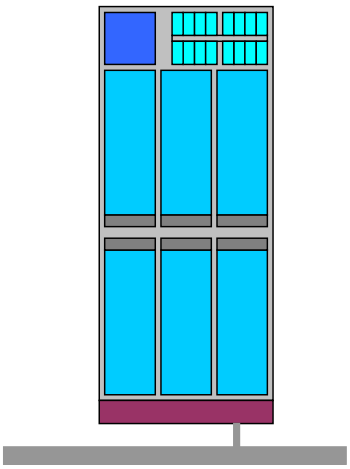
	Compressed air		Electricity
	Oxygen		Heat
	High caloric gas		

Building blocks of the HSF

The HSF consists of five different building blocks assembled on the site. Should the project be realised, a good project plan for a smooth integration of the blocks is to be made with the different suppliers of the blocks. The project is coordinated by an engineering company, which will take the full responsibility of the physical realisation of the HSF. This coordinating party will involve the suppliers in their project plans. The advantage of having this party is that judicial procedures and warranties can be handled by one company.

The building blocks are:

- Six concrete raceways
- Greenhouse
- Sustainable infrastructure
- Inventory
- Recirculation equipment



Lay out of the Happy Shrimp farm

Raceways

The six raceways will be made completely of concrete. It is also possible to just build a raceway-shaped concrete frame and then fill the large surface areas with styrofoam panels instead of concrete. Both options are coated with a PVC liner. It depends on the underground if there is a need for stabilising the foundation by inserting large concrete poles into the ground underneath the raceways. The groundwater level at the location plays an important role. If the groundwater level is too high, the raceways would be lifted by the upward pressure of the water.

The greenhouse

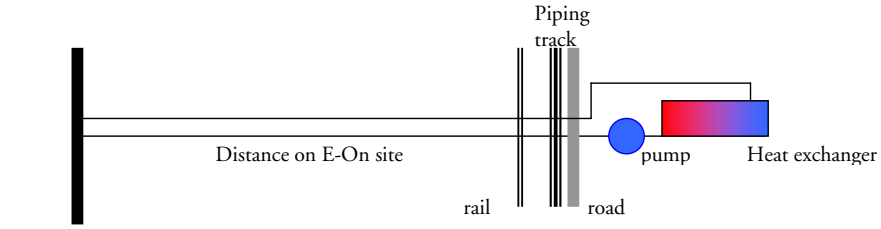
The greenhouse is supplied by Greentex, a company based in Rijswijk. The dimensions of the building are 155 meters long, 64.2 meters wide and 5 meters high. The greenhouse has a span of 21.4 meters crossing the raceways. The greenhouse has adequate climate control and the air inlets are covered with dust filters. The outside of the greenhouse is covered with polycarbonate sheets, which can be ordered in different colours.

Sustainable infrastructure

The sustainable infrastructure is composed of heat exchangers, piping, pumps and control equipment. The waste heat connection to the source is a pipeline and six heat exchangers within the farm. There is also a buffer system and a return pipe system to keep the heat circulating from the source setup to avoid flow problems. Further pumps are required to circulate the water within the transfer system at a certain rate.

The sustainable infrastructure is composed of four sections:

- The connection to the waste heat pipeline between E-On and Lyondell
- The distance covered on the E-on location to the road
- Surfacing the road, rail tracks and piping track
- Heat exchangers and pumps on the HSF location



Inventory

The fifth building block containes all other equipment such as lighting in and outside the farm building, parking spaces, offices, processing areas, water well, etc.

Recirculation equipment

The equipment is supplied by Megafisch Germany. Megafisch has developed the equipment in cooperation with various parties to achieve a working shrimp farm system that suits the requirements of the shrimp. The complete equipment list is stated below:

01. Oxygen cone 2080, stainless steel, diameter 80 cm (6 units);
02. Aeration frame, stainless steel, 1.2 metres each, 2 lanes each (6 units);
03. Aeration pipe, VHA 19 (360 metres);
04. Trico-wave industrial hose (160 metres);
05. Blowers, 3.0 kW/h, capacity 340 m^3/ hour, incl. pressure release valves, mufflers/silencers and fine filters (12 sets);
06. Main switchboard with all functions incl. measuring/sensing equipment for O^2, temp., pH and alarm system.(1 set);
07. Bio-filter carrier frames with backwash function (24 sets);
08. Micro-screen (80µ), PVC, MF 340 with one spare filter screen, one lift-out device, installation kit to sludge sump.(6 sets);

09. HP rinse pump for Micro screener 0.75 kW/h (6 set);
10. Sludge pump AP35 0.85 kW/h (1 set);
11. Sludge pump AP50 1.18 kW/h (1 set);
12. Flushing hose for sludge pumps (2 sets);
13. Propeller pump MF500 1.5 kW/h - 500m³/h lift at 80 mbar.(6 sets);
14. Wall mounting kit for propeller pump (6 sets);
15. Outlet box for propeller pump (6 sets);
16. Conveyor belt. 45 metres x 0.35 metres (6 sets);
17. Bottom vacuum device. (Mamut) (6 sets);
18. PE spade valve DN 110 (16 pieces);
19. PE spade valve DN 150 (6 pieces);
20. Wave creators. Gate technology with air cylinders, switches and controls. 2,25m³ per 30 sec. ((2 per raceway = 12 sets);
21. Artificial seaweed lines15.8 metres long (480 sets);
22. Various pipes, reductions, valves, flanges, fittings, glue, cleaner, PVC parts, small parts and consumables;
23. Inline-pumps Grundfos LM 80 - 160, 2.2 kW/h. For the oxygen cones (6 sets);
24. Back wash compressor (Dingo) WN 0100A 768m³/h at 3oo mbar (1 set);
25. Blower fan 0.37 kW/h for air/ heat exchange through reservoir (8 sets);
26. Top carrier frame for bio-filter, FRP profile (72 pieces);
27. Back wash units incl. fasteners and anti-return valves (24 sets);
28. Oxygen generator LE 90 8, KGs/h at 90% (1 unit);
29. Oxygen tank 280 litres with security valve and gauge (1 unit);
30. SM 11.150 Screw compressor 7/5 kW (1 unit);
31. TB 19 Refrigeration dryer (1 unit);
32. Air tank, 1500 litres with auto water drain, security valve and pressure gauge (1 unit);
33. Inter unit hoses (1 set);
34. Maintenance kit and spare parts (1 set);
35. Automatic start Diesel power generator 35 KWA with battery and built-in tank, mounted on metal frame (1 piece);
36. Feeding robot with rails and automatic refill station (1 set);
37. Pond lining sets PVC (6 sets);
38. Pond installation kit set (6 sets);
39. PVC Protection fleece under-liner (6 sets);
40. FRP walking grid for servicing the raceway (1 set);
41. Laboratory kit for the daily routine check up of water quality. Microscope.Test kits for one year (Ammonia, Nitrite, Nitrate). pH and Oxygen meter. (1 set);
42. Bio filter material FB12 at 240 m²/m³ (510 m³).

Business plan The Happy Shrimp Farm

Introduction

The Happy Shrimp farm (HSF) is a cooperation between Bass & Gill (Bas Greiner and Gilbert Curtessi), Bertus Dekker Seafood BV (Arie Ouwehand Sr.) and Megafisch Germany (Werner Gaus) which aims to set up a sustainable shrimp farm, which has a controlled and efficient interface with the exterior environment. Bass & Gill (B&G) is an agro-industrial project development company in Rotterdam, Arie Ouwehand is shareholder of Bertus Dekker Seafood (BDS) in IJmuiden, Megafisch Germany is the system designer of the farm. The HSF concept uses waste heat from the industry cluster for heating the six grow-out basins, called 'raceways', in which the shrimps are cultivated.

Oxygen and other utilities for the shrimp farming process are available at low costs in the port area, because of existing infrastructure and economies of scale. The location is acquired by the co-siting approach, which means sharing a location and infrastructure with an already present host company. Co-siting therefore enhances spatial and environmental efficiency in the port area. The products, produced with the farming system, are "never frozen" and "live" shrimp (Penaeus Vannamei). The unique selling point or distinguishing aspect is that the shrimp is offered as "never frozen" or "alive". It will be a very attractive product because of food quality (freshness) and hygienic matters. Currently, there is an existing market for "never frozen" and "live" shrimps. "Never frozen" and "live" are sold in Mediterranean countries such as Italy and Spain. A very small quantity of "live" shrimps are imported from Ecuador and cost around 28 € / kg.

The HSF will comply with EU regulations, such as Skall/Demeter and it will be ISO- and HACCP-certified. Bertus Dekker Seafoods, with access to the European high-end fresh fish market and over 30 years of experience, will distribute the shrimps. The “Happy Shrimp”, “Dutch Gamba” or “Hollandse Gamba” will diversify the existing shrimp market in NW Europe. The price of this exquisite product can be lower than the price paid at the moment for comparable products from Equador. Besides the lower prices, this new shrimp product, farmed in Rotterdam, will comply with the guidelines set by Novib for sustainable and socially responsible shrimp farming. Consumers will get acquainted with a new shrimp eating experience that will redefine their perception of freshness and taste, as something never experienced before.

The start of the HSF project in April 2004 was facilitated by The Port of Rotterdam. The initial set up was a B&G incubator, which could use the existing infrastructure and network of the Port of Rotterdam N.V. The “Happy Shrimp Farm” attracted interest from many public and private parties; it won the royal KIVI NIRIA price 2004 for innovation and entrepreneurship. It also secured a place in the South Holland regional finals of the Livewire 2004 contest.

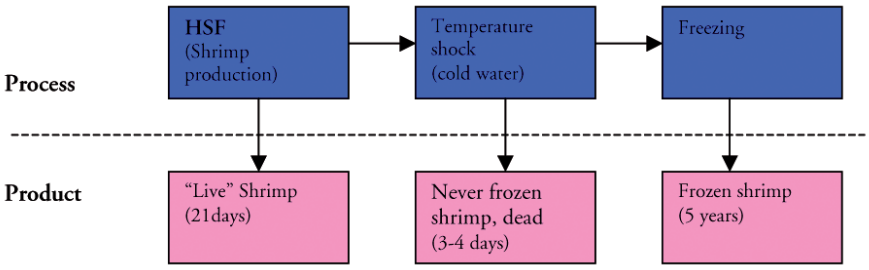
1. Product idea

The product is shrimp, which is “never frozen” and might even be sold “live”. While attending various conferences and fish markets, e.g. Paris and Madrid, we have discovered a need/desire for this new product. There is a strong consumer demand for new and fresh seafood products. The fresh seafood sellers want to expand their assortment. The shrimp, when sold alive, guarantees the consumer unbeatable product freshness. In this report, the shrimp produced by the HSF is called the “Happy Shrimp” or “Dutch Gambas”. The product offers sourcing benefits for the wholesaler because of the constant production. The price per kg will be steadier throughout the year than wild catches. Further aspects of the product and benefits are discussed in different sections of the business plan.

1.1 Unique selling proposition

The shrimps are alive or never frozen when they are sold. This guarantees better taste and texture of the shrimp meat. In China, as soon as shrimps are dead, they can only be sold for half the price paid for “live” shrimps. “Never frozen” shrimps are sold dead, but have not been frozen. Frozen shrimps have several disadvantages; the shell sticks to the meat, the heads are loosely attached to the rest of the body, yellow fluid comes out between the head and the tail sections. The time available for marketing of frozen shrimps is at least six weeks. In Paris, we encountered frozen shrimps older than two years. Food connoiseurs, as many people like to consider themselves, enjoy the delicious taste of ultimate freshness inherent only in live shrimps. Chinese and

Mediterranean customers know the live and never frozen products from their home countries. Live shrimps can be "stored" in an aquarium as long as they stay alive, without losing their freshness. We assume they are eaten within 21 days. Never frozen shrimps can be stored 3-4 days in the fridge and frozen shrimps up to 5 years. The innovative approach of the HSF is that the shrimps are produced near a potential market by using waste heat, utilities and other benefits adherent to an industrial area. The advantage of the HSF for the fresh fish wholesaler is that the sourcing of the live and never frozen shrimps is simplified. Now he has to order "live shrimp" from Ecuador. The HSF production process guarantees a steady supply of sustainable and socially responsible farmed shrimps each day at low cost that will not fluctuate during the year.



1.2 Sustainability

Aquaculture in general, could, and HSF in particular is enhancing sustainable food production in the world. The amount of proteins which is farmed on one hectare in the shrimp farm exceeds the protein production per hectare of cattle by factor 300. Even the manure from the farm is sold as high quality fertiliser. The shrimps cultivated intensively in the shrimp farm on 1 hectare substitutes 100 hectares of extensive shrimp farming in the countries of origin, e.g. Thailand, Vietnam, Brazil. The waste that comes from an extensive shrimp farm in tropical regions is destroying the mangrove forests and other natural habitats of many different species of natural life. Social consequences of the deterioration of local habitats and structures due to shrimp farming is also a serious problem in tropical regions. The shrimp farm in Rotterdam is land-based and has controlled exchange with the exterior environment. The use of antibiotics is not necessary because the shrimp and the water in which the shrimp live do not interact with the external elements. No bacteria or viruses will enter the farm. Strong UV lights will neutralise developing organisms. In addition, the farm will be heated with waste heat from the E-On power plant.

The algae farm

The algae farm, developed in Wageningen, which might be plugged on in the future, will use CO_2. The algae produced are partially fed to the shrimp, and the remainder is sold to companies that use algae in their products, eg health feed, cosmetics and pharmaceuticals. The algae farm is still a research project, but the HSF is willing to further develop and integrate the algae farm in the future. The algae farm is not essential to the HSF and does not influence the business plan at this point, but it could be a valuable addition in the future.

1.3
Protecting the idea

The product cannot be protected, but the Megafisch shrimp farming technology is already patented. Megafisch has developed the technology in the last 15 years and there are reference projects in China and Japan. Megafisch designs and installs fish farms around the world. The Happy Shrimp Farm joint venture will hold the exclusive rights for the North-West European market. The rights are now owned by Megafisch and will be transferred to the this joint venture. Bertus Dekker Seafood, represented by Arie Ouwehand Sr., is a strong partner which will distribute the produced shrimp, whether “alive”, “never frozen” or frozen. The involvement of strong partners, who together cover all the important aspects of the business chain, results in a powerful consortium for developing the live and never frozen shrimp market. Close cooperation with Bertus Dekker Seafood guarantees access to its distribution network throughout Europe. The brand names of the shrimp – “Dutch Gamba”, “Hollandse Gamba” and “Happy Shrimp” – will be protected. The situation, created by B&G (e.g. its developed network and knowledge about co-siting and aquaculture) is unique and will assure the partners a sufficient head start. Besides, the economic benefits gained from starting in the Port of Rotterdam will make the HSF feasible in Europe.

1.4
Patenting the idea

Megafisch holds a worldwide patent for several components of the shrimp farm system (Patent nr: 29917892.7, IPC A01K 63100). The algae reactors are patented by dr.ir. R. Wijffels, TU Wageningen en ir. Obbo Hazewinkel, Techno Invent. The development process of the first pilot reactor will be implemented in 2006. The final goal is a plug and play Shrimp Algae Farm with heat exchange technology for implementation at other industrial sites around the world. The knowhow for operating the farm is exclusively held by Megafish and is therefore sufficiently protected.

1.5
Confidentiality agreement

Confidentiality agreements are signed between B&G and the partners, Megafisch Germany, University of Wageningen, Techno-invent and the Port of Rotterdam. Any other party with access to the information has to sign a confidentiality agreement with B&G.

I.6 Implementation

B&G has been researching and developing the idea since April 2004. B&G is penholder and communicator between the different stakeholders taking part in the realisation process. In order to speed up the implementation and investments, several strategic partners are involved in the process. The farming knowhow comes from Megafisch, which will supply the system and the training of the personnel. The distribution of the shrimp throughout Europe will be done by Bertus Dekker Seafood, which has the infrastructure to operate and participate in the introduction of “never frozen” and live shrimps from Rotterdam. The Rotterdam Port Authority, the Ministry of LNV, EDBR and Rom Rijnmond (R3), BDO, KPMG, NIB consult are cooperating in the project and are looking forward to its realisation. The location at Breekwater near the E-On power plant is available. This location of 1 hectare will be transferred to the Happy Shrimp Farm BV. The Port authority plays an important role in facilitating the transfer process.

2.
Management team

2.1
Composition

The management team of the Happy Shrimp Farm is composed of Bsc. Gilbert Curtessi and Bas Greiner Msc., they will take care of the day-to-day business for at least three years. The additional knowledge which is required for operating the shrimp farm comes from a Chinese project leader (Winson Chi) who will train the management team and other staff. Permanent staff will be hired in Rotterdam. These should be persons with an interest in shrimp farming and industrial ecology. The universities of Wageningen, Beijing and Shanghai can provide additional staff; Chinese students can do an international internship at the shrimp farm for a period of six months.

2.2
Relevant skills and experiences of the team

Gilbert and Sebastian have known each other since March 2003, having met at the Rotterdam Port Authority. The shared interest for industrial ecology, environment and entrepreneurship brought them together. The idea of producing shrimps with waste heat was born after discussing possibilities for using so-called useless waste heat. They started a company together in April 2004 in order to push

forward the start-up of the first shrimp farm powered by waste heat in NW Europe. The team experienced many good times but also had its drawbacks. The latter were viewed seriously but overcome with a good conversation and lots of positive energy.

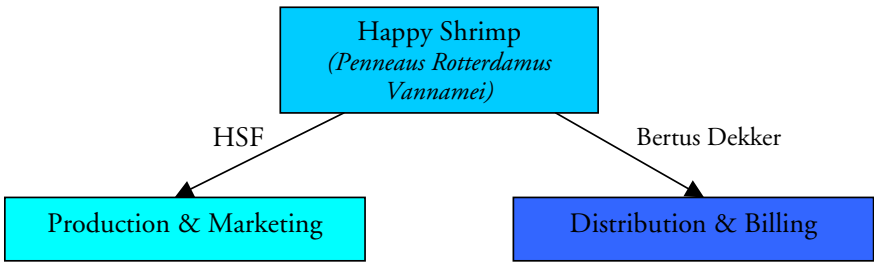
Stimulating each other is the most essential thing when working on this project and at B&G. In the absence of one of us who was on vacation, the business had to be taken care of by the other member completely. Having worked together since April 2004, the tasks have naturally been divided along the lines of interest. Gilbert takes care of the organisation, marketing and public relations. Sebastian takes care of technical and financial matters. Of course, important matters are discussed by both team members. Both members have great interest and aptitude for technology, biology and economy. The synergy which is present in the management team is hard to find elsewhere and it is definitely rewarding and challenging enough to let this continue.

2.3 Experiences and skills lacked by the team

Experience not present in the management team is the specific biological knowledge of shrimp farming. This however is being taken care of by attracting this knowledge from outside. Megafisch will supply a Chinese farming consultant, who will operate the farming process for one year. During that time, the management team will be able to learn all the ins and outs of shrimp farming. An internship in Urumqui, a 1000t shrimp farm, is being contemplated. The Urumqui farm operates the same system as that of the HSF. The Happy Shrimp Farm does not have access to the market yet, but the trading and distribution will be covered by Bertus Dekker Seafood B.V. This strategic partner has know-how of the market through 40 years of experience and has developed a widespread fresh fish distribution network in Europe.
The project exceeds both managers' track records and experience but sets a clear framework and challenge for them. External advice is acquired the moment it is necessary. Examples of coordinated help are the facilities of the Port of Rotterdam, ROM Rijnmond, LNV, BDO, NIB consult, KPMG audit, The Economic Development Board Rotterdam and several coaches from the business community in the Netherlands.

3. Marketing

The marketing of the shrimp is in the hands of the HSF. The Happy Shrimp will have certain unique selling points; the freshness/quality and the socially responsible way of farming will create its own niche market. These aspects have to be communicated in the right way by working together with partners, like Novib, who has already pointed out the negative effects of shrimps farmed in tropical regions. Yet another important contact will be the Chinese restaurant association. Distinctive packaging will be designed for the never frozen shrimp from Rotterdam. It will be inspired by the Ben and Jerry (expensive, good quality, socially responsible ice cream) approach. The marketing of the shrimp will be done by the HSF. Bertus Dekker Seafood does the regional and European distribution and billing.



The shrimps will be delivered to wholesalers or directly to restaurants. The restaurants will get an aquarium for displaying the shrimps; there will be another aquarium in the kitchen filled with live shrimps for food preparation. It is also possible to have never frozen shrimp in the kitchen and the live ones in the display aquarium. The advantage of having live shrimps in the kitchen aquarium is that fresh shrimps can be taken from this “storage” aquarium every day, thereby guaranteeing the freshness of the product. At the wholesaler, large storage tanks

equipped with oxygen dispensers will be used, like the ones at the fresh fish markets in Paris, Madrid and China.

3.1 Unique selling point

A few unique selling points will distinguish the Happy Shrimp from other frozen shrimps.

- Shrimps are sold as “never frozen”
- Shrimps are sold alive
- Live shrimps in storage at farm level, so “Order on demand” is possible
- Steady supply
- Fixed prices throughout the year
- The shrimps are farmed in a controlled environment
- Sustainable and socially responsible farming practices
- Controlled quality and grading
- Compliant to the general food laws
- Track and traceable

3.2 Customers

Customers which are fond of shrimps can be divided into two groups:

1 Ethnic people such as the Chinese, Mediterranean and Caribbean people, which have a common understanding of the extra dimension in quality offered by fresh and live shrimps. These communities are strongly attracted by traditional or national products from their homelands. The quality of fresh and live shrimps is something one does not have to explain. In China, the price of shrimp devaluates with 50 % after it has taken its last breath. The emotion and experience of eating fresh products is becoming more popular. wok, sushi, tapas and finger food restaurants is a growing market in the Netherlands and the major cities in Europe.

2 The food connoisseur favours the taste and texture of a live shrimp over a frozen one. Live shrimp means as fresh as it can get, while frozen fresh shrimp means at least older than six weeks.
The difference in texture and taste comes from the fact that the enzymes in the head of the shrimp will digest the shrimp meat after it is deceased. Shrimp should be eaten within a few hours after they have been killed in order to avoid this effect.

3 The socially engaged customer knows about the devastating effect extensive shrimp farming has on ecosystems and social structures in tropical regions. He will be able to eat a Happy Shrimp with a clear conscience. The farming system has already acquired a green

label from the Chinese government. The HSF will comply with the EU regulations, Skall/Demeter labels and the process will be certified with ISO and HACCP. Novib is already campaigning against the imported shrimp from tropical regions. We can offer a sustainable and socially responsible substitute from Rotterdam.

3.3 Differentiate from competition

The shrimps produced by the HSF can be differentiated from other shrimps on the following aspects:

Freshness

Fresh shrimps of the day means that they are not frozen today. This is how the competition is selling its product. We will have the only real fresh shrimps of the day, caught in the morning and eaten in the afternoon. The only substitute is a live shrimp from Ecuador transported by airplane, which sells at 28 €/kg. Moreover, the frozen 1-kg shrimp packages contain only 800 grams of shrimp; the rest is ice. In our case, what you see is what you get: no net weight deception or quality loss resulting from the frozen state of the product.

Environment

The impact the farming process has on the environment is essential in assessing the environmental aspects of the product. The regular way of farming shrimp requires vast amounts of land, production ratio's are 2000kg/ha. The HSF requires 1 hectare of land and has a productivity of 150-210 t/year/ha. The impact of shrimp farming on the environment is highligted by governments around the world. The Western NGO's often exert pressure, pointing out the devastating effects the disappearance of mangrove forests has on fish populations. As mangroves are the hatcheries for different kinds of fish species, these species will disappear if there are no mangroves anymore. After the Asian Tsunami of 2004, the number of shrimp farmers allowed to resume their shrimp farming activities along the coasts should be reviewed because this is the right moment for governments to put an end to coastal shrimp farms.

Social responsibility

The shrimp farms in tropical regions are destroying the local employment opportunities instead of creating additional jobs.
This social irresponsible behavior is now brought to attention in recent studies of several NGO's. Novib urges consumers to ask their local fish shop about the origins of their tropical shrimp and to supply sustainable alternatives. Supermarkets are aware of their social responsibilities towards society. For example, many retailers, eg. Albert Heijn, are promoting products that are produced in a socially responsible way.
The HSF concept can be exported to third world countries in order to enhance the sustainability and social responsibility of their national shrimp farming industry.

Food safety

Other issues arising when farming shrimp include food safety and hygiene of the product. Food safety and the perception of food safety is higher when the food is produced in a controlled environment with a standardised and certified process. Are antibiotics and other growth accelerating substances found in the shrimp? Dutch supermarkets are very much interested in the food safety of the products they sell. HACCP, ISO certification and track and tracing are important tools to develop an acceptable and safe food chain. All these factors will be complied with and shall be integrated in the complete process.

3.4 Market share

At the moment, global shrimp sales are 4.5 million tones per annum of which 1.2 million tones per year are farmed shrimps. These are mainly frozen shrimps, which are shipped around the world in kg-packages, each containing not more than 800 grams of shrimp. “Live shrimps” are sold (relative to the 1.2 million tonnes) in small quantities in the capital cities of south European countries. The demand for “live shrimps” is a hidden demand, because many ethnic people in the Netherlands know the live shrimp product from their countries of birth, but have excluded these from their diet because they cannot buy them for a reasonable price. Not yet! The market size in the Netherlands is 7,500 tonnes of frozen and fresh shrimps annually.

3.5 Marketing strategy

Product: Fresh high quality shrimps, produced in the local market.

Price: The farm gate price will be negotiated and ranges from 15 to 20 €/ kg for live shrimps. This is still lower than the price of live shrimps from Ecuador, which is 28 €/ kg. In case there is not enough demand for the live shrimps, they can be sold as “never frozen” shrimps for a price ranging from 10-15 €/kg. The shrimps which cannot be sold as “never frozen” shrimps can be frozen and sold for at least 5 €/kg. During the Christmas season, higher prices for all three products are possible. Competition on price, quality, freshness and social/ environmental issues on all three products is possible. The market price will rise when the live shrimp niche market is further developed and a reasonable margin between production and sales is maintained.

Place: farm gate sales, fixed contracts, shrimp bar, high-end catering at festivals and conferences.

Distribution: via BDS from IJmuiden. Other distributors that are positive about the product are: Rungis, Merca Madrid, Tang Frere,

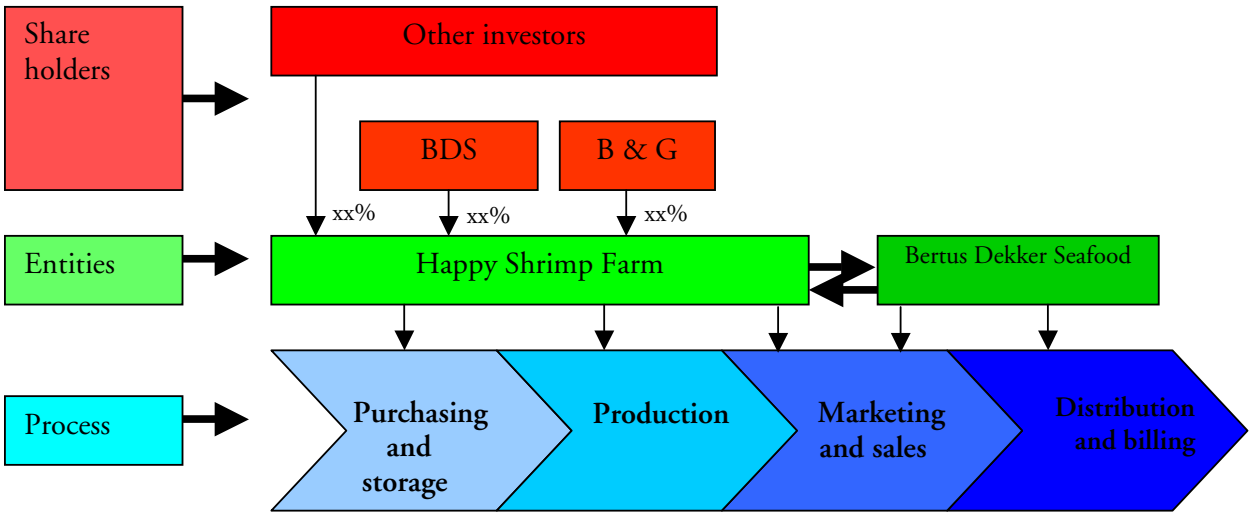
ISPC, Unima, Ledovo group (Russia). There will be a close cooperation between HSF and BDS. BDS will distribute the “live” and “never frozen” shrimps and therefore receive a fixed amount for every kg of shrimps sold. BDS holds shares in the HSF and is interested in getting the highest selling price for the shrimps. BDS activities concerning the HSF shrimp are solely distribution and billing of the shrimp sales. In case shrimps are sold to ISPC (Belgium), they will be distributed by BDS and ISPC will also receive a bill from BDS. The incoming cash from the sales, less the fixed amount per distributed and billed kg of shrimp, goes to the HSF. Shrimps sold directly to customers at the farm gate and paid in cash, are not subjected to the fixed amount per kg.

Promotion: The “Dutch Gamba’s” or “Happy Shrimps” will be promoted mouth to mouth, via websites, newsletters to the industry, presentations at congresses, media (free publicity, because of innovative HSF idea), shrimp bars in Rotterdam. Low profile marketing ensures a ”Dutch Gamba” hype. The HSF will promote the shrimps at the level of the consumers, because the HSF already has a large distributor who will sell the shrimp within his own network.

4. Business system and organisation

The HSF business system is very simple and transparent. It is demand-driven and single-minded in its focus on maximising the output of the process. The farm produces and markets the shrimps, while Bertus Dekker Seafood (BDS) will be the distributor. The demand in the market will further grow through market channel development and further product diversification.

The business system for the HSF is as follows:



The utilities, food and post larvae have to be purchased. The production process is the grow-out phase of the shrimps; they stay in the raceways for 4 months. The HSF shrimps are branded, sold and distributed with a distinctive name e.g. “Happy Shrimps” or “Dutch Gamba’s”.

Purchasing and storage

The purchasing department is responsible for assuring sufficient utilities, food and grow-out stock. The utilities involved in the production process are: oxygen, water, algae and additives. Oxygen is purchased from Hoek Loos or Air Liquide. An oxygen pipeline is available at the Lyondell location, next to the HSF location. Safety stocks will be held for food and oxygen. The water is pumped from a deep well, which contains salt water. Algae are used as a food in an early phase in the lifecycle of the shrimp. The algae are bought from abroad and later grown at the farm. The additives are chemicals for regulating the water quality and PH e.g. caustic soda and pro-biotics. For the food, there will be one supplier from China and possibly another from Miami. Food is transported per container; certain quantities will be held in stock. The post larvae will be bought in Miami or in China, they will be transported by air. It is possible to buy SPR larvae (Specific Pathogen resistant), which are resistant to certain shrimp viruses. This is different from just pathogen- free larvae, which can acquire a virus later during the outgrowing phase. Compressed air needed to operate the valves and wave creators of the HSF, is available on the E-On site from the compressed air infrastructure. Contracts are set up with reliable suppliers in and outside the industrial cluster for steady supplies at low prices.

Production

The production process is the grow-out phase of the shrimps. Access to the internet-based TOC (Technical Operating Center) has been granted; the TOC holds the information of the system that indicate precisely which actions have to be taken during the production cycles e.g. cleaning, feeding. The Chinese project leader from Megafisch, with years of experience in a similar farm in China, will guarantee that the procedures are executed and that the system will produce shrimps in the first year. There are different production strategies. It is possible to produce between 100-210 tonnes of shrimps according to the chosen strategy. The shrimps accumulate weight at a decreasing rate when they get older. More production cycles of smaller shrimps per year will ensure that the total annual produced tonnage will increase.

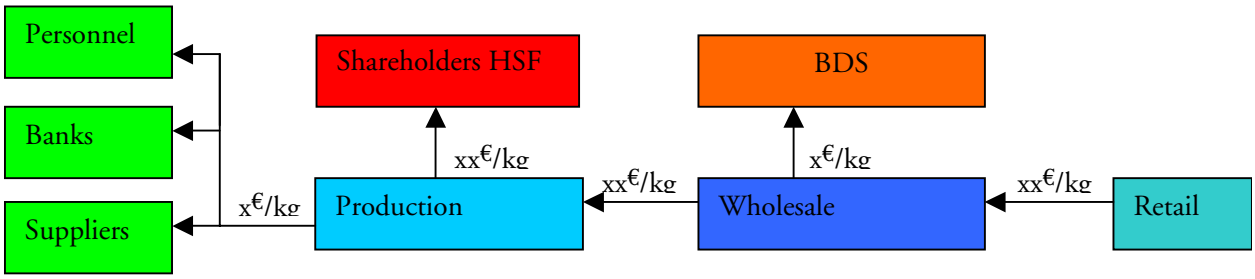
Marketing and sales

Customers want large fresh shrimps, at least 12-15 grams. Chinese people living all over the Netherlands and Europe only focus on the “live” aspect of the shrimp. Market development is accelerated by cooperation with the wholesale distributor. The benefits of this vertical integration are better tracking and tracing possibilities, steady supply at fixed prices for the distributor and a steady income for the producer. Further, the marketing and branding of the product is done by the HSF. The HSF will solely focus on production and marketing the distribution to clients will be done by BDS. The production can be adapted within limits to the demands of the market. Having six race-ways increases the flexibility of the production. It is possible to harvest a batch of 7000-8000 kg of shrimps every two weeks. The shrimps can be kept alive for an additional two weeks after the production cycle, after which 500 kg of fresh shrimps can be harvested every day. This fixed production per day assures a steady price and a steady delivery to the distributor. It should be communicated from the start that the happy shrimps are grown in a controlled environment with no

connection to the sea and without adding antibiotics. The packaging, a plastic net cage, containing 1-2 kg of "never frozen" or live shrimps, will have an informative label with all the necessary information and the brand name.

Distribution

BDS, with a network throughout Europe, arranges the distribution. This strategic partner is crucial for serving a widespread niche market. At the moment, the sourcing department of the distributor contacts its suppliers for fresh products every day, because the catches per day fluctuate and fixed delivery contracts cannot be made. Therefore, the prices of the fresh fish also fluctuate. The HSF offers a fresh product with high margins for a fixed price and guaranteed daily delivery. The fixed "from farm" price including the margin for the farm is set at 15-20 €/kg. The small fish shop will sell them for 25-30 €/ kg.
The value chain is shown below:



4.1 Make or buy

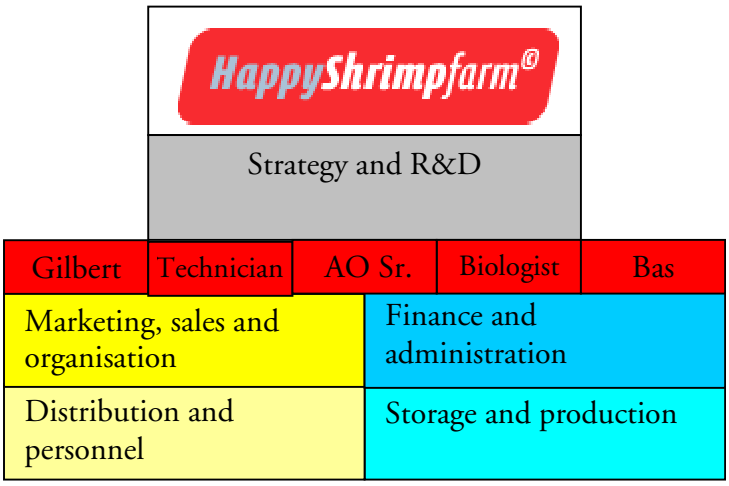
The farm produces shrimps. The shrimp food and the post larvae are bought. The algae are bought as well in the beginning, but will be produced in the farm later when the pilot for the solar collector is ready. The larvae arrive as PL 20-30 days old. The farm will install its own hatchery facility when the production is under control.

4.2 Focus

The farm focuses on the production and marketing of the shrimps. The distribution and billing is done by BDS so that the management team can solely focus on increasing the yearly output of the system and the quality of the product. The management team holds part of the shares and will benefit from maximising production and minimising costs. The same will apply to the partners and investors.

4.3 Functions

The partners handle sales distribution and billing, B&G will take care of production and marketing.



4.4 Values and standards

The values and standards of good conduct and practices are in line with the beliefs of the management team. We want to produce a happy shrimp. In our opinion, the word “happy” is another word for sustainable. It is in our interests to produce a high quality shrimp which is also the most sustainable, socially responsible and healthiest in the market. We will preserve our integrity, even if this is to our financial disadvantage. By certifying our processes, introducing advanced tracking and tracing and getting green labels for the product, we will show that we have a sustainable and socially responsible product. Novib and Milieu Defense have brought the devastating effect shrimp farming has on the natural environment in tropical regions to the attention of a wider public by a recently finished research study (November 2004).

5. Realisation schedule

The realisation schedule is further developed with the final contractor and suppliers. The management of the construction will be coordinated by a local engineering company, with assistance provided by Megafisch. An indication of the process is given below:

Feasibilty

1. Co-site analyses of a sustainable shrimp algae farm in the Port of Rotterdam
2. Feasibility study of shrimp algae farm at the E.on site
3. Market research is performed and proven to be positive.
4. Capacity planning is set at 150 tonnes.
5. Concept design by GTI and Ballast Nedam
6. Financing
7. Start up of building process

Building

8. Identify and secure location with PoR
9. Define drawings and specifications
10. Identify suitable contractors
11. Evaluate bids (inc. market conformity of prices)
12. Hire contractor
13. Supervise construction work
14. Start farming
15. Continue maintenance and supply contracting

6. Milestones and activities

Since the start of the incubator research in April 2004, several milestones have been achieved:

1. Industry and Sustainability seminar
2. Strategy meeting at Port of Rotterdam with LEI, RIVO
3. Strategy meeting at Port of Rotterdam with Nutreco, Skretting
4. Deposit of contract Bass & Gill at chamber of commerce
5. Start-up of the co-site research incubator, 1 April 2004
6. Cooperation with Megafisch and TU Wageningen
7. Cooperation with Msc Industrial Ecology, (Delft, Leiden and Rotterdam)
8. Signing confidentiality agreement with technology partners
9. Visit to Aquavision Norway Stavanger, Nutreco
10. End of and public presentation at World Port Centre, Co-Site research project
11. Workshop Financing Aquaculture Fish-ic Ijmuiden
12. Strategy agreement with ROM Rijnmond – Ministry of EZ and Ministry of LNV
13. Cooperation with Syntens, 10 c analysis, workshop and Livewire finals nomination
14. Start of second phase of Incubator, initiation of co-site research project
15. Meetings with market partners, ISPC, Heijploeg, Den Heijer, Bertus Dekker
16. Paris work visit Rungis/Tang freres
17. Presentation at the EZ Energy Transition Conference 2004 at Nemo, Amsterdam
18. Madrid World Shrimp Conference
19. Winning the KIVI NIRIA innovation and entrepreneurship prize
20. Presentation and adoption by Economic Development Board Rotterdam

21. Work visit China, Urumqi and Beijing, with partners to Shrimp Farm
22. Cooperation with Bertus Dekker, Arie Ouwehand Sr.
23. Presentation at master class of CoP agro industry meeting
24. Finalising report second phase Bass & Gill Incubator
25. Finalising business plan Happy Shrimp Farm
26. Start-up meeting of BV with partners at BDO
27. Meeting with partners at Port of Rotterdam for securing the site
28. Second opinion analyses of business report by NIB consult
29. Development of ISO-HACCP system with track and tracing module
30. GTI group signed on as chief contracter for construction
31. Presentation at the Day of the Future, Ministry LNV, Minister Veerman
32. Work visit Archer Daniel Midlands, Decatur, Illinois

7.
Risks

The major risks faced by the HSF will be covered with insurance from the German- based Wurtembergische Verzicherung, which operates an exclusive insurance agreement with Megafisch projects. The main aim however is to reduce and avoid the occurrence of major failures and their causes. An overview of the most likely risks is stated below, followed by the counter measures.

7.1
Potential risks

Potential risks are a low production capacity and low revenues .
There are risks when the system does not produce to its full capacity, due to biological, technical and organisational causes. Lower revenues can be caused by a lower selling price and/or lower selling quantities.

Biological risks:
1 Diseases or decreased growth rates
Technical risks:
2 Black-outs of the power station or shortage in utility supply
3 Equipment damage in the farm
Organisational risks:
4 Personnel not properly trained
5 Staff is sick
6 Running out of food, energy and utilities
Lower selling price:
7 Economic tides
8 Bad marketing

Lower quantities sold:
9 Bad image
10 Inappropriate distribution channels

7.2 Counter measures

There are different ways of reducing the potential risks the HSF can face during operation. If all the counter measures do not work, the insurance provided by Megafisch in cooperation with the Wurtembergische Versicherung (German insurance company) covers production losses up to a certain amount. The insurance also covers losses in production due to operating errors, defects of construction, material or design failures, fire hazard, storm, frost, short circuit and over voltage. The counter measures are:

Counter measures for biological risks:
- The farm operates its own water cleaning equipment, which is able to neutralise all kinds of unwanted elements.
- The larvae that are stocked will be SPR (Specific Pathogene Resistant) to ensure no viruses can enter the farm through the larvae's.
- Ensuring that the animals have no stress during their lives will make them more resilient against viruses and bacteria; a healthy shrimp will eat and grow big.
- There will also be a SKAL/Demeter label and ISO and HACCP certifications.

Counter measures for technical risks are:
- Back-up technical equipment, such as our own oil/gas fired boiler.
- Having contracts with suppliers of emergency equipment like generators and oxygen, for delivery within the hour.
- Stocks of the most fragile equipment parts are kept as reinforcements in case of such equipment damage in the farm.

Counter measures for organisational risks are:
- An experienced shrimp farm manager from China will operate the system in the first year. The Chinese project manager will be stationed in the farm until the management team and all staff are properly trained.
- There will be enough staff to cover for staff absence. Measures will be taken to ensure a good working environment in the HSF.
- Applying adequate inventory management policies covers the risk of running out of food and utilities.
- Cooperation with strategic trade and logistic partners will allow the team to acquire knowledge of the existing market structure and possible restraints.
- Cooperation with a scientific institution through contact with Wageningen and other knowledge partners assures good assessment and feedback.

Counter measures for low selling price are:

– The shrimp from the HSF will be distributed all over Europe to ensure the access to more people with higher disposable incomes, and who will pay for extra quality and freshness. (Eg. There is a large Japanese community in Frankfurt.)
– Branding the shrimp as high quality shrimp and focusing on the unique selling points covers the risk of having a low selling price at the farm gate.
– Getting the production costs per kg down to 5 €/kg will enable the HSF to sell on the frozen market.

Counter measures for low quantities sold are:

– A potential bad image can be countered by having good information on the packaging. Currently, there is a fisherman who sells fish caught in the Maas to French restaurants as a fresh product from Rotterdam. This means that the industrial image of Rotterdam is not negative for shrimp farmed in Rotterdam.
– In working together with NGO's such as Novib and WWF, the public can be informed about the good quality of the shrimp from the Happy Shrimp Farm.
– By working together with a strategic logistics partner with access to a wide network of fresh fish outlets will ensure the distribution of large quantities.
– B&G will further promote the freshness and good taste of socially responsible farmed "Dutch Gamba's" throughout the world, together with Novib. We have already given a presentation at the Biannual World Shrimp Market Conference 2004 in Madrid, without having realised a farm yet!

7.3
Impact of the different risks

Different risks have different impacts on the operation of the HSF. How serious these risks are will depend jointly on the frequency of occurrence and their possible impact.

Overview; Impact of different risks

Risk	Occurrence	Impact	Counter measure
Diseases or decreased growth rates	Low	High	Available
Power station black-outs	Very low	Average	Not available
Equipment damage in the farm	Low	Average	Available
Improperly trained personnel	Low	High	Available
Staff is sick	Low	High	Available
Running out of food, energy and utilities	Low	High	Available
Economic tides	Possible	Average	Available
Bad marketing	Low	High	Available
Bad image	Average	High	Available
Inappropriate distribution channels	Low	High	Available

7.4
Worst case scenario

The worst case scenario is when the farm does not produce at full capacity and there is no market for the shrimps due to bad image and high prices.
When diseases hit a certain raceway, it will be emptied immediately and cleaned. All raceways have their own recirculation system and are not interconnected. After cleaning, the raceway can be restocked. The loss will be what has been invested up to then in to the production of the affected batch. We learnt from a shrimp farmer whom we have visited in Cyprus that he has operated a farm for two years without diseases.

If there is no market, the shrimps could not be sold for the targeted high prices. The shrimps would have to be frozen and sold on the frozen market, which can easily absorb the quantities produced by the HSF. By doing so, an average of 70-90% of production costs can be covered. Bad image could always be a problem, but bad image could only destroy additional added value up to the point of what is paid for bad image shrimp. The shrimp can still be sold at prices ranging from 70-90% of the production costs. There is a lot of bad image shrimps in the market and these can still be sold at large quantities at a lower price.

8.
Finance and equity

B&G and AO sr. have set up a joint venture, which holds 100% of the shares in the HSF. The HSF joint venture is open for investments from other parties. Bank loans will be more forthcoming with reduced loan coverage, e.g. 40-50%. The amount that has to be attracted from banks depends on the way the different components are financed.
The components are: six concrete raceways, greenhouse, sustainable infrastructure for heat transfer and the installation of technical and farming equipment. Various grants are available for the sustainable transfer technologies. An overall investment subsidy is also feasible.

List of persons interviewed and organisations visited

Internal meetings at the WPC

Organisation:	Havenbedrijf Rotterdam
Interview:	Vincent van Os, commercial affairs
Content:	Co-site locations, possibilities, functional relations

Organisation:	Havenbedrijf Rotterdam
Interview:	Joris Hurenkamp, commercial affairs
Content:	Co-site locations, possibilities, functional relations

Organisation:	Havenbedrijf Rotterdam
Interview:	Jim Liekens, commercial affairs
Content:	Co-site locations, possibilities, functional relations

Organisation:	Havenbedrijf Rotterdam
Interview:	Guido Dominquez, commercial affairs
Content:	Co-site locations, possibilities, functional relations

Organisation:	Havenbedrijf Rotterdam
Interview:	Victor Schoenmakers, director Departement of Strategy
Content:	Co-site locations, possibilities, functional relations

Organisation:	Havenbedrijf Rotterdam
Interview:	Sander Rijsdijk, commercial affairs
Content:	Co-site locations, possibilities, functional relations

Organisation:	Havenbedrijf Rotterdam
Interview:	Bart-luc Olde Hanter, commercial affairs
Content:	Co-site locations, possibilities, functional relations

Organisation: Havenbedrijf Rotterdam
Interview: Anne van Delft, corporate development
Content: Sustainable industrial concepts

Organisation: Havenbedrijf Rotterdam
Interview; Marc Evertse, commercial affairs
Content: Co-site locations, possibilities, functional relations

Organisation: Havenbedrijf Rotterdam N.V.
Interview: Maurice Bosch, corporate development
Content: Fishing branch, marine relation with the port

Organisation: Havenbedrijf Rotterdam N.V.
Interview: Bram van der Staaij
Content: Agro-industrial concepts

Organisation: Havenbedrijf Rotterdam N.V.
Interview: Wijnand Schonewille
Content: Sustainable industrial concepts

External meetings in the field
Interviews from April until August 2004

Organisation: Faculteit aquacultuur Wageningen
Interview Peter van der Heiden
Content: Fish farming, bio scientific knowledge, review start document

Organisation: Wageningen UR, Biotechnion
Interview: Rene Wijfels
Content: Algae reactor, cooperation, non disclosure agreement

Organisation: Megafisch
Interview: Werner Gaus
Content: Shrimpfarming technology, cooperation, non disclosure agreement

Organisation: Wageningen UR
Interview: Henrice Jansen
Content: Student, animal welfare and health

Organisation: TNO-MEP
Interview: Ron Oorschot
Content: Fishfarming, systemen, network

Organisation: Notaris Nieuwland
Interview: van Nieuwland
Content: Start-up, incubator

Organisation: Van der Geijn
Interview: Piet Koet en Chris Luttikhuys
Content: Organisation and management

Organisation:	Novem
Interview:	Mvr Heamers
Content:	grants, O&O, DEN

Organisation:	InnovatieNetwerk
Interview:	Jan de Wilt
Content:	Agroproduction parks, project development, nat. platform

Organisation:	Chamber of Commerce
Interview:	Frans Wuyts
Content:	Technostarters, start-up, incubator

Organisation:	NIB capital
Interview:	Gabriel de Groot, Caspar Boendermakers
Content:	Financial analyses, risk analyses, agro production parks

Organisation:	BECO
Interview:	Michel van Wijk en collega
Content:	fishfarming and environment, ecosystems

Organisation:	TWA dag beursgebouw
Interview:	readings on sustainable technologies
Content:	international trade and knowledge

Organisation:	Landbouw Economisch Instituut
Interview:	Luc van Hoof
Content:	Fishery and policy, research and development

Organisation:	Catvis
Interview:	Martin Oomen
Content:	System developer, technology

Organisation:	Ecomares, Duitsland
Interview:	Uwe Jebens
Content:	System developer, technology

Organisation:	Novem EZ
Interview:	workshop
Content:	wbso grants

Organisation:	Nutreco
Interview:	Frank van Ooijen
Content:	Strategy, communication, product

Organisation:	Nutreco / Skretting
Interview:	Hans Vink
Content:	biology, feed, fish farming as a lifestyle

Organisation:	Seafarm kamperland
Interview:	Adri Bout
Content:	Fish farmer, system developer, technology, economy

Organisation:	DCMR
Interview:	Hans Knippels
Content:	Vergunningen, WMB, WVO, bouw, co-site inrichtingen
Organisation:	Heiploeg garnalen
Interview:	Martin Nijboer
Content:	productie, markt, logistiek
Organisation:	R3 / ROM Rijnmond
Interview:	Chris Jordan
Content:	Co-siting, duurzame ontwikkeling, incubator project
Organisation:	Aqua vision, Norway
Interview:	300 fish professionals
Content:	Production, systems, feeds, general information, network
Organisation:	NEVEVI
Interview:	Wim van Eijk
Content:	Fish farming, sector organisation, network
Organisation:	Nerefco
Interview:	GJ Smeenk
Content:	Co-siting, waste heat and energy supply, measure cooperation level
Organisation:	IC Fish
Interview:	Bas Bijker, Rita Springer
Content:	Regional economic initiative, relation with projects RIVO
Organisation:	HESI
Interview:	Sander de Bondt
Content:	Systems, leverancier, Technologie
Organisation:	EUR
Interview:	Mary Ann Cheung
Content:	Chinese markets
Organisation:	Biolife
Interview:	Andre Bennwitz
Content:	Fish farming Indonesia, bio products
Organisation:	Prosper media
Interview:	David van Bearle
Content:	Interview Utilities magazine
Organisation:	TU Delft, Industrial Ecology
Interview:	Gijsbert Korevaar
Content:	Systemapproach and methodology, student project

Organisation:	E.ON Maasvlakte
Interview:	Cees Corevaar
Content:	Co-siting, waste heat and energy supply, measure cooperation level

Organisation:	BP-Nerefco
Interview:	Paul Westerman
Content:	Co-siting, waste heat and energy supply, measure cooperation level

Organisation:	Redenco
Interview:	Pierre Brandts
Content:	Heat and energy technology, water pumps and pipes

Organisation:	Odfjell
Interview:	Wim van der Sanden
Content:	Co-siting, waste heat and energy supply, measure cooperation level

Organisation:	Prototype
Interview:	sven en chiel
Content:	Desing logo and branding

Organisation:	Greentex
Interview:	Dhr Verbakel
Content:	Greenhouse technologies, construction

Organisation:	Caldic chemie
Interview:	Joop van Caldenborgh, Dhr WJ Lucker
Content:	Co-siting, rest heat and energy supply, measure cooperation level

Organisation:	Sunergy
Interview:	Benno Wiersma
Content:	Sustainable development, project investments

Organisation:	Syntens, Live wire
Interview:	Maarten Baas
Content:	Livewire

Organisation:	Winkelman construction
Interview:	Dhr Winkelman
Content:	Building the shrimp algae farm

Organisation:	Rabobank
Interview:	Michiel Klompenhouwer
Content:	Market development, aquaculture

Organisation:	Min Agriculture
Interview:	Arjo Rothuis
Content:	Fisheries, aquaculture, nat. platform

Organisation:	Flevum network
Interview:	Bert Sigmund
Content:	Network meeting, presentation of project