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# Description

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**Abstract**
Feasibility studies are conducted to rationally evaluate strengths and weaknesses of a business opportunity. Feasibility study guidelines are prepared to achieve the most effi-cient and informative feasibility evaluation providing a robust basis for decision on new investments and technology transfer.
Within Aquabest-project, feasibility study is used to identify and characterize the most important bottlenecks for the development of the aquaculture sector in the Baltic Sea Region (BSR). Aquabest feasibility study will be focusing on innovative land-based farm concepts, to identify effective, functional and innovative measures for solving possible major barriers for a sustainable and competitive environmental efficient aquaculture sector in the region. However, the guidelines can be tailored to fit feasibility evaluations of other potential farming technologies.

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# 1. Aim and main output

Feasibility studies are conducted to rationally evaluate strengths and weaknesses of a business opportunity. Feasibility study guidelines are prepared to achieve the most effi-cient and informative feasibility evaluation providing a robust basis for decision on new investments and technology transfer.

Within Aquabest-project, feasibility study is used to identify and characterize the most important bottlenecks for the development of the aquaculture sector in the Baltic Sea Region (BSR). Aquabest feasibility study will be focusing on innovative land-based farm concepts, to identify effective, functional and innovative measures for solving possible major barriers for a sustainable and competitive environmental efficient aquaculture sector in the region. However, the guidelines can be tailored to fit feasibility evaluations of other potential farming technologies.

# 2. Objective of the study

The overall objective of the feasibility study is to investigate the feasibility and the possibility of developing the aquaculture production in the BSR country or region, by implementing technologies known from the Danish model fish farm concept.

The specific objectives are:

- To identify the requirements of the market in the specific country or region
- To estimate the demand for farmed aquatic organisms on the local markets as well as the regional markets
- To create an overview of the production costs in relation to the market require-ments
- To make an overview of technology level of the sector, educational skills and expe-rience in aquaculture, in the specific country/region
- To identify any critical risk factors, which have to be monitored and/or mitigated.

# 3. Contents of a feasibility study

## Introduction to the country/region

1. Population structure: i.e. age profile, educational level, employment, social condi-tions, distribution of settlements, etc.

2. Geography, economics and political conditions of the country: i.e. landscape profile, ge-ology, water resources and water quality and availability, national and regional economy and national and regional political conditions, international relationships, etc.

3. Infrastructure and access to markets: i.e. logistics from establishment of farm (availability of equipment, skilled management and labor, availability of fry/brood stock, availability of high quality feed, energy (electricity,..), roads, processing, mar-keting and markets.

4. Review of climate, i.e. climatic conditions in relation to sustainable aquaculture produc-tion.

**Comments:** Assistance from local partner is important for collecting this basic information for the in-troduction to the feasibility study.

## Current situation

1. Policies and legislation: i.e. National policy, strategy, legislations on aquaculture produc-tion and international relationships/obligations, etc.

2. Government and sector policies: i.e. National/regional policies in relation to aquaculture production, environmental protection/environmental legislations; it shall be considered, whether a development of the sector is possible under the existing legislation and sector strategy.

3. Fisheries administration in the country, i.e. administration of the fishery sector in-cluding aquaculture production.

# Environment and ecology

1. State of the environment with respect to eutrophication in the country/region and potential aquaculture activities. This also includes legislation related to waste water purification, discharge, requirements of recipients (max. content of e.g., nitrogen, phosphorus and organic matter in discharged water).

2. Endemic and introduced fish species in lakes and rivers of the country/region.

3. Fish diseases in local fish stocks i.e. Parasites, bacteria and virus diseases.

4. Current state and developmental bottlenecks legislation and sector strategies.

5. Current state of aquaculture in the country/region and potentials for future aquacul-ture production.

6. Developmental bottlenecks for aquaculture sector in the country/region.

**Comments:** This area of the feasibility study shall describe the relevant legislation regulating the industry, and identify potential bottlenecks, and governmental sector policies. In connection with this information the potentials for farmed species, volumes and main areas of location of the farms, as well as the general technical level of the farms shall be described and evaluated.

Assistance from local partner is important for collecting this basic information.

# Farmed fish markets

1. Import and export of farmed fish to the region or country, i.e. statistics, species, processing industry.

2. Processing and Product profile, i.e. description of the processing industry including technical level, veterinary and hygienic standard, level of product differentia-tion.

3. Marketing, distributing channels and pricing structure, i.e. efficiency and potential improvements in sale of aquaculture products.

4. Future, i.e. potential for profitable marketing/sale of aquaculture products in the country/region/export.

**Comments:** The collection of market data will be done in collaboration with local partners. The methods used for collecting data shall be a combination of interviews with active peo-ple and stakeholders in the industry and internet searches. The data collection can be supplemented with questionnaire interviews within the value chain representatives, i.e., fish farmers, processors, wholesale and large fish mongers.

It is important that all information is highly valid. The methods will be described in detail in the succeeding case study plan.The main purpose is to describe the current situation in the fish market and development trends.

# Price competitiveness analyses

1. Production costs, i.e. assessment of total cost of production of relevant species (see also 8.0 Cost structure evaluation).
2. Feed costs and quality assessment, i.e. ingredients, processing and feed manufac-turing, imported or locally produced, transport.
3. Fingerling costs and quality assessment.
4. Labor costs and educational skill and experience in aquaculture work.
5. Slaughter costs i.e. labor and connected costs.
6. Packaging and distribution costs.
7. Transport costs, i.e. all kind of transport until consumption of the fish.
8. Waste disposal, i.e. requirements to waste water treatment.
9. Use of water, i.e. limitations to use river water, ground water and price.
10. Energy costs.
11. Production cycle; description of production cycle including an evaluation of the fish market situations and the conditions of the current fish quality in the market.
12. Price competitiveness on global markets, i.e. what are the challenges for the market of this country/region in relation to f. ex. import of cheaper aquaculture products

**Comments:** For the price competitiveness analyses it is essential that the price and costs are valid. The price and costs shall be based on list prices and cleaned for discount schemes. However, list prices may vary from area to area or time of day etc., and therefore the price or cost of each item will be expressed as a range, instead of an exact figure. The information for the analysis is generated by contacting manufacturers and suppliers, combined with personal contacts and a questionnaire to selected primary producers.

# Preconditions of a model farm

1. Requirement, permits and authorization according to legislations for aquaculture in the current region or country. Some of the information can be transferred from WP 3 to this chapter, and legislation issues are done with reference to chapter 2.

2. General SWOT can be made in connection with the general conditions, as Environmental impact, production capacity, energy consumption, and climatic footprint etc.

3. Land requirements: Land requirement due to the chosen design of model farm.

4. Energy demand: Energy consumption due to production and the chosen farm de-sign.

5. Water quality: The quality of the water needed in respect of the design and the spe-cies of fish produced i.e. temperature, pH and oxygen level.

6. Water quantity: The necessary amount of water needed in the chosen design and production volume.

7. Production: The chain from the farmer to the consumer must be described and possible bottlenecks must be identified.

8. Logistics i.e. infrastructure in the region, access to the processing industry or mar-ket, compared with the time the fish must be on the road.

9. Educational skills i.e. the average educational level for a typical employed on a fish farm and education programs within fish farming are described.

10. Management skills: Available management systems are described together with an evaluation on suitable systems from related areas.

11. Suitable climate for cold water aquaculture. By curves the fluctuations in tempera-ture, pH and oxygen levels are described.

**Comments:** Topic 6.9 and 6.10 should be described with very high attention due to the fact that they are the key elements in the success for implementation of the model farm concept.

# Establishing standards for model farm units

1. Nature of investment: The investments are separated in Buildings, construction works, water supply and equipment.

2. Production strategies i.e. procurement strategy, sales strategy and detailed produc-tion plan (it is advisable to make a certain standard for these plans and strategies).

3. Technology: Is described with background in “Farming of freshwater rainbow trout in Denmark” by Jokumsen and Svendsen, 2010.

4. Lay-out: i.e. parallel or serial connected raceways or tanks with circular flow.

5. Land area: Necessary area for the chosen lay out including area for constructed wet-lands and area for services the facilities. It should be taken into consideration whether the available land is big enough to realize future plans for expansion.

6. Water supply: Water from borehole or from river stream, possible fluctuations in the wa-ter supply are described.

7. Waste water treatment: Particle i.e. removal by micro siewes, sludge cones, particle fil-tration, done by fixed media filter, moving bed filters, nitrate filter and constructed wet-lands.

8. Production plan: Detailed production plan; at least the plan must cover 3 years.

9. Expansion plan: Based on the market demand and must cover the following is-sues: Product produced markets and sale and capacity requirements.

**Comments:** The standard fish farm units will be described according to Jokumsen and Svendsen 2010, for further evaluation and calculation for the feasibility of the concept.

# Cost structure evaluation

1. Investments separated in Buildings, construction works, water supply and equip-ment. Investments costs including depreciation and capital interest rate.

2. Variable costs: See Chapter 5.0, and apply all variable costs to the case farm.

3. Production volume estimations based on e.g., biological growth models.

4. Cost estimation of various recirculation technologies. Investment costs and run-ning costs must be compared between different lay out i.e. parallel raceways, serial con-nected raceways and tanks with circular flow. Different methods such as cash-flow anal-ysis can be applied.

**Comments:** Already existing model should be fitted into cost structure of the local conditions

# Environment and Legislation

1. Environmental impacts of aquaculture i.e. Phosphorus, nitrogen, organic matter load.
2. Types of waste associated with aquaculture and their environmental impacts i.e. particles, dissolved matters, CO2 footprint.
3. Waste reduction and treatment and recycling i.e. mechanical filtration, biological filtration either fixed media or moving bed media.
4. Biological and chemical environmental risks.

**Comments:** Based on the reports “Farming of freshwater rainbow trout in Denmark” by Jokumsen and Svendsen, 2010 and report nr. 193 – 8 from DTU Aqua dealing with the model Fish farm concept a prediction of the total environmental impact from a number of model farms will be calculated. At company level the environmental impact will be pre-dicted by using a Nutrients recirculation, model based on the effluent from the standard model farm units.

# Assumptions and risks

1. Project risks i.e. pollution of the water source, energy failure, temperature, pH and oxygen fluctuations.
2. Sector tasks: Proactivity in sector legislation.
3. Financial and economic risks: Interests of the invested capital interest of standing stock, compared to the investments.

**Comments:** The assumptions and risks will be described in general terms due to the fact that the risk can vary from region to region.

# Final conclusions on the model farm concept compatibility in the current region or country

1. Human resources: Will be evaluated in SWOT analysis.
2. Economic and financial feasibility: Will be evaluated in SWAT analysis and must be supplemented by key figures over investment costs and running costs /produced kg of fish.
3. Appropriate technology: To be done in a SWOT analysis.
4. Ecology and environment: To be done in a SWOT analysis.
5. Concluding remarks on the sustainability assessment: Summarizing the feasibility study key results combined with identified bottlenecks and problem areas as local legislation, local market and supply change, etc.

# References

Jokumsen, A. & Svendsen, L. M. (2010): Farming of Freshwater Rainbow trout in Denmark, DTU Aqua re-port219-2010 – Follow link: http://www.aqua.dtu.dk/upload/dfu/pulikationer/forskningsrapporter/219-10_farming-of-freshwater-rainbow-trout-in-denmark-v2.pdf

Svendsen, L.M., Sortkjær, O., Ovesen, N.B., Skriver, J., Larsen, S.E., Bouttrup, S., Pedersen, P.B., Ras-mussen, R.S., Dalsgaard, A.J.T. and Suhr, K. (2008): Modeldambrug under forsøgsordnin-gen. Faglig slutrapport for “Måle- og dokumentationsprojekt for modeldambrug”. DTU Aqua-rapport nr. 193-08. In Danish.