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Arctic char Fisheries on land

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Abstract

The Aquaculture industry in Norway is the second largest industry and Norway is the largest exporter of salmon in the world. Thousands of salmon farms exists along the coastal and new technology land based salmon farming also started in Norway but farmers are producing only salmon smolts. Arctic char is another fish species that is harvested in Norway, but the char industry is still so young. Arctic char is cold-water fish that belongs to the Salmonidae family and can be anadromous or landlocked and can complete its life cycle in land-based systems. Arctic char farming is in practice in different parts of the world such as Iceland, Canada, Sweden, and Norway. Char Genetic improvement and breeding programs were conducted successfully in Iceland and Sweden. Iceland is the major producer of char in the world. Klosser innovasjon AS launched a char breeding program in 2015 in the inland county with the aim to develop sustainable land-based fish farming. Arctic char is selected by Klosser innovasjon AS as farm fish. Inland county is selected by investors as it is rich with natural resources (Freshwater, land, and breeding environment). At breeding, station-eyed roe is produced by breeders for sell to char farmers in the inland counties, and national and international markets. Inland county is the target market for the Klosser innovasjon AS. They are planning to establish a company for char breeding projects. Arctic Red AS will be a start-up future company that will be established by Klosser innovasjon AS with the goal to maintain the breeding project by producing eyed roes. The company will sell the roes to char farmers so that they will establish char farms in the inland counties. The aim of the thesis is to develop a successful business plan for the future company. Different methods such as value chain analysis, SWOT analysis, value proposition canvas, and business model canvas are used to develop a business plan. Value chain analysis gave a close overview of the activities that take part in developing the value for the target customers. SWOT analysis showed the company can grow in the future and fry can be a potential product in the future with eyed roes, but the company has very few potential customers which is a threat to the sustainability of the company. A successful business plan was developed for the Arctic Red AS with a yearly budget (roundabout 2 million with the production of 1,15 million-eyed roes). and future projection after analysis by using all the above-mentioned methods. The company can keep the project by delivering the right number of roes to target customers. The company will produce 2,5 million eyed roes within 2025 to meet the demand for national. As market analysis at national and international market showed the demand for Norwegian char in future.

1. Introduction

The Global aquaculture industry is developing and expanding rapidly (Subasinghe, Soto, & Jia, 2009). As it is an economically profitable industry. Moreover, the World population is increasing day by day and fish farming will be the key source for meeting the food demands for the growing population in the future (Bjelland et al., 2015). Asia is the major producer of seafood in the world (Bostock et al., 2010). However, Norwegian salmon industry is dominating worldwide (Liu, Olaussen, & Skonhoft, 2011) by producing and exporting large numbers of salmon (Olsen & Osmundsen, 2017). Economy and employment rate in coastal areas majorly depend on the aquaculture industry (Maroni, 2000). Aquaculture industry in Norway is strictly regulated by laws and regulations, Ministry of fisheries is the main regulatory authority which sets the laws and regulations for fish farming and licensing, and work closely with the environmental and pollution control authorities (Maroni, 2000).

The salmon farming at commercial level began in 1970s with limited production sites and has been developed and expanded rapidly along the coastal line (Norway, n.d). The Salmon industry is facing sustainability issues from last few years and production volume rate is affected per year (Maroni, 2000). This is due to fish escape from the open sea cages, salmon lice and chemical treatment (Olsen & Osmundsen, 2017). Extensive and non-sustainable development of salmon industry has led to many issues which are affecting biodiversity in a negative way (Olsen & Osmundsen, 2017). New sustainable production methods have been developed for sustainable fish farming such as RAS and Semi RAS. Land based RAS is sustainable technology which is used by different countries such as Denmark, Sweden, Finland, Iceland, and Norway etc. Land-based fish farming has opened new doors in the aquaculture industry. This technology is a satisfactory solution to solve the salmon production issues. As one can have a good control on internal and external environment. Although cost for land-based salmon farming is higher than sea-based but with the good lice control production can be increased and production cost can be managed by establishing industry near larger consumers (Bjørndal & Tusvik, 2019).

Arctic char production in Norway is low and salmon land-based technology can be used to improve the char industry in Norway. Arctic char is another fish in Salmonidae family. It is a cold-water fish and can grow at low temperatures. This advantage makes the char farming attractive and gives a competitive advantage. Arctic char is a very delicate food fish due its red meet colour and a fine taste due to shorter muscle fibres. It is classified as semi fatty fish

and has high omega 3 content as compared to other fish species which people eat in Norway and has unique taste (Gunnarsson, 2006). Furthermore, char is served in different forms such as boiled, smoked, baked etc (Glandfeld, 1993). Arctic char farming has been started in different countries on commercial level, (Neil, Thompson, & Albalat, 2013). According to Seafood Watch report Iceland and Canada are the major producers of Arctic char in the world but still production of Char is limited as compare to salmon production (AAC, 2019).

Klosser innovasjon AS assists the business community in inland region by introducing new and innovative business ideas. Their focus is to use the natural resources in the inland region for establishing the new industry. As Norway needs more sustainable industries to maintain its economic position. Klosser innovasjon AS introduced the idea of land based freshwater fish farming and they took a start in 2012 and launched the project arctic red (Arctic char breeding project). land-based farming was selected for the inland county because there is availability of fresh water, space for farming, and farmers which are interested in new farming industry. They selected Arctic char for land-based fish farming. Arctic char species belongs to the salmonid family that can be anadromous or landlocked (Tone Blixøen & Johansen, 2017). In 2014 Klosser innovasjon started two projects with the help of regional research fund Inland and Norwegian breeding community Hamar with the aim to produce char roe with selected traits. The second part of the project deals with mobilization of new investors and char farmers. Klosser innovasjon has the aim to establish a new company for the production char roe, today they are only Klosser innovation who owned the project.

In this thesis Arctic Red AS is the name given to the future start-up company with the aim to maintain the arctic red project and sell eyed roe to char farmers in the inland county. Moreover, with the help of inland county they are assisting the new fish farmers in inland region to start the land-based fish farming (Johansen, 2017).

Aims and Objectives: This thesis is also a part of project Arctic red, and the Project is operating a pilot facility at Rena. Klosser innovasjon AS is planning to launch a new daughter company named as Arctic red AS (the name used in this thesis).

The aim of this thesis is to develop a business plan for Arctic Red AS which is producing fertilized eggs and has aim to deliver the best breed of artic char to fish farmers in inland region and maintain the breeding project. This thesis will cover a small-scale plan with as

small investment as possible and an operation that is covering only the local farmers in the Inland of Norway. The objectives include

- What price do we need per roe to have a positive balance?
- How large volume (roe production volume) do we need to keep the operation profitable?
- What investments are needed for this size of operation (Investments/ year)?
- Why inland county for this project and how big is the market for the future company in the inland region?
- What should be the products to make the business attractive roe or fry?

2. Literature review:

2.1.1 Global Aquaculture industry and importance

Aquaculture industry has a long history. In 1980s and 1990s aquaculture industry developed rapidly in Europe and North America (Bostock et al., 2010). In 19th century trout and crap industry developed with complete controlled life cycle (Jones, 1987). In the year 2008, Asia produced 89% sea and freshwater aquatic organisms and became the largest producer in the world due to good aquaculture practices, economic growth, population, and greatest export opportunities. Aquaculture industry's success globally linked to market demand, competition, and environmental resources. Global population has been increasing and according to research animal protein will be the best source to maintain the food demand in future. According to UN (United nations) food and agriculture organization (FAO) 37% more aquatic organisms will be produced by the year 2030, As, the Aqua culturing is the most efficient and sustainable food production method (MMC, 2017). By 2050, the world must produce twice as much food in 2050 as in 2010, just to meet their needs. The potential for growth is to be found in the sea, not on land, while less than five per cent of world food production takes place in the sea (Sjomatnorge, 2011). More sustainable production methods are in demands to save the biodiversity (Bostock et al., 2010).

Table 1: This table represents the different animal protein sources and compares the production of animal protein with respect to feed (MMC, 2017).

FEED	***PRODUCTION***
8,7 kg feed	1 Kg Beef
5.9 Kg feed	10 Kg Pork
1.9 Kg feed	1 Kg Poultry
1.2 Kg feed	1 Kg Salmon

2.1.2 Aquaculture industry in Norway

Norway has a long coastal line, rich with marine resources (Hjellnes, Rustad, & Falch, 2020). There are different fish species that are farmed in Norwegian aquaculture such as Atlantic salmon (Salmo salar), Rainbow Trout (Oncorhynchus mykiss), Cod (Gadus morhua), Atlantic halibut (Hipoglossus hipoglosuss), and Arctic char (Salvelinus alpinus). Other fish species

include turbot, wolffish is cold water fish and adapted to northern areas (FAO, 2005). Fish industry is the second largest industry in Norway after the oil and gas industry. Commercial aquaculture farming in Norway began in the year 1970s (Directorate of Fisheries, Statistics 2003) with limited production sites and in 1999 salmonid production was nearly 460,000 tonnes (Maroni, 2000). In 2013 Atlantic salmon industry expanded throughout Norway's coastal areas and production of Atlantic salmon reached to 1.3 million metric tons. It is expected that by the year 2050 Norway will produce 5 million tons of fish yearly with the help of new technology (Bjelland et al., 2015). Initially, Seawater pens culturing methods were popular and still used today with improvements (Burr, Wolters, & Barrows, 2016). In the mid of eighteen century the Norway introduced strict rules and regulation for the fish farming but the research on this industry was the country's major priority and fish industry grew again in the 20th century (Reinertsen & Haaland, 1995). In 2017 Norway exported 95% farmed and wild fish to other countries with value 92 241 million NOK (Hjellnes et al., 2020).

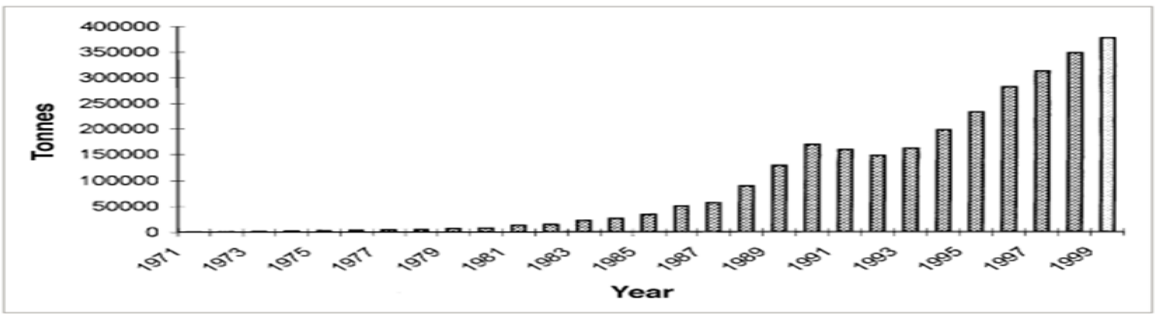

Figure 1. **Marine aquaculture industry**: It illustrated that production of salmon and rain bow trout between years 1971 to 1999 (Maroni, 2000).

Salmon and rainbow trout have been dominating the fish industry in Norway (Maroni, 2000) and is important contributing factor to the country's economy and employment (Sarker, 2020). The Aquaculture industry has created 22,700 Norwegian jobs and exported fish to 100 different countries and a key source of healthy protein production for a growing population (Sjomatnorge, 2011). More than 80% of total aqua production in Norway consists of Atlantic Salmon and 10-15% rainbow trout (FAO, 2021). Denmark and France also import large numbers of products and Trout is being exported in large quantities to Japan and Russia (FAO, 2005). Fish is exported in different forms like frozen fresh and chilled whole fish are important export products. Frozen fish exported mostly to non-OECD (the organization for economic cooperation and development) countries and Japan. Fresh and chilled exported to EU. Only 10 % of fish used for domestic sale. Domestic markets also have a value for national industry.

There are six fisherman's sales organizations in Norway which manages the sale of fish in domestic markets (FAO, 2021). Norwegian Salmon price in current market is 57 NOK /kg for size 3-4 kilos, 58 NOK /kg, and size 4-5 kilos, 59 NOK /kg, and size 4-5 kilos. Salmon with size more than 7 kg the price is 67 NOK/kg. In the global sea market price per Kg a little bit fluctuate due to currency change (Skulbru, 2021).

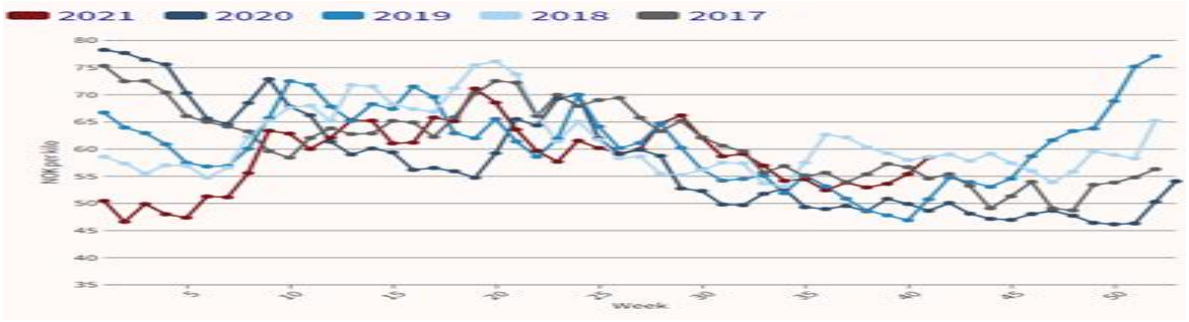

Figure 2: Weekly Salmon Export Prices: The above figure represents the average weekly export price of fresh and chilled salmon from Norway to other countries from the year 2017 and 2021 (Skulbru, 2021).

2.1.3 Atlantic Salmon (*Salmo salar)*

Atlantic salmon belongs to family Salmonidae, famous as king of fish. Atlantic salmon is an anadromous species and it spend a part of life cycle in sea water and other part in fresh water, but its main growth stage take place in sea (FAO, 2005).

Figure 3: The above figure represented the Atlantic Salmon in Norway (NOAAFishries, n.d)

Atlantic salmon has lot of health benefits as it is rich in protein, vitamin (A, D), B12, antioxidants and Omega-3s. It has a unique taste and color and can be served in cold and warm

dishes. It can be enjoyed as raw, fried, baked, boiled, or smoked. Salmon is the favorite and famous foods item in the top sushi dishes worldwide (Norway, n.d). According to a report production of salmon at sea has decreased and remained stable at the river level but farmed salmon has gained the forth position in the export products in Norway and farmed salmon production has increased as compared to wild catch (Liu et al., 2011). Salmon farming is carried out in different areas in Norway but Hardanger fjord has the largest salmon farming with 70,000 metric tons production of salmon (Husa et al., 2014).

Figure 4: The figure represented map which shows the locations for salmon and rainbow trout farming in the year 2004. These are the locations where farming is allowed but all the locations were not in used in 2004 (Fiske, Lund, & Hansen, 2006).

2.1.4 Diet of Atlantic Salmon:

Wild Salmon's diet related is to age, young salmon eat insects, invertebrates, and plankton and Capelin is a preferred food for adult salmon (NOAAFishries, n.d). Farmed Salmon are fed nutrient-dense, dry pellets, and ingredients are fish meal, fish oil and plant proteins (such as soy). Canadian feed manufacturers have introduced new feeds composition where fish-based ingredients are replaced by sustainable resources such as vegetables (less than 30% fish-based and 70% vegetable-based ingredients) (CAI, n.d). These dry pellets also had vitamins, minerals, pigments, amino acids antioxidant astaxanthin (to boost the immune system). The red color of salmon is due to Astaxanthin while Wild salmon get astaxanthin by eating crustaceans (Salmonfacts, 2016).

2.1.5 Challenges to the Salmon industry:

Norway secured a leading position in the global market due to the natural resources, simple and low-cost technology that is sea pens. However, now the industry is facing challenges due to the non-sustainability of the production methods. Researchers are concerned more with the sustainability of natural resources and the environment which are at risk due to pollution and overproduction (Bjørndal & Tusvik, 2017). The Salmon industry is also facing many challenges due to fish lice and fish escaping from open-net cages that is the direct economic loss to the fish farmers and on the other hand, a risk for wild salmon and biodiversity. Escapement of fish from net cages leads towards hybridization of wild and farmed salmon. Approximately 200,000 farmed salmon escaped from cages every year and this escapement leads to issues such as competition for food and natural habitat, mating between farmed and wild salmon gene mixing. Hybrid salmon have less productivity, and more aggression, and are more vulnerable to diseases and sea parasites such as sea lice. Sea lice is a parasite that attaches to the skin of salmon. Due to salmon aquaculture, this parasite grew rapidly in fjords because the salmon harvesting provides them a great number of hosts to grow on their skins and is a major source of parasites for wild salmons because it is reported that a great number of parasites have been transferred from farmed to wild salmon (Olaussen, 2018). Fish farmers started to use the chemicals to control the sea lice but unfortunately on one side sea lice have developed resistance against chemicals and on the other hand, sea creatures are also at risk due to these chemicals. Due to these problems, the salmon industry is not growing instead fish farmers are facing problems and this situation is also an economic burden on them. Researchers are looking for new ways of production especially more closed containment facilities instead of open net cages which are less harmful to the environment and will solve the problem of fish escape, sea lice and impact on wild salmon and the environment (Olaussen, 2018). Many researchers suggested that this industry still has the potential to grow, but there is a need to develop a sustainable aquaculture system that will produce species other than salmon (FAO, 2005).

2.1.6 Sustainable production methods

In the 1970s open net pens were constructed for sea-based salmon farming and still today this farming method dominates the industry. However, Over time technology has evolved, and different methods have been developed to get a sustainable production of large and prolonged smolt and post-smolt such as Land-based farming, offshore farming, and closed or semi-closed pens. New sustainable production methods for sea and land-based farming have been

developed, such as semi-closed containment systems in the sea and Recirculating aquaculture systems (RAS) on land. These systems have their own challenges regarding the pathogenic invasion and water treatment. Moreover, Microbiota in these systems is directly linked to fish health. Atlantic salmon smolt and post-smolt have been produced by land-based systems and traditional net pens are still used for full-sized salmon (Benjaminsen, 2021). Today, RAS are advanced production systems among fish farmers in Norway. In addition, flow through systems are also replaced by RAS (NTNU, n.d). Today Norway has more RAS as compared to FTS (EY, 2019). Water recirculating aquaculture systems (RAS) are now intensively used for the production of Atlantic salmon smolt (Summerfelt et al., 2015). During the last 20 years Norway has gained tremendous knowledge about land-based RAS Salmon farming. In addition, other species of the Salmonidae family have been produced on land systems (Benjaminsen, 2021). RAS facilities deal with the challenges of salmon lice and fish escape. Salmon are anadromous species. The first phase of the salmon life cycle is conducted in land-based freshwater RAS facilities to produce fingerlings up to size 100g. Due to the controlled environment, the production time is shorter. RAS systems help to prolong the smolt phase on land so that they can gain more weight before transferring them to the sea-based systems, so the growth period in open sea pens will be shorter and the chance of sea lice and fish escapes also decreased. Although RAS is a sustainable technology for land-based salmon farming still this technology does not attain large commercial scope. There is a need to improve this technology in terms of the whole fish production cycle of salmon on land (Bjørndal & Tusvik, 2017). Moreover, RAS technologies are more complex and expensive for entire life cycle on land, Still Fish farmers looking for ways to shift entire life cycle of salmon on land. At the present time, only smolts production is carrying on in a Land-based system to deal with the challenge of salmon lice. The land permits are for free if farmers own the land, but the sea permit costs millions. As one can use national sea space for farming. This is also another factor that influenced farmers to start farming on land (Communication with Karina).

2.2 Land based fish farming

Sea-based fish farming facilities are non-sustainable and there was a great need for eco-friendly aquaculture facilities. Technology made it possible and different types of Land-based aquaculture facilities have been developed for securing a sustainable future for aquaculture(Snir, 2020). Land-based aquaculture systems such as RAS, Flow-through, and

partly RAS have been introduced for reducing the pressure on the natural environment (Zhang et al., 2011).

Land based recirculating (RAS) and Partly RAS:

The recirculating aquaculture system technology is environmentally sustainable and has been developed with two main objectives as Increase aquaculture production and Sustaining natural resources (Martins et al., 2010). In the RAS system, water level and water parameters maintain in a way that fish enjoys and grows well. Water recycling in RAS is dependent on the demand for water-saving. Technical advanced RAS systems can recycle water up to 99%. These advanced systems demand high capital costs to work due for this reason it is recommended that small-scale production starts with the least advanced RAS systems until the farm can achieve the set goals (Røyeforum, 2021b).

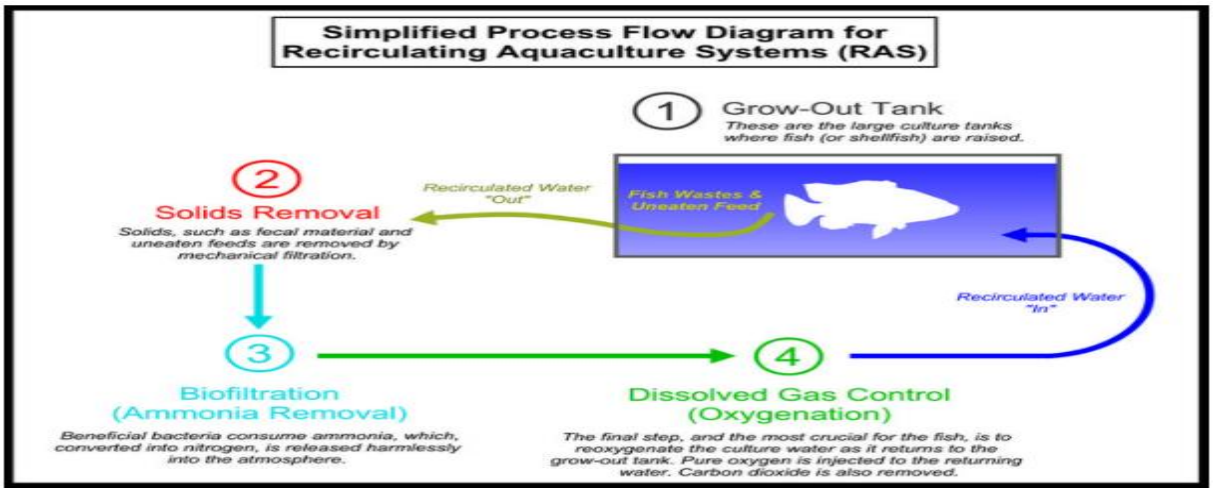

Figure 5: RAS system: Above figure stands for the process of how RAS systems works:1. Clean the water from water source enters the fish tank where fish thrives and grows. 2. Filters are used to remove the solid waste from used water. 3. Biofiltration is the next step after solid removal to convert the toxic ammonia into nitrates,4 Carbon dioxide is removed, and oxygen is added (Røyeforum, 2021b).

Advantages of Recirculating Aquaculture System (RAS) Technology

- RAS are land-based and closed systems with full control over culturing environment that helps to reduce the risk of disease due to this advantage farmers don't need chemical treatments as a result healthier fish is produced. Moreover, improved tissue

composition and natural fat result in fish species because water motions in the rearing tanks help the farmers to exercise the fish (Snir, 2020).

- RAS has no coastal line restrictions that's why land-based facilities can be set up near the end market which will reduce the cost of production and fresh fish can be supplied to market (EY, 2019).
- RAS have advanced filtering systems that reduced water pollution by feed, fish waste, and chemicals.
- Higher nutrients recycling and proper and efficient waste management (Martins et al., 2010). Waste is converted into biogas or fertilizers that are used for agriculture production (Benjaminsen, 2021).
- Reduce the use of water and land for fish production. Harvesting of fish is possible around the year and fish reached to commercial size faster as compared to other methods.
- Intensive fish production can be achieved (Badiola, Basurko, Piedrahita, Hundley, & Mendiola, 2018) due to a better feed conversion ratio (FCR) in fish mass, and overall production cost also reduced this is achieved due to complete control over water temperature and efficient maintains of optimal oxygen and carbon dioxide (Snir, 2020).

Difficulties in using RAS systems:

- Technically skilled staff required RAS also have drawbacks such as high energy demands, and usage of fossil fuels leads towards environmental issues, and cost of operation also increased. Different RAS systems have been developed now which use less energy and are more efficient (Badiola et al., 2018).
- Electricity is needed 24/7. High-quality fish feed is required that contains high protein and fats content (Aquacultureid, n.d).
- Ras have more technological complexity and facilities require more capital to start up (EY, 2019).

2.2.1 Flow through systems

Flow-through systems are type of land-based aquaculture systems (EY, 2019). Fish farmers use natural waterways and water currents to supply freshwater flow and remove waste. These are used extensively for seafood production and use water flow for providing oxygen through pumps or gravity and removing waste. To improve the system efficiency technologies such as

water coolers and better be the use of feeding mechanisms can minimize the water loss superfluous water discharge and increase biomass production efficiency. Cages are used for finfish nearshore and ropes are used for shellfish (Seafood, n.d). In Norway, Flow-through systems are used for small-scale land-based freshwater facilities. Water from watercourses, lakes, or groundwater is used. In these systems, oxygen is the limiting factor for this reason water is continuously replaced by fresh water to maintain the oxygen level in the water (Røyeforum, 2021b). Flow-through system is used for low intensive fish farming. In these systems, water tanks have one inlet attached to the water source and an outlet for removing wastes. These kinds of systems are the better option for rural areas where electricity supply is limited but the presence of reliable water sources weighing scales, and technical and fish farming training on-site (Aquaculturеid, n.d).

Table 2: Difference between RAS and FTS: The above table illustrated the difference between land-based RAS facilities and flow through systems (EY, 2019).

Recirculating Aquaculture systems (RAS)	Flow through systems (FTS)
Consumption of water is minimum (95% to 99 % of water can be recycled). High technological demand High investment Non-restricted to coastal line Challenges with hydrogen sulphide	Water consumption is high Limited water recycling technology Limited advanced technology Low investment Due to continuous replacement of water hydrogen sulphide challenges are low compared to RAS.

Challenges in land-based fish farming

Land-based fish farming is an advanced technology. However, this is not free from challenges such as chemical water quality and control over microbial conditions are two major challenges because young fish are sensitive to water quality. RAS facilities also suffer from mass moralities and tainted fish meat and in worst cases suddenly thousands of salmon smolts die. This includes microbial control and chemical water quality are the two key factors for the sustainable production of fish. Furthermore, different physical components are also important

for the successful working of land-based systems such as mechanical filters, biofilters, degassed for the removal of CO2, and the ‘tanks’ in which the fish are reared (Benjaminsen, 2021).

2.3 Development of aquculture in Inland

Inland is a county is the only landlocked county in Norway and covers approximately 17% of the total area of the mainland area of Norway. This county consists of 46 municipalities. This region is rich with natural resources and has strong value chains, experts, management, and innovative companies in food production, agriculture and forestry, genetics, breeding and reproductive technology, bioenergy, residual materials, waste management, and freshwater management, the food industry, and renewable energy. Due to these reasons, the Inland Region is ready to play a key role in developing the economy through land-based freshwater fish farming.

2.3.1 Klosser innovasjon AS

Klosser innovasjon is innovative company operating in inland region. The objective of the company is to promote knowledge-based business development in the inland county. Klosser innovasjon focus on different development projects in the county that has the potential to grow and contribute to the country’s green economy (Proff, n.d). They are also the secretariat and administration of NCE Heidner Biocluster, a business cluster for biotechnology and sustainable food production. NCE Heidner Biocluster is Norway's leading business cluster within the green bioeconomy and sustainable food production (Biocluster, n.d).

Klosser innovasjon AS took the initiative to start their own project in the inland county for the development of sustainable business project by using the county’s own natural biological resources. In 2013 there was a discussion on what can be a potential new growth industry in Inland County. Because there were already agriculture, wood, and other industries. The idea of land-based freshwater fish farming was attractive for the county due to the freshwater resources everywhere and the inland county has a lot of land for land-based fish farming. Arctic char fish species that belong to the Salmonidae family were chosen for land-based fish farming. In the section Arctic char farming I have described why this species was selected and in 2014 two projects were started by Klosser Innovasjon AS.

Projects: Arctic Red & Mobilization project Innlandet (Two projects started parallel in 2014 by Klosser innovation AS.

Partners in projects:

- Inland university College
- Norwegian Røyeforum
- Nord University
- Aninova
- Hongset Char & Tydal Char (Char breeders)
- Regional research fund inland (Research grants).
- Inland county
- NMBU (A new project partner for the genetic work)

Funding for projects: Klosser innovation AS leader of the projects and main investors and received partial funding from partners (Røyeforum, 2021a).Arctic Red - a national breeding program for Arctic char in a separate fish farm on Rena. Project manager Arctic Red: Karina Hauge Johansen

Arctic char Breeding program was selected towards the best breed of Arctic char that shows fast growth rates, late sexual maturity, and is well suited for production in land-based facilities besides this also started prodution of the best quality eyed roe for new fish farmers to start their land-based fish farms.Char farming industry in Norway is a small and undeveloped industry as compared to other countries and the reason behind this is the absensce of char breeding and strict legislation in Norway. Breeding is the key to a sucessfull char industry in Norway. Arctic Red project received its funding from project partners for the construction of the breeding core, and another for making a genetic marker panel for the genotypic of the fish. Klosser innovasjon AS invests for the keeping of the fish and facility.

Mobilization project where we recruit and start new char farmers:

Inland county is the biggest owner of Klosser innovasjon AS and they collaborate with each other all the time. In 2015- 2018 Klosser innovation AS together with inland county started project with the aim to establish char industry in the inland county. As conditions in Inland are well suited for land-based char farming. There are few groups in Inland that are interested in char farming but still, there is a need to get more investors for making projects successful.

The Market for char is demanding both nationally and internationally and char has a high price compared to salmon due to its unique taste, and less availability in the market. In Norway char need proper branding and marketing to be known by consumers as luxury fish with good quality, unique taste and low availability (Tone Blixøen & Johansen, 2017). The plan is to be able to deliver eye roe to new farmers from the year 2020. Project leader Mobilization: Tone Blixøen. To find and mobilize the people who want to avail the opportunity as well as guide and help them to start a land-based fish farms. Arctic char breeding station has now produced the best quality eyed roe and sell to breeders. Now they have the capacity to produce 1,15 million roes. The Goal of the breeding program is to set up char farms in the inland region and to keep the breeding station in economically sustainable conditions. In the inland county there are four farmers who are ready to set up the land-based fish farming by using char eyed roe produced through breeding program Arctic Red (communication with Karina Hauge Johansen). Politicians, municipalities, and the county want to develop the char industry and land-based aquaculture on other species like brown trout. Inland county is incredibly positive. Farmers need proper license and permission from responsible departments for land-based aquaculture.

1. The Norwegian Water Resources and Energy Directorate gives permission to take water from a water source and use it for aquaculture. They will see if your water intake will have any effects on other parameters or any impact on fauna or flora.

2. The aquaculture permit: being allowed to keep fish and being allowed to have emission in the water recipient. Nitrogen and phosphate are the main emission that comes through the feed and can be polluted to a freshwater source. Algae and bacterial likes it. The recipient must be able to tolerate the amount.

Getting the license is a long and detailed procedure, the whole planning of building the facility and how you are going to clean the water must be described in the document (Fiskeridirektoratet, 2022).

2.4 Arctic char (*Salvelinus alpinus*)

2.4.1 Geographic distribution:

Arctic char is circumpolar in distribution, found in arctic, subarctic, boreal, and temperate climate regions. It lives normally above the Arctic circle. Different populations of Arctic

char are founded in many rivers, in different parts of Europe such as Southern Greenland, Iceland, and the northern part of Norway (villmarken, n.d).

2.4.2 Biology

Arctic char (Salvelinus alpinus) is freshwater that belongs to the Salmonidae family which consists of 36 species, but arctic char is studied most out of all these fish species (Klemetsen et al., 2003). It is also distinct from other species in body shape because it has larger jaws and wider heads (Dennert, May-McNally, Bond, Quinn, & Taylor, 2016). They show different lifestyle patterns for example they can be either anadromous or can be landlocked (spend their whole life cycle in the freshwater). Phenotypically they resemble salmon but genotypically, they are closer to lake trout. Arctic char shows distinct color patterns for example pale pink to silver or bright red. Color variations are linked to environmental conditions and time of the year. Farmed char has red skin colour while wild char has silver skin colour (FCI, 2008). It is cold water fish and can grow between 9 and 12 degrees Celsius It is the only fish in the Salmonidae family that can grow even at 0 degrees Celsius (Tone Blixøen & Johansen, 2017). But it can grow best at 12 degrees Celsius because at this temperature it shows good growth rates, use the feed at its best, and disease and fungus growth risk is also reduced (FCI, 2008). In Norway arctic Char has two categories sea char that migrate to the ocean for food search and freshwater for spawning. Landlocked or stationary Arctic char that spend whole life in fresh water (Sandlund et al., 1992).

Figure 6: Arctic char: Phenotypical different types of Arctic char (Albert, 2021).

2.4.3 Feed of Arctic char (Salvinus alpinus)

Wild char feeding pattern: Arctic char feeding patterns depends on the seasons as in summer they prefer surface insects and fish while in autumn they prefer to feed on littoral benthos, and zooplankton (Gregersen, Aass, Vøllestad, & L'Abée-Lund, 2006). It is carnivorous. According to another research, arctic char feeds on aquatic insects, salmon eggs, snails, small crustaceans, and fish in the late spring and summer and in the winter months, favorite food is zooplankton, freshwater shrimps, and small fish. Char that is found in late summer or fall is more delicious, has more flavour and oil (FCI, 2008).

Farmed char feeding: Arctic char demands a food that is rich in protein. Feed Manufacturers are making feed for arctic char that exactly matches nutritional requirements. Feed is in the form of dry pellets, and the main ingredients include fish meal, fish oil, essential vitamins, minerals, and carotenoids. Now manufacturers are replacing the fish-based ingredients with vegetable-based resources (CAIA, 2018). **Feeding** costs are 50-70% of the total production cost of Arctic char. To have an economically successful industry there is a need to reduce the feeding cost (Bjornsdottir, Brännäs, & Sigurgeirsson, 2015).

2.4.4 Arctic char as food fish

Arctic char has a unique and different taste because its taste has a combination of both salmon and trout. Compared to salmon and trout meat has finer flakes with flesh color that ranges from deep red to pale pink, but the taste remains the same in both cases. Moreover, the high-fat portion keeps the meat tender (seafoodsource, 2014). Arctic char is famous among Norwegian chefs due to its good taste and fine texture. Arctic char can be included in gourmet meals. This fish can be roast or baked, warmed and cold smoked, and served with fresh salad and white wine a complete diet with good flavor and taste (villmarken, n.d).

Table 3: Nutritional values: The above table represents some nutritional facts about the Arctic char as food fish (seafoodsource, 2014).

Calories	154g
Fat Calories	73
Total Fat	8.1 g
Protein	20.2 g

Omega 3	1.6 g

2.4.5 Char as a farming fish

Arctic char (*Salvelinus alpinus)* is the only species in the Salmonidae that grows best in low temperature, sustainable culture conditions, and landlocked. This feature makes them highly desirable to aquaculture (Burr et al., 2016). Char can grow at lower temperatures. This property makes it suitable for farming economically because there is no need to invest in heating the water. Due to its property, it grows in cold water, this is beneficial from a competitive point of view and business will be protected from the farmers that have fish farmers in a naturally warmer environment. In the case of the salmon farming density of fish have a direct impact on growth but arctic char is a fresh and calm fish that can enjoy living at higher fish density. This point is also economically beneficial, and farmers can produce more fish in the fish farms plant (Johansen, 2017). Arctic char is suitable for farming due to its flexible culturing conditions as compared to other salmonid species. Fluctuations in culturing environments such as high densities, temperature vacillation, and water quality have no considerable influence on their growth. The choice and Fish wise program also declared it the best choice for land-based fish farming (RAS). Salmon shows a slow growth rate and risk of death in high stocking densities while char can enjoy equally in high stocking densities. These properties make it favorable for fish farming out of all Salmonidae species (Neil et al., 2013). Salmon species cannot bear water fluctuations and an elevated risk of death. However, char species can survive in slight changes in water quality. Although char is a small industry in Norway, national market demands are high and there is a need for more production of this fish. Sweden, the EU, Austria, and Germany offer the International market for Norway s char products and there is a need for more char products in the future (Røyeforum, 2021a). Tanks and raceways onshore are used for farming char with less pollution discharge while for salmon raised in open-net pens in coastal areas chance of fish escape and disease are more compared to Arctic char (EDF, n.d).

2.4.6 Production of char world wide

Arctic char renowned since the 1980s as farmed species at a progressive rate (Dolmer & Burnell, 2021). Arctic char farming has been started in different countries such as Iceland, Canada, Sweden, Norway, and the united states (FCI, 2008), but the industry is highly regulated so that overexploitation of this fish species can be avoided (Neil et al., 2013). Arctic char farms exist also in the United Kingdom, Austria, and Italy but according to the Seafood

Watch report, Iceland and Canada are the major producers of Arctic char in the world (AAC, 2019). Char has a complex genetic makeup but different countries such as Canada, Iceland, and Sweden have started different breeding programs to get the traits that are favorable and suitable for culturing (Dolmer & Burnell, 2021).

Table 4. Arctic char production in the year 2016: The table shows that Iceland was the major producer of Arctic Char in the year of 2016 (Dolmer & Burnell, 2021).

Name of countries	**Production of Arctic Char in (%)**
Iceland	**(~60%)**
Sweden	**(~27%)**
Norway	**(5%)**
Canada	**(3%)**
Austria	**(3%)**

Sweden is producing approximately 1700 tonnes of Arctic char annually. Arctic char production is 15% part of the fish production in Sweden (Carlberg, 2016). In Sweden production usually takes in net cages in oligotrophic lakes (Dolmer & Burnell, 2021). Canadian Arctic char industry is still a small industry and char farms are found Yukon Territory, Nova Scotia, New Brunswick, Newfoundland, Quebec and Manitoba (Char, 2014). Arctic char production is also preferably continued in North Canada because it is fresh cold-water fish. Canada arctic char industry is producing both eggs, and mature fish which they are also exporting to other countries. According to a report, approximately 500 mt of char is produced by Canada annually Canadian Arctic char production is round about 500 mt (MBA, 2014). Farming of Arctic Char in Iceland is regulated by different departments such as federal, and regional authorities (FCI, 2008). Icelandic aquaculture has intensive land-based flow through farms and used brackish water 7-12 degrees Celsius for the production of Arctic char (Dolmer & Burnell, 2021). To improve the production of Arctic char Icelandic government has started genetic improvement and breeding programs in 1992. This program wanted to develop strains that have a better genetic makeup for fast growth rate and slowed sexual maturation. This program has improved production and it was doubled within the next five years from 1992 to 1997. Iceland produced 50% of the total Arctic char production in the

world (Heimisson, Arnason, & Olafsdottir, 2016). The US marketplace imports Arctic char mainly from Iceland (MBA, 2014). Samherii is the largest producer of Arctic char in the world and produced 3,800 tonnes annually. Iceland exports fish farm products of value around about 25 billion Icelandic kroner (McDonagh, 2020). Due to the highest market demand for Icelandic Arctic char, it is expected that Arctic char production in Iceland will be doubled in the next five years and this trend will continue in the future (Dalsgaard et al., 2013).

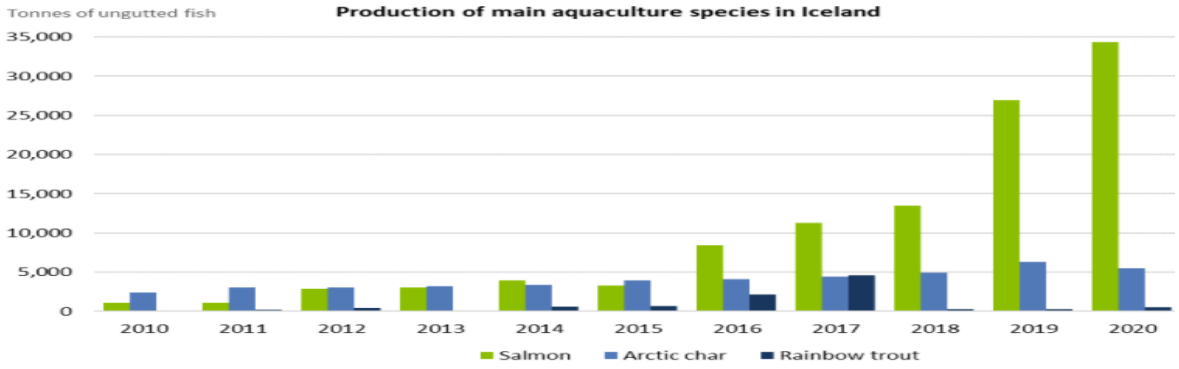

Figure 7: Production of main aquaculture species in Iceland, Arctic char is the second largest farming species in the Iceland and salmon is produced most and rainbow trout produced least (Dalsgaard et al., 2013).

US, Austria, Ireland, and the united kingdom are among the countries that export Char to meet the market demand (AAC, 2019). By the year 2010 Iceland has become the major producer of farmed Arctic char and produced 3500 metric tons of arctic char, Norway produced 421 metric tons, united states produced 100 metric tons (Neil et al., 2013). Approximately 8 thousand tons of Arctic char were produced in the year 2013 and 50% of this production took place in Iceland (Heimisson et al., 2016). Seafood Watch reports that global production of farmed arctic char between the years 2012 and 2016 had been increased to 25% and 85% of the farmed char rated as Best Choice by Seafood Watch and 80% of this highly rated fish supplied by Iceland (AAC, 2019). Arctic Char industry still is a niche industry and its annual production overall world is about 5000 metric tons 60% of production takes place in Iceland and the rest 40% in the other countries (Dalsgaard et al., 2013).

Table 5: Farming of Arctic char in Europe (tonnes), The table represents the production of Arctic char in different countries of Europe from the year 2010 to 2019/ Iceland is the only country that continued to be the major producer of Arctic char and second largest producer was Sweden but in 2018 and 2019 production is not calculated (iceland, 2021).

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Austria	45	116	120	142	151	208	193	237	272	266
UK	14	13	11	11	10	11	41	61	20	25
Faroe Islands	1,791	-	-	72	-	-	-	-	-	-
Iceland	2,427	3,021	3,089	3,215	3,411	3,937	4,084	4,454	4,914	6,322
Italy	135	99	148	165	16	33	-	28	22	-
Norway	492	276	309	281	285	257	333	341	288	519
Sweden	1,307	1,128	1,849	1,808	1,644	1,675	1,760	1,310	-	-

2.4.7 Arctic char farming in Norway

Char farming in Norway has been started years ago and the main farming sites are in Nordland county (freshwater as well as seawater) but the industry is young in Norway as compared to other Nordic countries (Sjomatnorge, 2011). There are five medium-sized and couple of small-scale farms (communication with Karina Hauge Johansen) producing Arctic char because recirculating aquaculture systems are very rare in Norway (Skybakmoen, Siikavuopio, & Sæther, 2009). In the year 2010 Norway was the second producer of Arctic char (421mt) after Iceland (3500 mt) (Neil et al., 2013).

Table 6: Production of Arctic char: The table below shows the number of Arctic chars in tonnes with respect to years. The table contains information about char production between the years 2010 and 2019.

Arctic char production in Norway	
Year of Production	**Arctic char production (tons/ metric tons)**
2010	492 tons
2011	276 tons
2012	309 tons
2013	281 tons
2014	285 tons
2015	257 tons
2016	333 tons
2017	341 tons

2018	288 tons
2019	519 tons

Although Norway's main aquaculture sites are along the western and northern coast but still Norwegian fish farming industry looking forward to making the Telemark a leading inland arctic char farming center in Norway (USN, 2018).

2.4.8 Char Market and Products

Char is available both fresh (Fillets and whole) and frozen (Fillets, value-added, whole) and can be served as smoked, baked, and raked char (fishchoice, 2020). Iceland is the major producer of char and Europe; Nordic countries and the United States offer a great market for the Icelandic char (Dalsgaard et al., 2013). United Kingdom (UK), Denmark, Germany, France, and Sweden are the top importing countries of Arctic char. Greenland, Poland, Taiwan, and Portugal are among the small importers (AAC, 2019). Europe and United States offer the main markets for fresh or frozen Arctic char fillets and the price for fillets currently is 10-13 €/kg. (Dalsgaard et al., 2013).

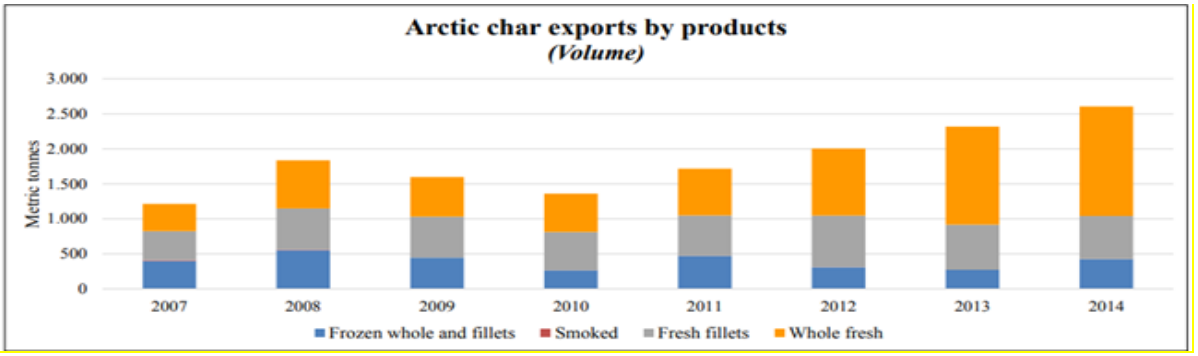

Figure 7: Market for Arctic Char : This figure represents the exports of Arctic char in different product forms by volume in metric tonnes (Heimisson et al., 2016).

Arctic char that is exported by Iceland and Norway are sold in US grocery stores and restaurants. According to purchasing power and population, the US seafood market is the largest market in the world and the US seafood market is the perfect market for Arctic char. UK and France also serve Arctic char in their restaurantsrestaurants (AAC, 2019).

Top global countries importing processed Arctic Char, 2017-2018

Country	Import value (Canadian dollars)		Import quantity (kilograms)		Import price (Can$/kg)
	2017	2018	2017	2018	2018
United Kingdom	3,413,450	3,698,170	698,887	768,275	4.81
Denmark	3,146,953	3,345,510	404,971	383,363	8.73
Germany	353,998	2,707,164	75,420	629,298	4.30
France	1,447,170	1,807,495	209,456	314,403	5.75
Sweden	1,446,255	1,177,835	191,458	146,712	8.03
Netherlands	628,257	381,035	82,313	50,129	7.60
Belgium	319,940	281,035	50,287	40,963	6.86

Figure 8: Arctic char imports: the above table shows the top five countries which imported Arctic char in processed form in the years 2017 and 2018 (AAC, 2019).

Arctic char is not available in the market that's why it is expensive fish (due to high production cost) as compared to salmon. The market price of char products is much higher compared to salmon. Distributors can buy whole fish from producers at 80 NOK/kg (Communication with Karina Hauge Johansen). Salmon is easily available in the domestic and international market and the production rate is also high compared to Arctic char. In the year 2021, the price of the whole salmon was NOK54.99/kg NOK54.99/kg (FishfarmingExpert, 2021). In the period January 10th – January 16th 2022 price for fresh salmon NOK 72.05 per kilo, frozen salmon at NOK 65.97 per kilo (Sivertstøl, 2022).

2.5 Importance of Breeding programmes

Breeding programs are conducted to select the genetically desired traits of organisms, but selective breeding practices are still limited in aquaculture (Chavanne et al., 2016). Different fish breeding programs are in process in different European countries with the aim of the fastest growth rate and better feed utilization because this factor is directly linked to economic and business growth (Carlberg, 2016). Breeding programs have helped the researcher to select the traits which show a high growth rate, disease resistance, quality (Chavanne et al., 2016) high reproductive output, delayed maturation and high food conversation ratio, and high market value. Breeding improves flesh quality and disease tolerance can be increased Breeding programs in Norway started in 1971 with Atlantic salmon and rainbow trout. The breeding goal for the first two generations was growth rate and delayed maturation and the fifth generation s goal was disease resistance and meat quality (Holum, n.d). Atlantic salmon is the best example with an enhanced production rate (Fjalestad, Moen, & Gomez-Raya,

2003).There are two institutions in Norway where selective breeding programs take place. One is the Department of Animal Genetics and Breeding, Agricultural University of Norway (Trygve Gjedrem & Nævdal, 1979). Norsk Lakseavl AS (Norwegian Salmon Breeding Company Ltd) or NLA runs the National Breeding Programme in Norway and the cost-benefit ratio is approximately 1:15 (T Gjedrem, 2000). Arctic char is another salmonid species selected for breeding programs. For example, the Swedish breeding program have been started 40 years ago with the aim to select the better traits such as fast growth rate, disease resistance, and delayed sexual maturity (SLU, 2021). Icelandic char production dominating the global industry due to its better genetic and breeding programs. Klosser innovasjon AS has also started a national Arctic char breeding program to get the better bred for enhancing Norwegian Arctic char production. The Arctic red breeding project is the key to developing the char industry in Norway. Norway already leading the world in the production of salmon and salmon technology and breeding projects are the responsible key elements for the success of the industry. Klosser innovation has the aim to maintain the breeding project and establish land-based farming in the inland county by assisting the new farmers. Moreover, Norway is rich with freshwater sources and a lot of land in Inland County. The Arctic red breeding project's main goal is to produce the fertilized egg through breeding best-selected populations and traits. This project will lead to the development of the char industry in Norway. Arctic Red AS will be a start-up company that is ready to sell the eyed roe of char produced through the Arctic red breeding project. The aim of the company is to maintain the project with an economical stable condition and produce enough roes to meet the demand in inland county. Does the company need to expand its breeding project in the future to full fill the demand for roes and what should be the price per roe to have a positive business? This company needs a business plan to maintain its projects. This thesis will deal to develop a business plan for the new start-up company so the company will continue the breeding projects and produce enough revenue and target the right investors and customers (Discussion with Karina Hauge Johansen).

3. Material and Methods

3.1 Data collection

The data used in this thesis consists of both primary and secondary data. Primary data was collected through questionnaires directly from the key persons that are directly involved in this project and research. Secondary data was collected through articles, and review articles. websites, newspapers, books, research reports, and the websites that were linked to the upcoming firm Arctic Red AS such as Norsk røyeforum, Klosser innovasjon AS and FAO, etc. Secondary data was important for this research for giving background knowledge about aquaculture and the Arctic char industry in the Nordic countries. Secondary Data was collected from Google Scholar, PubMed, Oria, Science Direct, and google.

3.2 Tools used in this research

Differnet bio economical tools in this study that are mentioned below

3.2.1 Value chain analysis

Value chain analysis for the Arctic Red AS was done to get information about the overall processes and activities of the company that participates in creating a product and services that are valuable for the customers. Value chain analysis gave information about the competitive advantage that Arctic Red AS has over other companies in Norway(Cambridge, 2021). Value chain analysis is a tool in bio business that is used for the analysis of all business activities that a company has performed to create valuable products for the target customers. It helps to improve the competitive advantage of the final products, so the company is competitive in the market. There are two types of competitive advantage, cost advantage (cost advantage strategy adopted by the companies who use the low-cost raw material to provide a lower-cost product to their customer) and differentiation advantage (The company creates a product that is highly innovative with high and specialized product value in the market. It involves research and development) and a company must choose one of them (Hart, 2021).

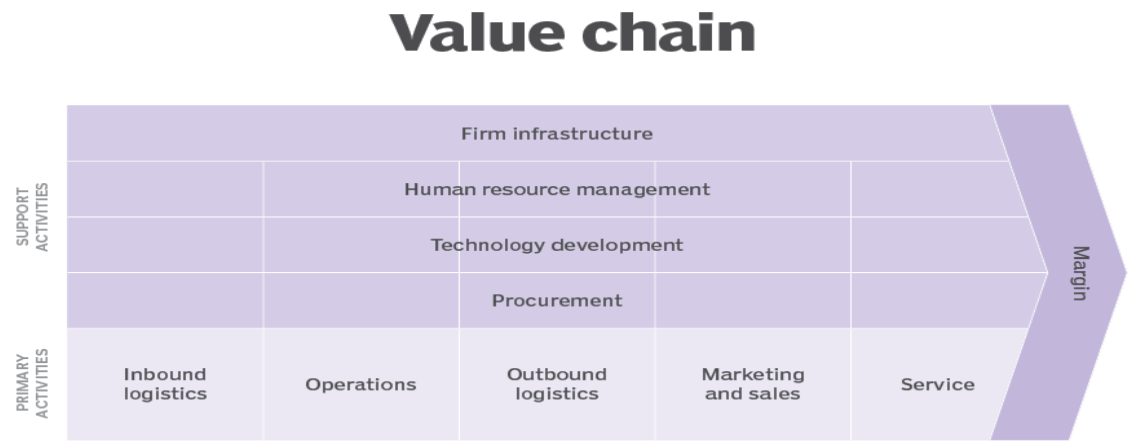

Figure 9: Value chain analysis: This figure represents the components of the value chain analysis that are used to analyse the company's activities for creating a product with a competitive advantage (Chai, 2022).

Value chain analysis consists of two types of activities primary activities and support activities. Primary activities give the information about how the raw materials and resources are obtained, shipping cost, Product development operations, technology, final product delivery to the target customers (shipping cost, warehouse fees, distributors fee), marketing which includes promotion and marketing expense, services this is your relationship with your customers after they have bought the product. Support activities in value chain analysis work as a backbone for the primary activities for creating a product with a competitive advantage (Hart, 2021).

3.2.2 SWOT analysis for Arctic Red AS

SWOT analysis is the best tool to be used to understand the base and potential of a start-up business, as it gives information about internal and external factors that are linked to the success or failure of a business. SWOT abbreviated as strength, weakness, opportunity, and threats. Strength and weakness are internal factors and opportunity, and threats are external factors. SWOT is used to analyze the potential of Arctic Red AS. This tool was developed by Stanford in the 1970s. This analysis helps to evaluate the business progress. It is a simple and powerful tool that evaluates the business strength, helps to improve business weaknesses, minimizes the threats, and takes into consideration all possible opportunities that will help to make a business successful (Paradigm, 2022). SWOT analysis has internal and external factors. Internal factors include financial resources, physical resources, and human resources. External factors are those that influence the company, and these factors have direct and indirect

relation with the company and the company does not have control over these factors such as opportunities and threats. External forces influence and affect every company, organization, and individual. Whether these factors are connected directly or indirectly to an opportunity (O) or threat (T), it is important to note and document each one. External factors such as

- Market trends such as consumers demands, technology advancement etc.
- Economic trends include financial trends both the national and international level.
- Donations and legislature
- Demographics, relationships with suppliers, political, and environmental (Schooley, 2021).

3.2.3 Value preposition canvas

The Value Proposition Canvas was introduced by Dr. Alexander Osterwalder to ensure a perfect fit between product and market (international, 2021). value proposition canvas was used to find out the factors that give a clear description of the value proposition that Arctic Red AS is going to offer its target customers. The value proposition is the promise about the product or service that will company offers the customers. The value proposition canvas has two sides one is value preposition the other is customer profile.

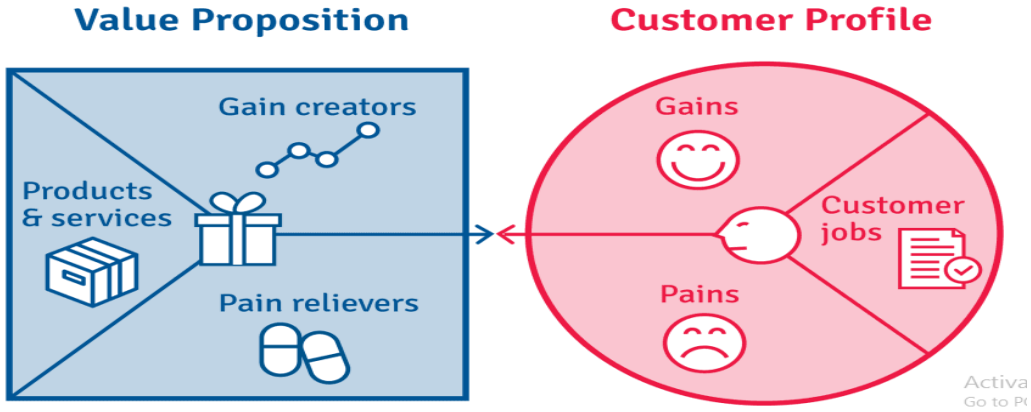

***Figure 10: Value proposition Canvas*:** A tool in bio business used to develop a business plan (international, 2021).

3.2.4 Business model canvas

Business Model Canvas (BMC) is a powerful tool that provides a strategic approach to a start-up business and was designed by Alexander Osterwalder and Yves Pigneur. It contains nine

blocks (Miro, 2021) and provides a strategic approach towards developing a business plan for Arctic Red AS.

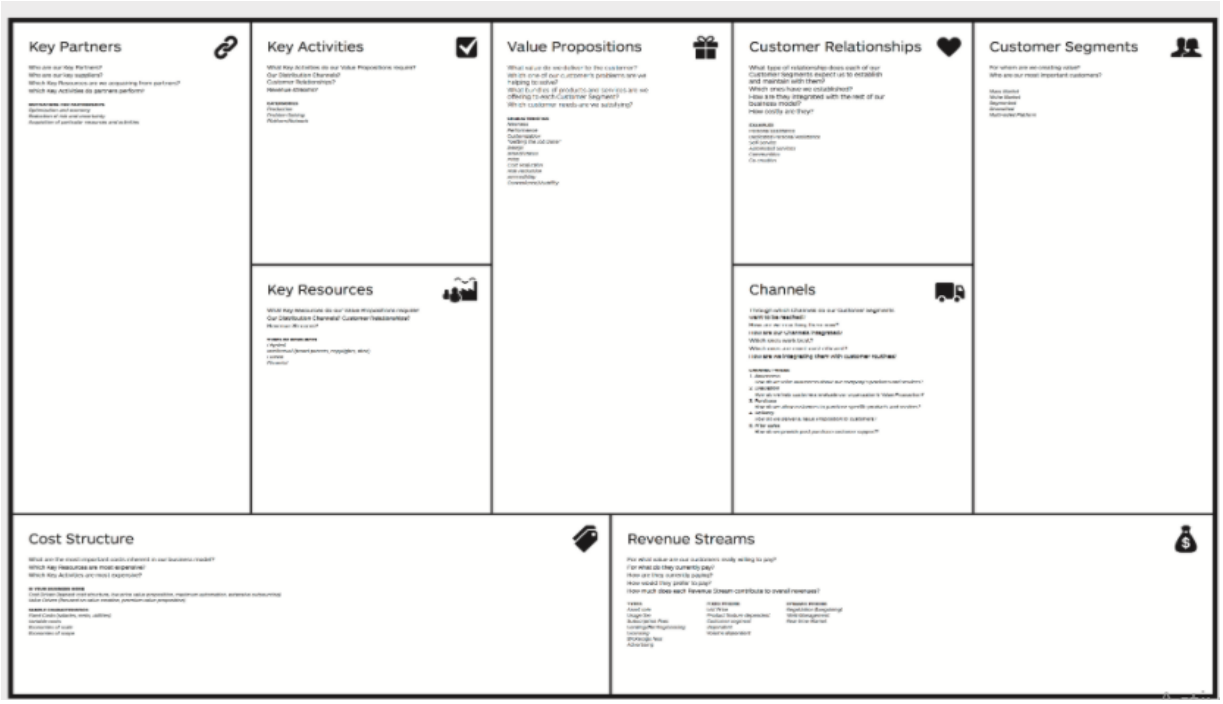

Figure 11: Business Model Canvas (BMC): A tool that gives an overview of a new business and helps to understand the a business model in structured way (BMI, 2022).

4. Results and Discussion

The aim of the thesis was to develop a business plan for a future company which I named Arctic Red AS. To develop a business plan there is a need to solve some research questions. This section includes the findings and answers to all research questions after data analysis.

4.1 Value chain analysis

Value chain analysis gave information about the overall process, activities, and projects that the company conducted to create value for the customers and income through the products and services. In this study value chain analysis was performed from breeders to target customers and every step was described in detail.

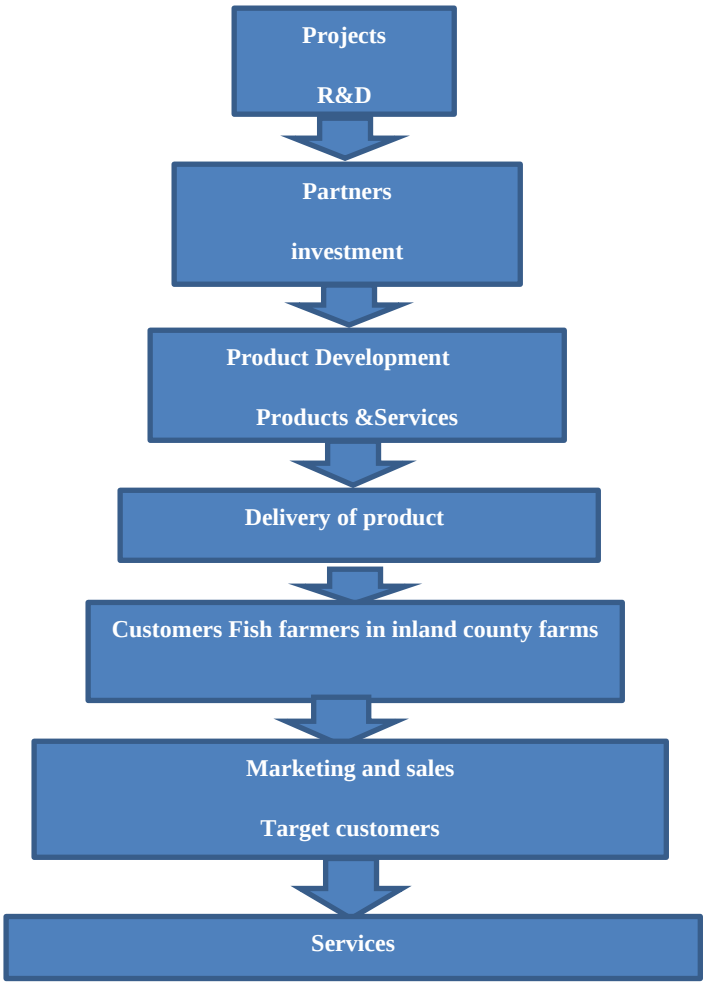

Figure 12: Value chain analysis of Arctic Red AS (a future company which is not established yet) for Arctic char aquaculture in inland region.

4.1.1 Projects and R&D

Char industry in Norway is still a small industry. There are few char farmers in North Norway and in South Norway (røyeforum, 2022). They are Harvesting the char and supplies mostly to the domestic market. They were allowed to use only the local char population due to strict rules and regulations, but now rules are changed, they are allowed to buy other strains other than local strains. Arctic red is a Norwegian national char breeding project that got special permission from the government for the breeding of Char populations and broodstock for the breeding program is collected from different regions of Norway. The aim of the project is to establish a char breeding program and maintain the breeding program as well as provide roe for the new farmers in the inland counties and meet the national demand. NMBU is a project partner for genetic work with the aim to construct an SNP chip for genotyping of char. This will provide char family tree reconstruction and prove a milestone for further research. The mobilization project also started parallel to the breeding project with the aim to target the new fish farmers in the inland county.

4.1.2 Partners and investments

Klosser innovasjon AS is leading the project and planning to establish a daughter company named Arctic Red AS. Partners in this project have different areas of experts (Innlandet university college, Norwegian Røye forum, Aninova, 4 char farmers with own brood stocks (Char breeders), NMBU (Genetic work). Project received partial investments from regional research fund inland and from projects partners. Klosser innovasjon AS invested lot in this project.

4.1.3 Product development

Karina Hauge Johansen is a project leader and scientist. The breeding station is located at Løpsjøen of Rena, and staff is rented from HINN Evenstad for daily keeping. Brood fish have been collected from different regions of Norway and careful interbreeding is done in selection for new char line. Available water sources and groundwater is used as a source of water for fish farming as fish grows well and thrives in fresh cold water. The goal of the breeding is to develop a char line that is suitable to use in aquaculture, fast growth rate, delayed sexual maturation, and with time better feed efficiency, good color, and meat quality. Char farming takes 2 to 3.5 years to grow fish to market size. The final product of this breeding project is eyed roe. The competitive advantage of Artic red AS is that it is the only company that has a national char breeding program in Norway. Char gives a sustainable production through a

complete life cycle on land-based systems which will help to secure our biodiversity. Fish farmers can establish char farms anywhere on the land if the water quality is suitable (no metals).

Final Products: Char roe is the final product with a value proposition that char will grow fast in high densities that will decree production cost and market sized fish will show good meat color and meat quality that will meet the market demand.

4.1.4 Delivery of final product

Eyed roe is the final product obtained after careful breeding and collected in trays with careful handling and incubated until they are delivered to the customers. For delivery to customers, final product eyed roes are packed in Styrofoam roe-boxes with cardboard boxes around the box. There is a total of five trays inside the box, one tray of ice on top of tray 4 in the box, and a 1-liter roe pr tray (12,400/13,500 roe per liter).

Figure 13: The above figure illustrated the packaging method of char roe that are ready for shipment to customers.

Delivery Routes: If the company must deliver small orders such as one or two boxes, they use regular post express and they deliver to customers overnight customers receive their boxes next day on their doors. Eyed roe can survive if delivery takes two to four days depending on the temperature and where the packages are placed. The Company also has self-service point,

and the customers also have the option to collect their packages themselves at the breeding station for safe transport, others can receive their boxes from the nearest airport after the staff drives to the airport. It takes 1 hour 40 min to drive to Oslo airport. International orders that Exports to Europe must be delivered at Oslo airport and via flight orders are exported to international customers.

4.1.5 Marketing and sales

Marketing of the products is the key element in the value chain analysis. Proper marketing and the right promotion of the product place the new product in the right market with target customers. Marketing is a way to tell the target market about the competitive advantage of char roe such as fast growth, best suited for fish farming, land-based systems, and a sustainable production way which will help to save the biodiversity and environment (wastewater treatment, fish waste can be used for fertilization production). Arctic Red AS used diverse ways of marketing such as online marketing Norsk røyeforum is the online platform that promotes Arctic char farming in Norway, personal communication and meetings with arctic char farmers, and Product promotion through the Arctic Red Facebook group. The Company can target the national and international market and contact the farmers directly and promote its product by explaining its competitive advantage. The price of the product also plays a significant role in the marketing of the product.

Table 7: The above table contains information about the price of char roe. The average price per char is 2,2 Kr if the customer order below 150000 roes. There will be a 5% discount on orders from 150,000 to 249.999 and the price per roe is 2,09 and a 9% discount on the order >250000 then the price per roe will be 2 Kr.

Amount	**Discount**	**Price**
0-149 999	0	2,2
150 000-249 999	5%	2,09
>250 000	9%	2

4.1.6 Target customers for Arctic Red AS

There are few char farmers in North Norway and in South Norway. There are five big char farmers found in Norway such as Sigerfjordfisk, finnmarksrøya, telemarkrøye, Norwegian fish

farms tydal, Blåfjell (røyeforum, 2022). The Company has a niche market and targets new farmers in the inland region to whom the company has helped in getting permits. These new farmers are on the priority list of the company Inland County was selected as a target market for roe as this county has great natural resources such as fresh water and land area and Klosser innovasjon AS aims for business development in the inland county. There are four farmers who are interested in buying eyed roe from Arctic Red AS. Two of them have completed all the documentation and license requirements to establish land-based farming in the inland county and are ready to buy the eyed roe from Arctic Red AS when they will build fish farms. Small scale farming needs 5-15 million NOK and production will be 10-50tonnes and around about150 million NOK capital needed to establish an industrial-scale farming (1200 tones production for commercial level) depending on the type of land-based systems. As fully technologically developed RAS systems are expensive as compared to Flow-through systems and partial RAS. Arctic Red AS targets other markets also other than the Inland region. In Norway, there are 6 to 7 char farmers in Northern and southern areas and the company targets them to sell them eyed roe because in this way the breeding station will be economically sustainable by getting revenue, and the company can get the time with sustainable production until the inland region to be succeeded. Moreover, the Company needs the income for economical sustainability, and revenue in the start is generated by selling roe to char farmers in other regions. At the international level, Sweden is also offering a market for the Norwegian roe as they are already placed the order for Norwegian roe.

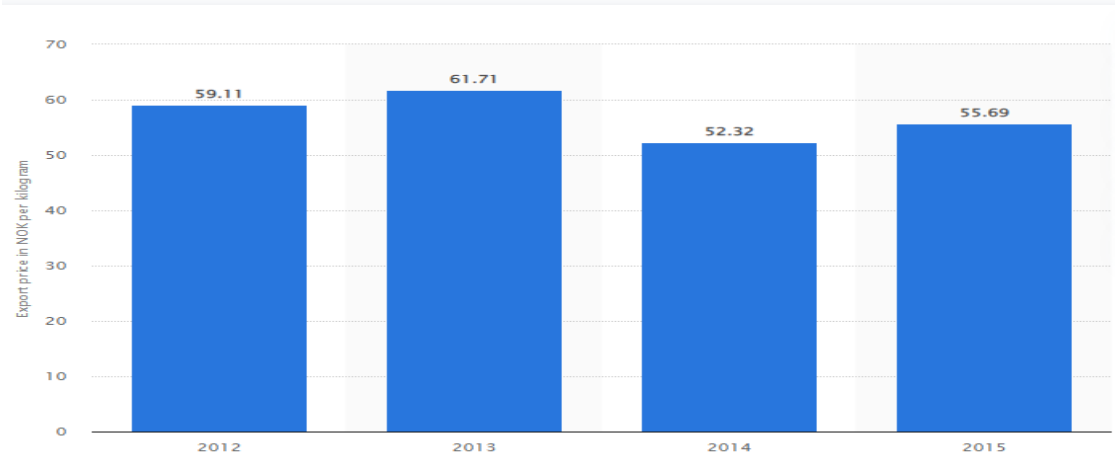

Figure 14: Export of Arctic Char, The above figure illustrated the export price of Arctic Char in Norwegian Krones from Norway from 2012 to 2015 (Statista, 2016).

4.1.7 Services

Arctic red AS must maintain good relationships with their customers after selling their product. A good customer relationship helps to main the position in the market. Arctic Red As has developed a good relationship with its customers. They are providing information about char farming and guide new farmers in factors such as start feeding temperatures and feeding regime as well as growth curves for roe customers. A good customer relationship is another key element to maintaining a start-up business.

4.2 SWOT analysis

SWOT analysis was done to find out the internal (strengths, weakness) and external (opportunities, threats) factors that are crucial for the successful operation of Arctic Red AS.

4.2.1 Strengths

Arctic Red AS is a start-up company in an inland county that is selling eyed roe of char after successful construction and interbreeding of the first selected generation of arctic char. The Company has a competitive advantage due to the Arctic red project which is a national Norwegian breeding program for Norwegian Arctic char. Arctic red AS is the only company in Norway that has started a char breeding program. This breed of Arctic char has a fast growth rate, delayed sexual maturation, and high food conversion ratio, and is fit to farm in land-based cold freshwater systems. The product of the company is eyed roe (Røyeforum, 2021a). Arctic char is a delicate fish with a unique taste, demanded in both national and international markets at a high price and in different forms, and can grow well in cold freshwater, land-based systems (FCI, 2008).

The Company got approval from authorities for breeding projects. Watercourses are available for fish breeding and simple flow-through systems are used that are less expensive. Moreover, the company has the best collaborators and the research partners that are working mutually and gained initial funding from regional research funding inland (Røyeforum, 2021a). The Breeding community in Hamar and the successful breeding of pigs and salmon is the advantage of the char breeding project. As there are already experts who are experienced in breeding and char breeding will be done without any risk such as lack of breeding staff and experts, Moreover, the Inland region is the only county with land and freshwater, and Klosser innovasjon AS working in this county for business development this is the best place to start

a business. The aquaculture facility located at Rena offers a cheap infrastructure (5500 rent per month) and a simple land-based system offers a cheap breeding environment.

4.2.2 Weaknesses

The Company needs more financial resources to maintain the breeding project and the Breeding station at Rena does not have enough capacity to serve the whole market with fertilized eggs. Arctic Red AS needs to set up a new breeding station to meet the market demands or need to make deals with char farmers for keeping a copy of the breeding core and produce roe as well. There are several models or company can target other production facilities and deal with them to produce char roe.

The Company has few active customers who are still working with permits and the establishment of farms. The Company needs funding and economical sustainability to maintain the project. Skilled workers are also needed to make the operation successful. The Company also needs equipment for the breeding stations to create a setup that will meet the demand of the market. The project leader is the key person in this project and the project is unstable regarding staff. Project leader quit the project; the project will suffer. Seasonal staff is another weakness, the company needs more staff for making the project successful. The breeding station does not have a great space to expand the production volume and there is no permit to change the water temperature. The Char industry is a small industry in Norway due to a lack of breeding programs and few char farmers are using the regional population. It is expected that breeding program with a successful generation of char lines, the char industry can grow just like the salmon industry both in the national and international market.

4.2.3 Opportunities

The company has potential and a bright chance to grow nationally and internationally in the future. As char farming is a small but growing industry in Norway and in different countries that will lead to high demand for the best quality char products. There are four farmers in an inland county that are ready to establish their farms and will buy roe in the future. Other than inland county there are char farmers who are active customers and demand in the future will increase. Opportunities also exist at the international level as Sweden, Iceland, and the EU will also offer a market for Norwegian char products in the future, but the market is not yet built as it needs large export volumes.

Arctic char has an opportunity to be placed at a good place in the market with good marketing. Arctic char has a high price in the market due to its high production cost, with the help of a better-bred char production cycle can be fast that will help to reduce the production cost. Arctic Red As is the only company in Norway that is running a breeding project with the aim of commercialization of the products nationally and internationally and the government is taking interest in this project which is a positive attribute in terms of the funding.

The company has an opportunity to get funding from the government (Proff, n.d). Still, the company needs commercial activities to maintain daily operations in breeding stations. Product development ideas can open new doors for the company. For example, using new and different methods for cooling roe to make different delivery dates.

Another business opportunity for the Arctic Red AS will be selling fry instead of only roe. Fry is the stage where the fish start feeding. It will be a good idea for company development. Customers would like to buy fry as the closest small customers would like to buy 5 g fry it is the size of char when finished with the start feeding process. Two distinct products roe and fry will open new opportunities and the company will grow at a sustainable rate (communication with Karina Hauge Johansen), but the Company needs to extend its facility and buy the new equipment for fry production. The company needs to adopt new delivery routes and boxes for the delivery of fry as they need water and oxygen to be alive and needs extra care to be delivered.

4.2.4 Threats

Arctic char farming has high production costs and high prices in the market and is not well known in market Moreover, char needs proper branding to be well known in the market. There are few investors that are interested in char farming because throughout history char farming is not successful business in Norway. Company s success lies in the farm building of new farmers in the inland county, who are still working with documentation work, and want to build their farms in the future. If they quit the farm building process, then the target market for the Arctic red AS will be finished and the company s project will be ended.

Klosser innovasjon AS is the main investor for the project. If they withdraw from the project, then the project will be ended with no gain. The company also lacks skilled workers and project leaders. If the present team or members of the project team quit the project, then the project will be at risk.

Table 8: SWOT analysis for Arctic Red AS: The below describes the company's internal and external factors which have direct relation with the company's development.

	Strength	***Weakness***
Internal Factors	Breeding project (Best quality char roe) Mobilization project (to motivate investors). Klosser innovation AS. Assist business community has skilled business experts. Experts and qualified researchers. Best breeders. Government support (as they want more aquaculture). Cheap infrastructure simple land-based system offers a cheap breeding environment. Electricity rent is also less. Cooling trays are used for roe and near to Oslo airport offers a great access to customers	Few active customers High production cost for land-based systems Less economic stability Needs income to maintain operation Legalisation and licensing process is time taking and needs money. Present breeding station is not producing enough roe to meet the demand Needs of Skilled breeders which can use other production method which are more beneficial than existing.
	Opportunities	***Threats***
External Factors	Opportunity to grow at national and international Salmon technology and industry techniques can be used to develop arctic char industry in inland county and in Norway. New genetically based production method can be used. Product development opportunity Fry as product to sale farmers	Start-up company Investors can withdraw from project (new farmers/ Klosser innovasjon AS few investors Funding from research funding was only at the start of project. Legalisation process can be changed Less economical sustainability. Threat of losing staff

4.3 Value proposition canvas

The value proposition canvas tool is used to develop a direct connection between the product and services that Arctic Red AS is going to offer the customers. How this project will solve

char farming issues and it will be proved crucial for the success of this industry in Norway and how Norway will become a leading country in Arctic Char farming in the future time.

4.3.1 Arctic Red AS value propostion

1) ***Products and Services***: Arctic Red AS is a start-up company that is running a breeding project for the Norwegian Arctic Char for selecting beneficial traits and successfully producing fertilized eggs/ fry and ready to sell to fish farmers in the Inland County, char farmers in Norway and at international level (Germany, EU, Austria, and Sweden, etc).
2) ***Gain Creators:*** Arctic Red As promises a value to their customers that Arctic char produced through these fertilized eggs will have a fast growth rate, delayed sexual maturation, high food conversion ratio, good meat quality, and flesh color. This fish species has the potential to grow at the commercial level both nationally and internationally.
3) ***Pain Relivers:*** A fast growth rate will shorten the life cycle of Arctic Char and help to reduce the production cost. Feed cost is high in aquaculture, and this breed of Arctic char shows a good feed conversation ratio this trait will help to reduce the wastage of fish feed. Inland farmers can start their fish farms as this is a land-based freshwater fish project that is not limited to coastal lines.

4.3.2 Customer Profile

The customer profile illustrates how the products and services of Arctic Red AS are positioned in the customer profile.

1) ***Pains:*** Arctic char industry in Norway is not a large-scale and commercialized industry. Arctic char shows early sexual maturation due to which meat quality, taste, color, and yield decreased (Fantom, 2020). Lack of breeding projects and genetic research projects.
2) ***Gains:*** Arctic red Breeding project has selected Arctic char bred that shows delayed sexual maturation, fast growth rate by reducing life cycle, good food conversion ratio to meat, land-based freshwater system and not limited to coastal areas.
3) ***Customer jobs:*** Fish farmers in the inland county can set up their own char farms on a small scale and large scale. They have availability of land and fresh water and easy access to the fish markets. Arctic red AS supplies services to fish farmers in char

farming at early phases and supply guidelines related to the water source and farm types.

4.4 Business Model Canvas

This This business model of Arctic Red AS was developed based on the nine building blocks canvas model of Osterwalder & Pigneur. The business model canvas gives an overall view of the company. It gives information to investors, on how the company is creating the product, creates the values, funding, revenues, and how to deliver to the target market. To develop a business plan for the company it is essential to develop a Business Model Canvas for the Future company Arctic Red AS. Klosser innovasjon AS is the project leader and main investor in this project and working on the project with other partners mentioned in key partners. They also get support and funding from other project partners. NMBU is a project partner in genetic work and working to construct the family line for char.

Key activities include Char breeding at the breeding station and fertilized eggs are produced with selected traits and incubated to eyed roe stage and delivered to customers. Customers segments of the company are dependent on the priority customers such as Company's target market is inland county but customers in the inland county are still working with the permits and will start their farms in near future. The company is targeting the char farmers in North and south Norway to sell their roes to them so that keeps the project until the farming is started in the inland county. At the international level company can target Sweden, EU, Austria, and Germany but they need to increase their production volume to create a good customer relationship company is arranging the direct meetings with the customers and started delivering packages to char farmers which they can receive at their door. Others can also pick up their orders direct from the breeding station.

Norsk Røyeforum is an online platform for breeding projects and for customers to reach us. Customers can call and email the to company for placing the order. To keep the project and support the budget the company needs an economically stable condition. According to this model, the main income resource is selling roe to char farmers and the price per roe is 2 Kr which is generating enough revenue to maintain the project.

Table 9: Business Model Canvas: The below table gives an overview about the Arctic red AS company.

<table>
<tr>
<td rowspan="2">Key Partners

Klosser innovation AS

Hedmark county inland (Funding for research)

Innlandet university college

Char breeders in char Networks

NMBU (Genetic Research)

NCE Heidner Bicluster (Provides best breeding environment)</td>
<td>Key activities

Char breeding

Production eyed roe

Marketing

Target customers

Maintain the project funding (through selling of roe to customers)</td>
<td rowspan="2">Value Preposition

Fast growth rate

Suitable to land-based fish farming

High quality meat

Best quality meat colour

Thrives well in tanks even in high density</td>
<td>Customers Relationships

Direct meeting with customers

Personal Assistance</td>
<td rowspan="2">Customer segments

Char farmers in North and south (Telemark)Norway

Target New farmers in Inland County

Char Farmers from EU, Austria, and Sweden</td>
</tr>
<tr>
<td>Key Resources

Human resources

Infrastructure (breeding station and land-based system, freshwater resources).

Char brood stock

Capital to keep the project</td>
<td>Channels

Online website

Delivery of products through post service

Airline service for international export

Personal contact</td>
</tr>
<tr>
<td colspan="2">Cost Structure

Research and development, Breeding project cost

Infrastructure

Employee salaries

Equipment, feeding cost</td>
<td colspan="3">Revenue Streams

2 Kr / eyed roe (price per roe is differ depends on the order as explained above see table 7)</td>
</tr>
</table>

4.5 Business plan for Arctic Red AS

A business plan is a written document that describes the aims and goals of the company and strategies that the company will adopt to achieve its goals. The business plan for the Arctic

Red AS gives an overview of the company's aims, products, management, market, and financial strategies.

4.5.1 Executive summary

The Char industry in Norway is underdeveloped and there are only a few char producers in Norway char has a great market potential both nationally and internationally. Arctic Red AS the main goal is to sell char fertilized eggs or char roe to fish farmers in the inland region. Arctic Red AS is associated with the Arctic Red project and mobilization project by Klosser innovasjon AS Selective breeding program is a competitive advantage for the company as it is banned for the farmers to import char eggs from other countries. Arctic Red AS has competent management and research and business team that includes business experts, genetic research partners, breeders, and a management team. At the Breeding station, char breeders have successfully produced the first char line with selected traits. Arctic Red AS has 1,15 million-eyed roes that are produced at the breeding stations with around about 2 million NOK investment per year.

4.5.2 Business idea and impletation

The Inland region is rich with freshwater resources and land area, a new business idea freshwater land-based char farming is suitable for the business community of this region. Arctic char is the fish species that were selected for the new business idea. As Char production in Norway is exceptionally low and only at the domestic level and there is the market potential for this species nationally and internationally. Norway is already a major producer of salmon(Olsen & Osmundsen, 2017) . Salmon industry technology and experience can be used to develop the char industry in Norway. The idea behind the project Arctic Red is to increase the production of char roe by targeting new places in the inland county, they closely track the problems in char farming and came up with solutions to problems by selective breeding of char population in Norway. New char line has traits such as fast growth, delayed sexual maturation, and good meat color and quality. Moreover, land-based freshwater farming is a sustainable production method and does not limit to the only shoreline.

4.5.3 Product and services

The final product of the company is eyed roe which packed according to the demand of the customers and delivered to the customer next day the door (if express service is being used). Some customers can buy the product directly from the company and picked their parcels from the company. For the customers at the international level, airline services are being used. The

average price per roe is 2,2 Kr if the customer order below 150000 roes. There will be a 5% discount on orders from 150,000 to 249.999 and the price per roe is 2,09 and a 9% discount on the order >250000 then the price per roe will be 2 Kr.

4.5.4 Team and management

The Company can drive a successful business operation with a competent team. There are skilled experts from the different sectors such as business, innovation, genetic research, marine experts, fish feed and health experts, project planners, breeders, technical managers, marketing manager investment, and budget planners. At the breeding station, Karina Hauge Johansen is the project leader and dealing the research /science part, and budgeting of the project. There are 3 staff members rented from HINN Evenstad who fish experts are, and they also do the production partly by stripping the roe and milt from the fish. Fertilization and incubation of roe and family's construction and dealing with the orders and sales, the package for shipping/collecting is done under the supervision of project leader with help of other staff members. There are 4-5 students who are hired for taking care of the incubated roe.roe.

4.5.5 Market analysis

There are only a few char producers in Norway, and they are using the local char population for char farming production is extremely low and normally they sell it to the domestic market. Market analysis of char showed that the char market is still unsaturated nationally and internationally. The major producer of char is Iceland still international char market has the potential to grow and the demand for char is more compared to its production. In south and north Norway, there are 7 char farmers who are buying eyed roe. The market in the inland county is not so big. There are 4 farmers who are interested in developing the char farms in the inland county. Rendalsfisk company is the biggest potential customer in future when they built facility, and they would need 1-1,2 million roe. Another two groups are still planning and applying for permits) with the aim for a medium-sized facility and each will produce 325 tons of biomass. One group has completed all the permits and is ready for building the facility. It is a small-scale facility and will produce 60 tons of biomass. All of them will need the right amount of roe. The Slaughter size of char is approximately 1 kg, and the mortality of the fry might be 5-10 %. Norwegian roe is also in demand in the international market such as EU, Austria, Germany, and Sweden. In Norway, the char market is less popular due to its limited production, the market where consumers know the char is in demand due to its unique taste and considered a luxurious fish. Char introduction in all seafood markets and proper branding

and promotion will make it a high choice fish in the market. Currently, char is known in bigger cities and on the menu get a place as a luxurious fish in restaurants, local food markets, and sushi restaurants.

Table 10: Char market in inland region: Target customers in inland region

Char market in inland region
1. Rendalsfisk Company (needs 1-1,2 million eyed roe) 2. Medium sized facility (> 325 tones production) 3. Medium sized facility (> 325 tones production) 4. Small scale facility (> 60 tones production)

4.5.6 Marketing strategy

Marketing of char products is a most essential element of the business plan. Marketing strategy places the products of a company at the right place at the right time and targets the right customer segment. 4Ps marketing strategy is used by Arctic red AS to introduce their products and target the right market. Products of a company are the value proposition that the company is promised to its customers. At the breeding station under controlled conditions eyed roe are produced. The company will also help with early phase farming and helps to select the right type of facility. Char farming is environmentally sustainable as it is land-based, uses less water, and fish waste is not directly discharged into the sea and treated for producing secondary products such as fertilizer. The place is the second major element if a company targets the right customers in right place, then the company will grow and develop. In this research, the target place for the Arctic Red AS is the farmers and business community in the inland region. New farmers inland who are working with permits and in the near future ready to build their farms are top customers for the Company. The target place and target market for Arctic Red AS products are inland regions. The Inland region is rich with freshwater sources and land area and the inland region is suitable for freshwater land-based farming. A group of new farmers is to establish char farming. Char farmers in the south and north of Norway are the second target places for the company. The international market also shows interest in Norwegian-eyed roe. But company fulfils demand in the Inland region first that target national and international market. The price of the product is the critical factor for successful business operation. At this point, the company must sell their eyed roe to maintain their project.

According to the project leader price per eyed roe should be 2 Kr for the order of more than 250000 eyed roe. See table 6 for price details with quantity. Promotion is a way to introduce the product in a way that customers wish to buy it. The mobilization project's main goal is to target the new fish farmers, mobilize them, and assist them to start their own fish farms by using char fertilized eggs or roe. Team meetings have been arranged to promote the idea of land-based fish farming in the inland region Advertisement and promotion are conducted through the newspaper and online promotion. Norsk røyeforum is online char information plat form. Arctic red AS company used this char platform to sell their eggs and roe and customers can reach them through this. Norsk Røyeforum is the website where one can get information about projects, char, and selling and purchasing of eyed roe from this website. This website is playing a significant role in establishing char farming in Norway. There is also a char Facebook group for the promotion of the char breeding program. Promotion and marketing are the keys to the successful launching of the product in the market.

Table 11: 4Ps Marketing strategy for the Arctic Red AS.

Product	Price
Products: eyed roe. **Services:** Consultancy **Value:** Fast growth rate, delayed sexual maturation, high meat quality, good meat colour. **E**nvironment sustainability	Price per eyed roe 2 Kr (Price between 2-3,5 Kr /roe. On top delivery 10% extra roes is delivered to customers (2,2- 2,5 NOK customers comfortable with this price)
Promotion	**Place**
The Mobilization project main goals to target the new Farmers. Team meetings Advertisement and promotion are conducted through online promotion. Norsk Røyeforum is online char promotion plat form.	The target place and target market for Arctic Red AS products is inland region. North and south Norway International market

4.5.7 Budget

The budget for the Arctic Red breeding station per year sees appendix 1. The table in appendix 1 shows the budget to produce eyed roe per year. According to the budget table, a capital of around about 2 million is invested to produce 1,15 million eyed roe per year. To maintain the project company the needed an investment of 2 million per year and the production volume will be 1,15 million. The company is also planning to buy new incubators and freezing milt that will cost 100,000. Price per eyed roe according to cost per roe should be between 2,5-3 Kr to maintain the project.

Production Volume/year	=	1,15 million Eyed roes
Investment / year in Krones	=	2 million Kr
Total Cost per egg	=	1,7 Kr / eyed roe
Selling price /eyed roe	=	2- 2,5 Kr

4.5.8 Financial Planning

The financial planning of Arctic red AS is the step toward achieving their goal and maintaining their project. The Company has produced 1,15 million eyed roes with investment around about 2000,000 NOK. Main income sources are selling eyed roe to customers. The ideal price for customers is 2 NOK pr eyed roe and selling of 1,15 million eyed successfully generates 2,3 million in revenues. The company is also giving 10% extra eyed roe on delivery to compensate for the mortality rate. For example, if a customer placed an order of 300,000 eyed roe delivery contains 10% extra (30,000 extra eyed roe) and the price per eyed roe is 2 Kr but in actuality, the company gets the price per roe is 1.8 due to 10 % extra roes and Cost pr egg is 1,7 Kr. Revenue generates per egg is 0,1 Kr. As the company is producing 1,15 million eyed roes with 10% extra on delivery round about 1 million eyed roes will generate revenues that are 2 million. The company can also set a price between 2,5 to 3 NOK per eyed roe to get good revenue in terms of profit and maintain their project yearly, but customers maybe not be willing to pay this price. They are comfortable with 2 Kr per eyed roe.

4.5.9 Future projection

The company has the aim to become a successful supplier of eyed roe nationally and internationally. In the present state, the company has the aim to create enough healthy-eyed roe to meet the demand for new farmers in the inland region. 1,15 million eyed roes have been produced by the company in 2021. In the future, the company has aim to meet the demand for

char eggs with a focus on the ongoing projects in the inland county and needs to increase the production volume from 1,15 million to 2.5- 3 million eyed roe within 2025. The Breeding station at Løpet might not have the ability to produce this amount due to restrictions in space and water sources. However, recently 14 cabinets have been made plans for in the space that the breeding station has, and it is expected that This will create capacity for production.

Table 12: The below table illustrates the future production planning of eyed roes by the Arctic Red AS to meet the demands of their customers in future.

Years	No. of cabinets	Production volume
Winter 2022/2023	10 Cabinets	1620000 eyed roes
Winter 2023/2024	14 Cabinets	2,3 Million

At present, the company has 6 incubators and planning to buy four new incubators to increase the production volume. In the future, the Company will need a new breeding station to meet the demand by 2025. At present, the breeding station has a capacity for production volume of 2,3 million.

5. Conclusion

Value chain analysis of Arctic red AS was performed for each stage and specific values for each stage were found and added at each step to get results. A market analysis showed a niche market for Arctic char and main market establishment in Norway will make the char business profitable in Norway. Value Proposition Canvas is used to evaluate the product to customer demand. Value proposition analysis showed that the new char line after breeding meets the market demand. SWOT analysis was performed to find out the company s internal and external factors. SWOT analysis showed that char farmers in Norway can make char farming a profitable business by using the eyed roe produced through the first char line by Arctic red AS. The competitive advantage of the company is that its the only char breeding company in Norway. The business model canvas was developed on the base of nine blocks. It gave an overview of the company's projects and successful operations. Arctic Red AS company needs financial and legal support from the concerning authorities to make their project a success in the coming years as land-based char farming is a sustainable farming method. The company has produced 1,15 million-eyed roes with around about 2 million investments. It is expected from the business plan that within the year 2025 company needs to produce 2.5 to 3 million eyed roes to meet the market demands with larger investments. The company has already started to produce revenue by selling the eyed roe. Production cost is still a challenging factor for the breeding company and needs funds and investments for keeping the operation. Char farming is suitable both for the environment and economy of the company as Norway is the second-largest producer of salmon and the salmon industry technology can be a positive point for the growing char industry.

Appendix 1

Facility Expense	Expense/Year	Explanation
Breeding station Rent	66,000	
Electricity Expense	45,000	
Repairment Expense	10,000	
Equipment cost	10,000	
Security Expense	42,000	Security camera service for 24 hours
Water analysis expense	8000	
Brood Stock		
Feeding Cost	60,000	
Keeping	600,000	
Veterinarian services	35,000	20,000/monthly visit 15000 testing
Destruction dead fish	18,000	Getting rid of dead or out sorted fish, fish ensilage
Breeding Program		
DNA bank	20,000	Preserve frozen DNA(5,5/Sample)
DNA preparation	46,000	92kr/fish (1500 fish/generation)
Genotyping	225000	450Kr/ fish 2000 fish
Roe production		

Equipment	12,000	Disinfectant, tranquilizer, cups, paper, lab)
INN working hours	220,000	320 hrs 650 kr/hr
Roe pickers	70,000	4-5 people, 200-300/hr (1 million eyed roe)
Packaging	2,500	Roe boxes,60kr/box,6 litres/78000 roe per box+60kr/cardboard box for air freight= 120kr box shipped.
Staff		
Project leader	500,000	50% 230days/2 (115days*7,5=863 hrs)
Transport cost	20,000	
Sum	2,009,500	
Further Investments		
Incubators	50,000	Per incubator156000 roe.
Freezing milt	50,000	Soon to be incorporated.
Microscope	15,000	Need to buy this. Not sure about price.
income		
Roe Sale		Price between 2-3,5 Kr /roe. On top delivery 10% extra roes is delivered to customers (2,2-2,5 NOK customers comfortable with this price) Customers pays 25% moms/ VAT-value added tax)

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