SUSTAINABLE FISH FARM

SOLOMON ISLANDS

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INTERNATIONAL BUSINESS STUDIES Abstract

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Small-scale fisheries employ many millions of people around the world, and are particularly important in developing countries, where the dependency on marine resources in high and livelihood diversification options are scarce. In many areas of the world however, small-scale fisheries management has in many cases been insufficient and new comprehensive approaches are recommended to achieve social-ecological sustainability in the long-term. The aim of this thesis is to identify the main challenges Solomon Islanders face when it comes to national fisheries. The unsustainable practices that damage the ocean, especially coastal fisheries as a result of population growth.

Climate change plays an important part. How does climate change affect the South Pacific Ocean including Solomon Islands? Does climate change contribute to the unsustainable fisheries? How does it affect people's livelihood who depend on the Ocean's resources? Is there evidence that climate change is a problem.

The author uses the Business Model Canvas and SWOT Analysis as the methodology for this thesis. And the United Nation Sustainable Development Goal (UNSDG), the UNSD goal 14 "Life Below Water"

Finally, the author presents a business idea that tackles the unsustainable fishing methods in the Solomon Islands. A sustainable solution to coastal fishing challenges due to population increase and the consequences of climate crisis.

The Sustainable Fish Farming in the Solomon Islands is a business venture owned by two brothers. Adding value to a local product with a competitive pricing. Aiming to support food security challenges predicted by Solomon Islands Government for 2031. And educating local communities to be good stewards as ocean custodians.

Keywords Sustainable Fishing, Ocean, Climate crisis, Solomon Islands, Aquaculture

Pages 49 pages including appendices 52 pages

Contents

1 INTRODUCTION

Pacific Islanders are the custodians of the ocean. Pacific islanders have been living in the Pacific Ocean for centuries, they have made this ocean their home using knowledge of seafaring, navigation, ship design and construction, and have developed social and cultural systems that can be used to manage the sea and its resources.

The author of the thesis is a native of Solomon Islands, from the South Pacific Ocean. Although this thesis is not representative of all Pacific Islanders, its highlights the necessity of bringing their perspectives into the centre of global debates about the governance and the sustainability of marine resources. The author's viewpoint, and one increasingly shared in Solomon Islands and regionally, is that Pacific Islanders' close association and special relationship with the ocean should be used in the drive to effectively manage the ocean.

The author's encounter with the sea was as a five-year-old boy accompanying his older sibling to the coast for a "swim in the sea" as they called it. Solomon Islands is surrounded by the sea, as a child learning to swim in the ocean is second nature.

The author was the fifth born in a family of nine and was born and raised in Honiara the capital of Solomon Islands. Every now and then the author traveled to the Malaita Province to visit his rural tribal village situated at Langa langa lagoon. At the tribal village the author participated in reef gleaning, fish poisoning, fish drives, turtle fishing, gill-netting, handling of other types of nets, spear fishing on the surface and underwater, and a variety of night fishing activities. This was all part of an induction into being an islander. It was told that if you did not want to eat, you could be excused from these family chores, but if you love food, you had to work hard and learn to take care of your family. There was no such thing as sustainable or unsustainable fishing method. It was fishing for survival. The ocean was the supermarket. The grocery shop where food was collected and it was free, a person just needs to go and get it. As a child growing up it was fun and normal. There was an element of adventure when visiting the tribal village. Something that was looked forward to every time there was a visit to the tribal village.

As the thesis writer grew older, the increase demand for coastal fish species in these islands fueled overfishing, which in turn threatened local food security, livelihood, and ecosystems. Climate change is compounding this problem by lowering harvests from coral reef fisheries.

The warmer ocean is also changing the distribution on fish stock, threatening island economies.

Research Question:

How can we keep the Ocean sustainable? Our action today though insignificant will have a great impact in the years to come.

There are 2 main objectives according to this thesis : Firstly, its the awareness that climate change is real, it affects and changes peoples livelihood, especially the island nations who depends on the environment for food . Secondly, Human activity affects our environment same way as climate change. It can either affect it in a positive or negative way. Fish farming is a positive way of impacting our environment. Fish farming is the raising of specific species of fish in enclosures or special tanks. The fish raised on farms are primarily for food, though the objectives of this aspect of aquaculture include more than increasing the seafood supply. There are employment and and economic advantages, as well as the possibility of sustaining species that might be over - fished if not for the controlled environments of fish farming. If the Solomon islands' ocean resources are managed well, it should be one of the main supplier of the global demand for seafood. Turning the challenges into opportunities and introducing new method of fishing.

1.1 DISPLACE BECAUSE OF CLIMATE CHANGE

Warmer sea water, coral bleaching, sea-level rise, coastal erosion, soil salinisation, changes to tidal patterns and population growth are all connected, and negatively impacting the marine environment. In the 70’s, the locals could find plenty of fish in the waters surrounding their islands. But 40 years later locals have to travel further away and spend much more time to catch less fish mostly juvenile. Although the more experienced fisherman can see the difference, some younger ones have not been fishing long enough to know that things have changed.

Over the years the lower islands have tried to hold the water back by building stone walls. The sea level rise is also evident as they witness water advancing up the shoreline causing erosion that brings big trees down, washes away graveyards and forces communities to

2009 COP 15 took place in Copenhagen, Denmark. By then I was 14 years old and noticed an Island I held so closed to my heart slowly being washed out. Kale island on which I stand today was my Grandparents home. This personal loss prompted my journey as a climate advocate. In 2014 COP 20 was hosted across our Pacific Ocean in Peru. You see, whilst the rest of the world was participating in COP 20, five of our islands was completely submerged underwater including Kale. This is documented land loss in Solomon Islands alone.

I have been advocating for climate action for over half of my life and I still do not believe we are doing enough. Instead, what I am seeing particularly in the Pacific, is political division. Our islands are sinking, our people are being displaced, our children are going hungry, our communities are becoming unhealthy and dying. Today we are at risk of losing access to some of the most basic human rights. If we are unable to unite, we will lose our beautiful Pasifika way. "(Gladys Habu's Vblog, 2021)

Mrs. Habu continue to challenge the world leaders to bring the climate change event to our shores. She said, "It is now 26 years and counting, and our region has yet to bring the worlds biggest climate event to our shores, we need to bring COP closer to us, we contribute almost nothing and yet we are at risk to losing everything. Please come and stand in our seas and feel for yourselves the urgency and importance of your responsibility! The loss of my beloved Kale is my line in the sand and should be a red flag for our global community." (Gladys Habu's vblog, 2021)

1.3 UNSUSTAINABLE FISHING METHOD

Figure 1 Traditional Fishing method (photo Solomon Islands Government. 1. 2021)

As population increases, the demand for food will naturally increase. Solomon Islands traditional way of fishing is changing due to modern way of life.

The challenges they faced with sustainability is, most fish eaten are caught close to the shore, but those fisheries are declining due to poor management and rising populations. Climate change and other external threats increase the risk that coastal fisheries will not be able to provide required economic, cultural and nutritional benefits into the future. Solomon Islands are affected by malnutrition and non-communicable diseases, childhood stunting and anaemia. Productive and resilient fisheries are critical to improving food and nutrition security across the Solomon Islands. (Ocean Hub 2015)

Figure 2 Net Fishing Solomon Islands (photo Solomon Islands Government.1. 2021)

Coastal fisheries are under increasing pressure from over exploitation and loss of habitat. Coastal fishing is practised both by local communities for subsistence and livelihoods and by commercial artisanal fishers. A wide range of finfish and invertebrates are harvested. Ecosystem's degradation in the coastal zone is a result of both local stressors such as pollution/ sedimentation, coastal development, destructive fishing practises, and the effects of climate change. Rising human population and urbanisation is also increasing the demand for fish at the local and national level. (Gillett R. 2016.)

There is increase recognition that growing populations, combine with effects of climate change and overfishing on fisheries resources, particularly inshore reef fisheries resources, will compound food security problems arising from an increasing gap between fish demand and supply from coastal fisheries.

Solomon Islands is one of the pacific island's countries where shortfalls in the food fish production are projected to be most serious. (Bell 2009). Calculations suggested coastal fisheries will not supply the fish required for future food security, with projected shortfalls of more than 4000 tonnes per year in fish supply versus demand by 2030.

There is a need for new sources of fish to meet future food security requirements, and aquaculture is one means of supplying future demands (Gillett R. 2016.)

1.4 Aquaculture the solution for sustainable fishing

In the mist of all these challenges the hopeful solution is Sustainable fish farming. Aquaculture is farming fish in a controlled environment. Having control over how mush fish can be farmed and sold, therefore always managing the fish stock. Which reduces the risk of over fishing. Aquaculture is proven to help manage the ocean resources and distribute it evenly over time in order to manage food security. Solomon Islands government insisted that “with projected shortfalls of more than 4000 tonnes per year in fish supply versus demand by 2030” In other words in order to reach its target in 9 years, aquaculture is the solution for the problem. Sustainable Fish Farming in the Solomon Islands is a sustainable solution to the coastal fishing and climate change challenges. (Solomon Island Government 1. 2021)

Figure 3 Image by Cliff

1.5 SOLOMON FISH – THE SUSTAINABLE FISH FARM

Solomon Fish believe in sustainable sea food. Starting from the hatchery to the open ocean farm, Solomon Fish take extreme care to raise amazing fish.

They go thru a careful site selection process to install their cages, ensuring there is minimal or no traceable impact to the surrounding ecosystem and the seafloor.

Solomon Fish breed their marine fish species in a controlled environment before transporting them to the farm in the open ocean.

Figure 4 photo by Visit Solomon Islands 2021

1.5.1 TECHNOLOGY

Solomon Fish use a proven technology in the entire process monitoring the right temperature, light, and filtrated recirculated water in raising their juvenile fish. Their fish are fed with a natural custom-made diet for taste and quality.

1.5.2 SUBMERSIBLE CAGES

Solomon Fish raises the fish in the open ocean. Their submersible cages are innovative and sustainable system for offshore (Deepsea) aquaculture because of their low ecological impact. To make it as natural as possible.

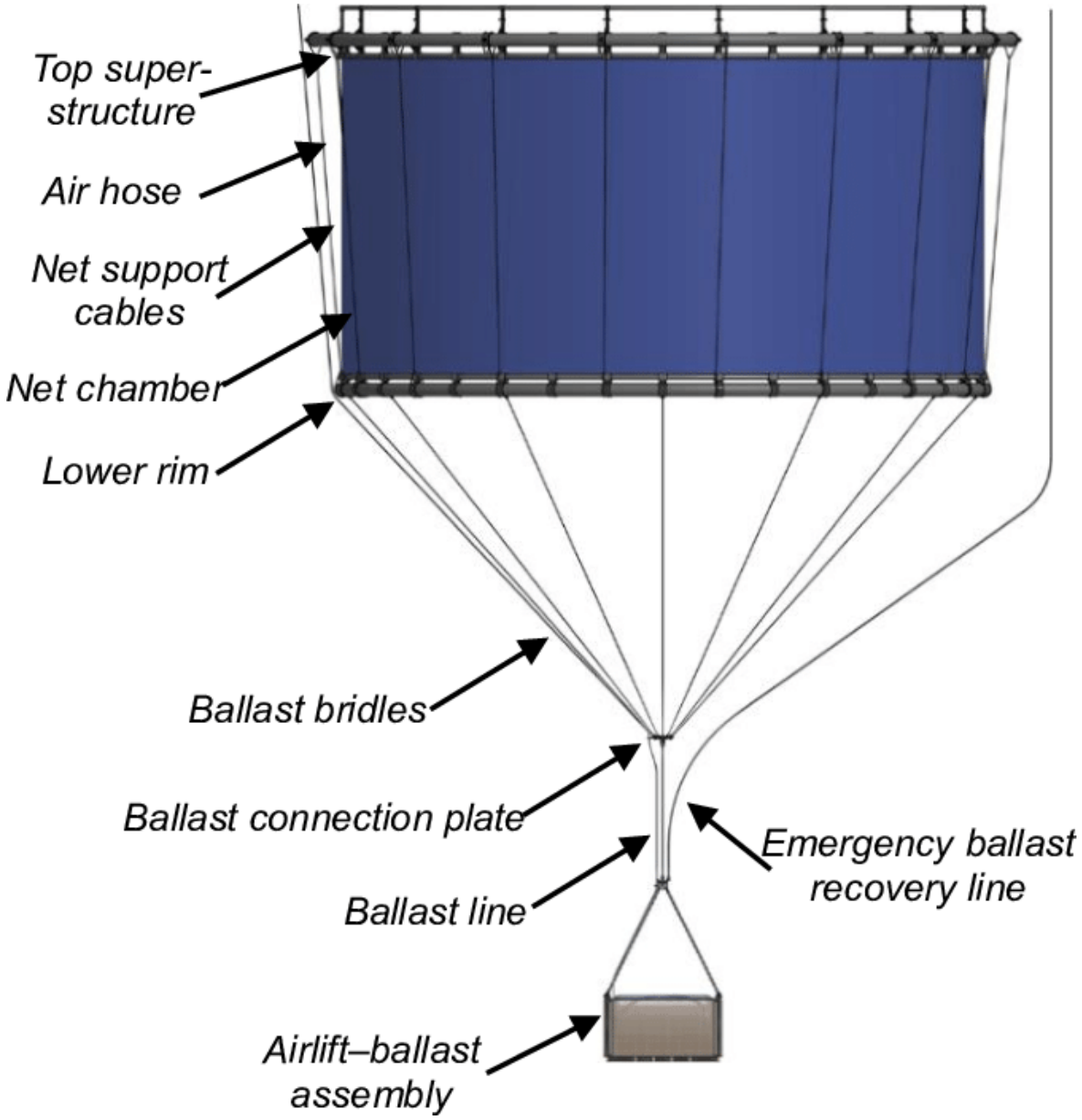

Figure 5 prototype design

2 THEORY AND BACKGROUND

2.1 SOLOMON ISLANDS

Solomon Island is situated some 2000kms northeast of Sydney Australia. Solomon Islands consist of six major islands and approximately 900 smaller volcanic islands, coral atolls and reefs, more than 300 of them are inhabited. They stretch about 900 miles in the south-easterly direction from Papua New Guinea toward Fiji. The former UK protectorate, establish in the 1890s, is one of the poorest countries in the South Pacific; 85 percent of the country's population live in isolated rural villages in undeveloped outer islands. Self-government was achieved in 1976 followed by independence in 1978. Government malfeasance, ethnic armed conflicts and civil unrest left the country in danger of a total collapse. Following an urgent request from the Solomons government for help, Australian-led regional forces landed in the capital Honiara on July 2003 to rescue the Solomon Islands from collapse. (Solomon Islands Government .2 .2017)

2.2 EARLY EUROPEAN CONTACT

In 1568, the Spanish navigator Álvaro de Mendana was first European to encounter the Solomon Islands archipelago. He named his discovery the Islas Salomon after the biblical King Solomon. The islands were probably given this name in belief that they contained vast amounts of gold and other great riches. source?
Missionaries visited Solomon Islands in the mid –19th Century. They made a little progress at first because "blackbirding" the often brutal recruitment of laborers for the sugar plantation in Queensland and Fiji led to a series of reprisals and massacres. The evil of the labour trade prompted the United Kingdom to declare a protectorate over the southern Solomons in June 1893 (Solomon Island Government. 2. 2017)

2.3 SECOND WORLD WAR

Solomon Islands suddenly found itself at the forefront of World War II. The battle of Guadalcanal became one of the most important and bloody campaigns fought in the Pacific war as the Allies began to repulse Japanese expansion, and only recently, prominent WWII historians such as John Prados' "Islands of Destiny" recognise the Solomon Islands as the true turning point of the Pacific (Solomon Islands Government.2 2017)

2.3.1 GENERAL STATISTICS

Population: 600 thousand (Solomon Islands Government 1. 2017- SIG.1.2017)
Climate: Tropical with daytime temperatures around 27 degress and high humidity, monsoonal wet season occurring between November and March (SIG.1. 2017)
Natural resources: Fish, forest, palm products (oil and kernels) as well as cocoa, gold, bauxite, phosphates, lead, zinc, nickel. (SIG.1. 2017)
Exports commodities: Timber, fish, copra, palm oil, cocoa (SIG.1. 2017)
Exports partners: China 61%, India 5.9%, Italy 5.9% (2015) (SIG.1. 2017)
Import commodities: Food, plant and equipment, manufactured goods, fuel, chemicals. (SIG.1. 2017)
Import partners: Australia 24.7%, China 18.4%, Malaysia 6.3%, Singapore 5.8%, Fiji 4.7%, NZ 4.6%, PNG 4.6% (2015) (SIG.1. 2017)
Currency: Solomon Islands dollar (SBD) (SIG.1. 2017)

Figure 6 Map of Solomon Islands (SIG.1.2021)

9 Solomon Island provinces		
1. Central Province		
2. Choisel Province		
3. Guadulcanal Province		
4. Isabel Province		
5. Makira-Ulawa Province		
6. Malaita Province		
7. Rennel and Belona Province		
8. Temotu Province		
9. Western Province		

Table 1. Number of Provinces in the Solomon Islands. (SIG.1.2017)

2.3.2 SOLOMON ISLANDS NATIONAL FISHERIES SECTOR

Solomon Islands has an exclusive economic zone (EEZ) of 1.58 million square Kilometres (CIA 2014), the second largest in the Pacific. The total area of seagrass is at least 100 Km2 (McKenzie et al. 2006), mangroves occupy about 650 km2 (Warren-Rhodes et al. 2011) and the total coral reef area is 3591 Km2 (Sulu et al. 2014). Solomon Islands is one of the most rural societies in the world with more than 80% of the population engaged in subsistence farming and fishing. Solomon Islands has an annual population growth rate of 2.3%, and a very

young population with a median age of 19.8 years and about 41% of the population under 15years of age (Solomon Islands Government.1 2017)

2.3.3 SOLOMON ISLANDS FISHERIES ARE DIVIDED INTO FOUR SECTORS

First is offshore sector or some time known as Deepsea fishing, second is Inshore fishing some time known as coastal fishing (most population fishing method in the Solomon Islands because people have limited resources to travel out into the deep ocean. Third is Inland freshwater fisheries sector and forth Aquaculture a new concept of fishing method introduced to Solomon Islands in the 60s.

2.3.4 OFFSHORE SECTOR

Solomon Islands offshore fisheries are dominated by tuna fishing. Tuna are a regional resource located in the Western and Central Pacific Ocean. Because tuna is a regional resource their effective conservation, management and development require a high degree of cooperation between coastal states and those states with fishing interests.
Ministry of Fisheries and Marine Resources are responsible for management and control of nations commercial tuna resources. In support of this Solomon Islands is party to a number of agreements that are relevant to offshore fisheries and participates in the work of several agencies with cooperative aims, including the western and Central Pacific Fisheries commission (WCPFC), The Pacific Islands Forum Fisheries Agency (FFA), the collection of agreements between the tuna-rich central Pacific countries (Parties of Nauru Agreement), the Palau Arrangement and Federated States of Micronesia Arrangement. (Mekem strong SI Fisheries program)

The annual catch of the four main tuna species (albacore, Bigeye, skipjack and yellowfin) from the Pacific region averages around 2.5 million tonnes, with about 6% of this coming from the Solomon Islands waters. The estimated value of the Solomon Islands catch is about SBD 2400 million per year. In 2017, the Solomon Islands government received more than

SBD 300 million in fisheries access and administrative fees through the MFMR. Gear used in tuna fisheries sector compressing purse-seine, long-line and pole and line. (Mekem strong SI Fisheries program)

2.3.5 INSHORE SECTOR

Inshore commercial fisheries also provide an important source of income for Solomon Islanders. Beche-de-mer and trochus are highly values on international markets. However, the value of exports and catches, of both commodities, have been decreasing steadily for the past 40 years. International trading of those inshore fisheries resources is governed by the requirements of the convention on International Trade in Endangered Species to which Solomon Islands is party. (Gillett R. 2016.)

Area et al. (2015) values commercial inshore fisheries at SBD 70 million per year. For 2014, Gillett (2016) estimated the coastal commercial catch in the Solomon Islands to be 6,468 mt, worth SBD 98 million per year. This considered the following components: Baitfish at 32.5 mt, which worth at SBD$32,500. Exported coastal fisheries products at 1435 mt and worth SBD $8 million (a year when export of beche-demer as banned. And domestically consumed coastal commercial fisheries products at 5000 mt and worth SBD $90 million (2017). In addition the beche-demer harvest was values at more then SBD $32 million when opened in 2015 (Govan 2017)

Inshore fisheries management and development is the domain of local communities, provincial governments and the national government. Community-based resource management (CBRM) is most suited to the land and sea tenure context of Solomon Islands and the relative weak central government capacity. Over the last 15 or so years the numbers of communities known to have carried out some sort of CBRM has increased from a handful to more than 300 (Govan 2015), and much has been learned in terms of best practiced from a handful community processes. The government has made commitments through the UN Ocean conference to strengthen CBRM initiatives to contribute to fulfilling SDG 14 (Solomon Islands Government.1 2017)

Inshore (Coastal) small-scale fisheries are an important source of food security and household income in the Solomon Islands. In rural areas, where most Solomon Islanders live, nearly half of all women and 90% of men fish or collect aquatic resources for food and income fishing, and diverse and composed of multiple species. Solomon Islands is part of the Coral Triagle region, a global centre for marine diveristy that exemplifies the richness, uniqueness and beauty of the World's coastal and marine environment. (Solomon Islands Government 2. 2021)

			Catch per kilometre	Catch per ha of
Province	Total Population	Total catch (t)	of coast Kg/Km	reef Kg/ha
Central	26,051	2,214	1,503	230
Choisel	26,372	2,482	1,373	115
Guadulcanal	93,613	5,625	6,996	542
Isabel	26,158	1,964	653	46
Makira - Ulawa	40,419	3,162	3,638	377
Malaita	137,596	8,131	9,043	499
Rennel and Belona	3,041	205	579	136
Temotu	21,362	1,956	1,629	88
Western	76,649	7,263	2,307	172
Honiara	64,609	554	2,473	192
Total	516,147	33,556	30194	2397

Tab.2 stats of total catch per Province in tonnes according to given area. (SIG 2, 2021)

2.3.6 INLAND FRESH WATER FISHERIES SECTOR

The many large islands in the country result in a relatively large inland population having no direct access to marine food resources, and for this reason Solomon Islands has a significant subsistence freshwater fishery. Information is scarce on the inland fisheries, and no comprehensive survey has been carried out. Anecdotal information and survey reports that

focus on single islands suggest that flagtails, gobles, eels and freshwater shrimps are important native species (Gillett 2016). Mozambique tilapia inhabits many rivers, streams and swamps in Solomon Islands. Many people have become accustomed to eating it and enjoy its taste. In periurban settings inland of Honiara and Auki, Lees Lake on Guadalcanal and Lake Tengano on Rennell Islands, people depend on tilapia as a supplementary or main source of animal protein (MFMR 2010). Limited by the information scarcity described above, freshwater fishery production in Solomon Islands in 2014 was deemed to be 2300 mt, with a farm gate value of SBD 29 million (Gillett 2016)

The Fisheries Management Act (FMA) 2015 is applicable to inland waters but to date there are no inland waters fisheries management initiatives at the national government level.

Figure 7 photo by University of the South Pacific, 2021

2.3.7 GENERAL VIEW OF AQUACULTURE ENTREPRENUERSHIP

Fish farming or aquaculture is relatively a new method of fishing in the Solomon Islands. Solomon Islanders live and gather food from the ocean for many years. Using primitive methods. Method such as diving, collecting seashells during low tides and fishing.

On the other hand, the concept of aquaculture was introduced by private companies and individuals with the purpose of making a profit. Those early aquaculture pioneers had observed and assessed aquaculture operations throughout the Asia-Pacific region, noting the economic benefits that were reaped. During that period, monetary profit was the main driver of aquaculture activities. The Solomon Islands Aquaculture Division, within the Ministry of Fisheries and Marine Resources (MFMR), is mandated to sustainable manage the development of inland coastal aquaculture for the livelihood and income of rural Solomon Islanders and the national economy. (Solomon Island government. 1.2017)

The growth and development of aquaculture has been through many challenges in its history: from political will, commitment of resources, gaps in technology and capacity, and even disputes and ethnic conflict. All these challenges have shaped the initial establishment of earlier aquaculture activities and the status of national aquaculture today. Aquaculture in Solomon Islands initially came about when an Australian business entrepreneur first established the culture of pearl oyster, Pinctada maxima, at Wagina, Choiseul Province in the late 1960s. Unfortunately, his operations ceased 10 years later because of marginal profit. (Pacific community article 2018)

After that, aquaculture development was dormant until the 1980s and onwards, when private investors activated activities once again. Despite the unsuccessful pearl operations in the 1960s, another Australian private entrepreneur established the south Pacific Aquaculture Company in west Guadalcanal to culture the giant freshwater prawn, Macrobrachium rosenbergii. In 1988, the seaweed Kappaphycus alvarezii was introduced from Fiji into Solomon Islands, and was first trailed in Vona, Vona Lagoon in the Western Province. The initial introduction was unsuccessful because of heavy grazing from herbivorous fish that devasted the trail farms. This put a halt to the distribution of seaweed farming to nearby coastal communities and the rest of Solomon Islands. (Solomon Islands government. 2. 2021)

2.3.8 PRE – ETHNIC TENSION

Aquaculture's potential was realised when the International Centre for Living Aquatic Resources Management (ICLARM), now known as World-fish, was established in 1984 in Solomon Islands, which contributed significantly towards aquaculture development. Later, in

1994, a local Chinese executive established a second prawn farm to culture the tiger prawn, Paeneid monodon, at Ruaniu in west Guadalcanal. Unfortunately, the ethnic conflict that occurred in Solomon Islands in the early 2000s delivered a huge blow to the local aquaculture development. During ethnic tension no aquaculture activities were occurring. Fearing for their safety, expatriates, scientists, and researchers were forced to evacuate, leaving behind infrastructures in ruin. (Solomon Islands Aquaculture Development Plan 2009-2004).

2.3.9 POST – ETHNIC TENSION

The post-ethnic tension brought a wave of change for aquaculture resurrection. In 2003, MFMR resolved to rejuvenate seaweed farming in Solomon Islands through the restoration of former trail sites. Seedlings for the start were collected locally from the wild. Funding was sought from the EU to support seed collection, the purchase of planting materials, communications and other logistics. The intervention attained success when many farmers successfully cultured and produced commercial quantities of seaweed nationally. Additionally, commercial buying linkages and export systems were established. The EU continued to expand its support towards seaweed development from funding the Commercialization of Seaweed Production in Solomon Islands project from 2005 to the end of 2008 (Solomon Islands Aquaculture Development Plan 2009-2004).

2.3.10 BRIEF HISTORY OF AQUACULTURE IN THE SOLOMON ISLANDS

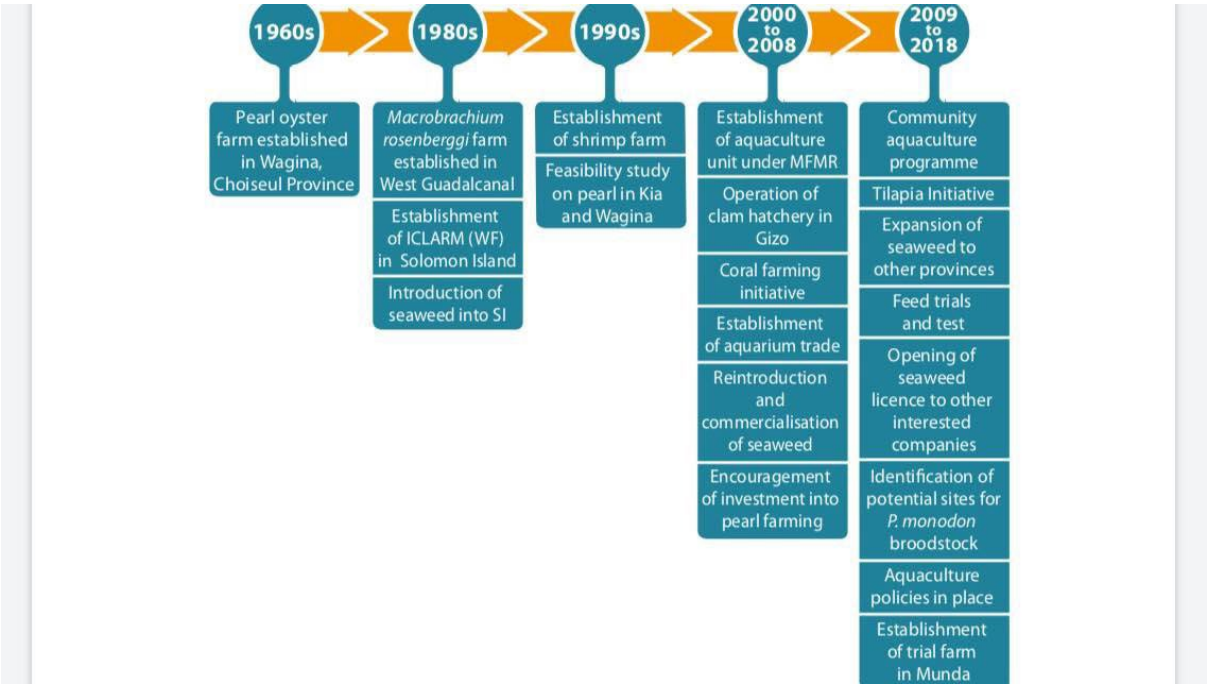

Figure 8 Solomon Islands Government stats. 1 2017

2.3.11 CURRENT INDUSTRY AND CHALLENGES

Fisheries provide a widely consumed protein staple as well as an economic livelihood for many people. Human consumption of seafood has doubled in the past 30 years, while fishing intensity and harvest methods have intensified worldwide (Delgado et. al. 2003, cited within Jacque and Pauly 2007). The fisheries are renewable resources, they are not inexhaustible. Current statistics from the United Nations Food and Agriculture Organization (FAO) indicate that 52 % of world marine capture fisheries are fully exploited, over-exploited (19%), or depleted (8%) (FAO 2009). Other research warns that many more stocks may be in danger of becoming over exploited if current fishing trends persist, especially considering the projected rise of seafood consumption (Pauly et al. 1998)

2.3.12 WHAT IS THE FUTURE OF FISHERIES IN THE PACIFIC?

The Pacific Ocean has exceptional dimensions: It covers about half of the Earth's total ocean area and a third of its total surface. It also plays a major role in the global supply of fish and other marine resources (for example, crustaceans and echinoderms 5). In 2011, according to statistics from the Food and Agriculture Organization (FAO) of the United Nations. the Northwest Pacific has the highest fisheries production with 21.4 million tonnes (26% of the global marine catch), followed by the Southeast Pacific with 12.3 million tonnes (15% of the global marine catch) and the Western Central Pacific with 11.5 million tonnes (14% of the global marine catch) (FAO 2014:37). Together, these three regions provide almost half of the global marine catch. The current challenges "to produce more fish, to do so in a sustainable manner and to ensure that fish food is also available where most needed" (FAO 2014:199) are therefore of paramount importance in the Pacific Ocean. (Pauly et al. 1998)

Figure 9 Google image

3 METHODOLOGY

3.1 THEORY: BUSINESS CANVAS MODEL

According to Gitlin, the Business model canvas can help move entrepreneurs to address specific risk and acquire more information (about competitors and a market niche, for example)
The Business Model Canvas is an entrepreneurial tool that enables businesses to visualize, design, and reinvent their business model. It was developed by Swiss business theorist and author Alexander Osterwalder.
Definition of BCM according to Osterwalder “A plan for the successful operation of a business. Identifying sources of revenue, the target, customer base, products and details of financing” (Las Cruces 2016)

3.1.1 What is a business canvas model?

- **Visual thinking:** The tool allows for easy, visual representation for decision makers to ponder upon. The tool provides a neat breakdown of the major considerations impacting the business and also makes clear the direction the organization is taking through its business model.

- **Iterate Quickly**: If a poster sized of the canvas printout is taken, it can be used in a combination with sticky notes for executives to evaluate current and potential tweaks in the business model and their impact.

- **Grasp the relationship between the 9 blocks:** The Business Model Canvas allows the executive team to understand how the 9 building blocks relate to each other and the different ways these relationships can be changed to increase efficiency or effectiveness. An opportunity or innovation can be spotted through the use of this tool.

- **Short and Succinct:** The tool encourages teams to keep their suggestions short and simple enough to fit on post-it notes

- **Easy to circulate:** The tool allows easy access and shareability. Pictures of the completed canvas or simply physically passing it around so people can gasp its gist as well as add to it, if need be, make the Canvas a very portable and convenient tool. (HAMK Innovation and Entrepreneurship, 2021)

3.1.2 Building Blocks

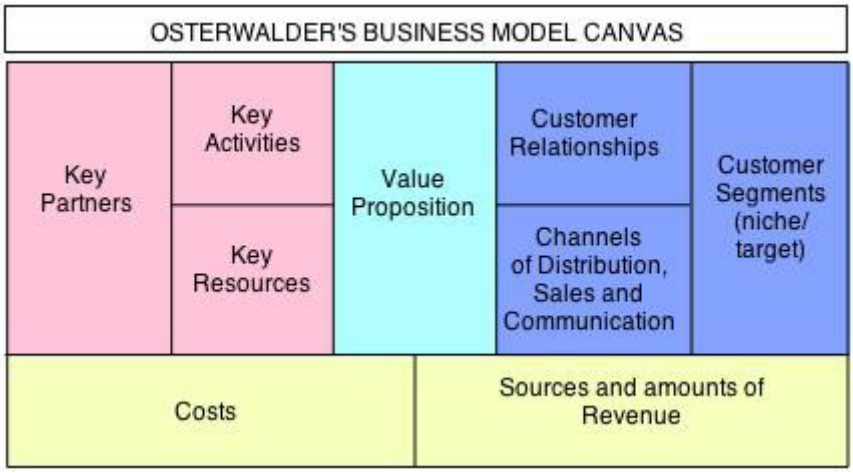

Fig. 8 (Osterwalder's BMC. 2021)

In the Business Model Canvas there are 9 building blocks.

1. **customer segments**

   It answered the question of who your customers are. Customers don't exist for you rather you exist for the customers.

   Customer's segmenting is the practice of dividing a customer base into groups of individuals that are similar in specific ways, such as age, gender, interests and spending habits. (Galiot Ricardo 2021)

2. **Value proposition**

   Why should the customers buy from you? What is the gain that you provide and the need that your satisfied?
   Describe the value you delivered to each segment. Common value propositions: Newness, high performance, ability to customize, design, Brand/status, price, cost reduction and convenience. (Galiot Ricardo 2021)

3. **Channels**

   How your services or product delivered to the market? How do customers reach? You could have your own channels or share with someone else's channels. (Galiot Ricardo 2021)

4. **Customer Relationship**

   How do you get, keep, or grow your customers? This helps clarify the points of engagement between you and your customer and the modes used to relate to your customers. It will help you start to define your operations as a business and also help you identify opportunities for automation (Galiot Ricardo 2021)

5. **Revenue stream**

   How does your business earn money? Revenue streams are defined as the way by which your business converts Value Proposition or solution to the customer's problem into financial gain. It is also important to understanding pricing your business accordingly to pain of purchase in exchange for pain of solving the problem for your customer. Example of how to gain revenue. Depending on what kind of business. Other options are: Pay per product (pay per view), fee for service, fixed rate, subscription, dividends etc. depending on what business you run. (Galiot Ricardo 2021)

6. **Key Resources**

What unique strategic resources does your business have or need? You should think about what practical resources are needed to achieve the key activities of the business? Key means the resources your business requires to do business. Key location. Example, Office space, computers, hosting, people (staff), internet, land, water, etc……. (Galiot Ricardo 2021)

7. **Key activities**

What unique strategic activities does your business performed to deliver your value proposition. The key activities of your business/product are the actions that your business undertakes to achieve the value proposition for your customers.
What is the resource used? (Galiot Ricardo 2021)

8. **Key partners**

What non key activities can you out-source to enable you to focus more on your key activities Key partners are list of other external companies/suppliers/parties you may need to achieve your key activities and deliver value to customer. Example, if I sell groceries to customers, I may need a local baker to supply fresh bread to my store. They are key partners to achieve the value my business promises to the customer. (Galiot Ricardo 2021)

9. **Cost structure**

What is the major cost incurred by your business? Your business cost structure is defined as the monetary cost of operating as a business. How much does it cost to achieve my business key activities? What is the cost of my key resources and key partnerships? How much does it cost to achieve the value proposition from my customers/users? Are there additional cost in running a business? Legal, insurance, infrastructure etc.

The right side of the Business Model Canvas (dark blue) focus on the customer (Revenue) while the left side of the canvas (pink) focuses on the business cost. Both revenue and cost meet around the value proposition (light blue), which is the exchange of value between your business and your customer/clients. Why use it? To quickly draw a picture of what the idea entails. It allows us to get an understanding of your business and to go through the process of making connections between that your idea is how to make it into a business. It looks at what kinds of customers decisions influence the use of your systems. It allows everyone to get a clear idea of what the business will likely be. (HAMK Business design thinking road map, 2021)

Figure 10 google image

3.1.3 THEORY: SWOT ANALYSIS

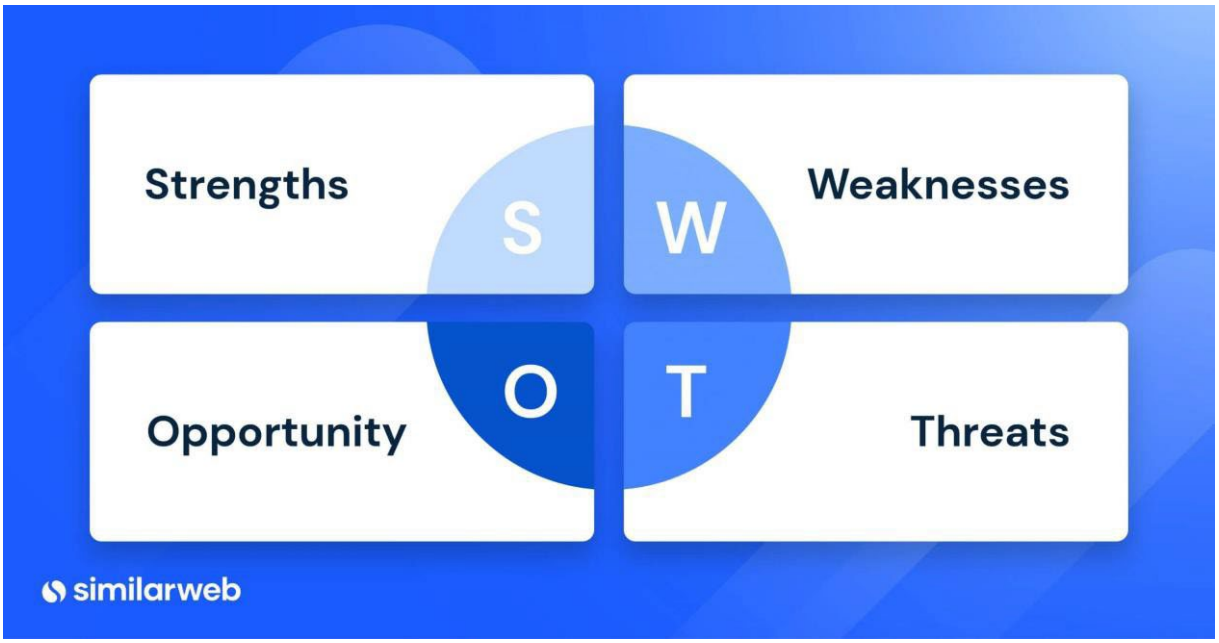

Figure 11 SWOT Analysis Map (photo Similarweb)

Solomon Fish adopted the SWOT Analysis. It is important to know and identify the organizations strengths and weakness, possible opportunities, and potential threats. It helps us to build on what we do well, address what we lack and minimized risks. It is a simple tool to use, doesn't cost much and can lead to positive changes. Therefore, it's a great technique to use to assess our business. (Dr. Sajal Kabiraj 2021)

What is SWOT analysis?

SWOT is a formula that stands for Strengths, Weaknesses, Opportunities, and Threats. It's an effective method that helps build a successful business and growth strategy. A SWOT company analysis lets you understand your organization's strengths and weaknesses, identify the opportunities and the threats you are facing, and gauge your position in global markets. (Dr. Sajal Kabiraj 2021)

The formular includes the key points that you need to identify, both internal and external. The company's strengths and weaknesses generally refer to self-evaluation. Opportunities and threats aim at identifying external factors to consider.

By conducting an external analysis, an organization identifies the critical threats and opportunities in its competitive environment. It also examines how competition in

this environment is likely to evolve and what implications that evolution has for the threats and opportunities an organization is facing. While external analysis focuses on environmental threats and opportunities facing an organization, internal analysis helps an organization identify its organizational strengths and weakness. It also helps an organization understand which of its resource and capabilities are likely to be sources of competitive advantage and which are less likely to be sources of such advantages. Bases on SWOT Analysis, organizations can choose the appropriate strategy. Strategic choice is associated with vision, mission, objectives and the external and internal analysis of the organization. An organization is willing to make strategic choices. (HAMK The Entrepreneurial Mindset 2021)

3.1.4 THEORY: SUSTAINABILITY

The UN goal 14:" Life below water" is the corner stone of our project and thus promoting sustainability in the fishing industry which is heavily over exploited in its current form. Over three billion people depend on marine and coastal biodiversity for their livelihoods. This is the reason why sustainable fishing is important for humans as a species, but also for the whole ecosystem we live in. (UNDP, 2021)

The goal for sustainability in any field is to find balance between our need to move forward with technologically and economically, while protecting the environment in which we move forward. This does not necessarily mean environmental sustainability only, but also economic and social sustainability. (Environmental science, 2021)

Environmental sustainability is protection of the environment we live and breathe in. Meaning of this is to find ways to reduce our power consumption, develop new and more effective ways to do things without compromising natural ecosystems. There are legislations in place in which businesses needs to operate in, but those have had varying effects around the globe to combat this. For the "Life below water" goal, there has been numerous efforts to combat the overfishing and depletion of fish stocks in the whole Pacific Ocean area, but nevertheless we are facing extinction of some species in the area because of the overuse of these resources. In short, we cannot

keep on abusing natural resources and ravage the environment without care of tomorrow. (Environmental science, 2021)

Economic and social sustainability go somewhat together. If we for example set too restrictive legislations to protect the environment, we all live in, it will influence the businesses, which then by extension effects jobs and employability, which then leads to decrease in the quality of life and thus affecting negatively to social wellbeing. Balance between these two is paramount to achieve and keep in control. Economically we need to encourage businesses through legislation and rules to develop business practices that are sustainable, but also offer workforce high enough quality of life. (Environmental science, 2021)

In the category of social sustainability, we need to protect the health of everyone and keep pollution and other harmful activities in check. This can be achieved through education of the issues we might face if our over-consumption and overuse of natural resources does not come to an end. This is the goal of H2O, develop a profitable business model which considers the sustainability and the hazards of ravaging the natural resources like the fish stock of Pacific Ocean. (Environmental science, 2021)

Figure 12 UN Sustainable Developement goal image

4 RESULTS AND FINDINGS

Sustainable Fish Farming in the Solomon Islands

4.1.1 MISSION STATEMENT

Protecting, nurturing and empowering smaller/artisan fishing as a way to keep the oceans and seas sustainable and still provide the access of fish to consumers

4.1.2 COMPANY LOGO

Figure 13 Solomon Fish Logo, design by Kalle Viljakainen

The Business plan draws from the United Nations sustainable development goal, “Life Below Water? The plan is to establish a fish farm. The business will be located in the Solomon Islands. Our mission is to develop sustainable use of ocean and marine resources. We aim to offer education for local communities and build a sustainable way to farm fish in the South Pacific Ocean. We hope to be an inspiration for generations to come where sustainable development is concern.

4.2 STAKEHOLDERS MAP

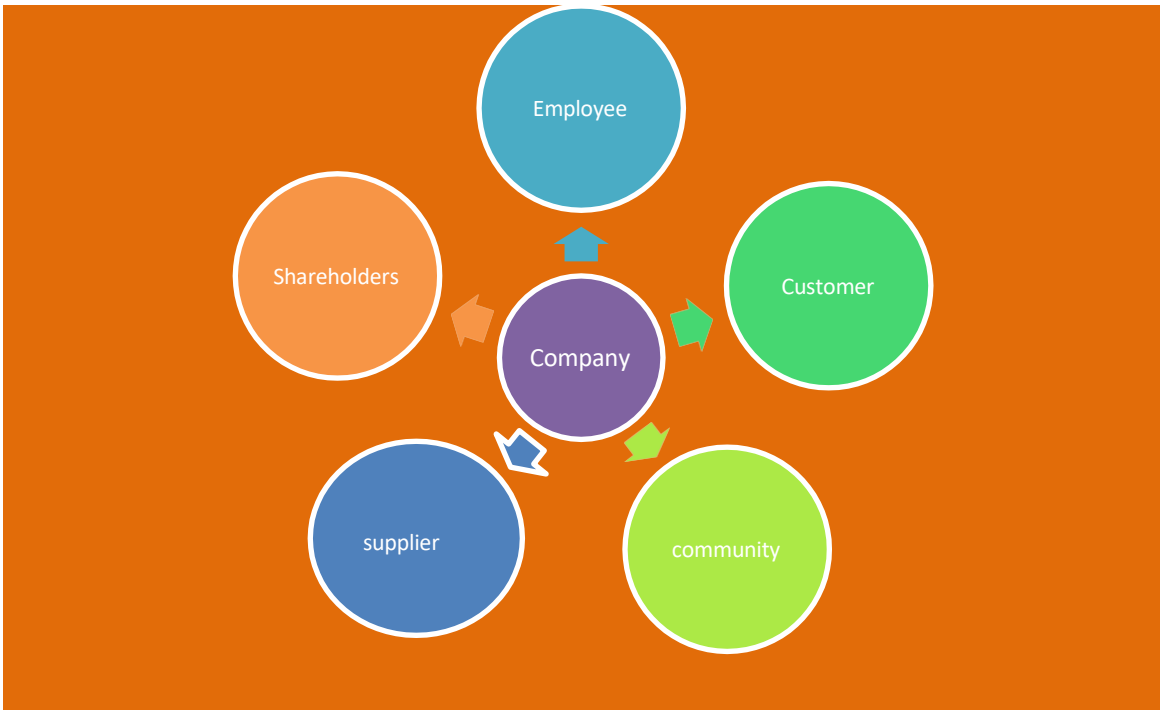

Figure 14 Stakeholder Map (created by the author)

Solomon Fish is a sustainable Fish Farm. Our company is surrounded by our important partners.

4.2.1 EMPLOYEE

Our employees are highly trained to deliver excellent products/service. Our employees have local knowledge of the ocean. We work together with our employees to make sure our farming methods are sustainable.

4.2.2 CONSUMER

Fish is the only source of protein for most Solomon Islanders when people cannot afford beef, pork, and chicken. We aim to be competitive, adding value to our products to keep our consumers appetite satisfy.

4.2.3 COMMUNITY

Solomon Fish work together with the community to provide employment and promote sustainable fishing methods. It is our way of giving back to the community. Our relationship with the local community is important.

4.2.4 SUPPLIERS

Our local suppliers are our valued partners. We source our raw material through them to keep our product competitive.

4.2.5 STAKEHOLDERS

Solomon Fish have meaningful relationship with its investors. Our stakeholders believe in our product. They are result driven. And they happy with our turnovers. We work hard to keep our stakeholders happy.

4.3 BUSINESS CANVAA

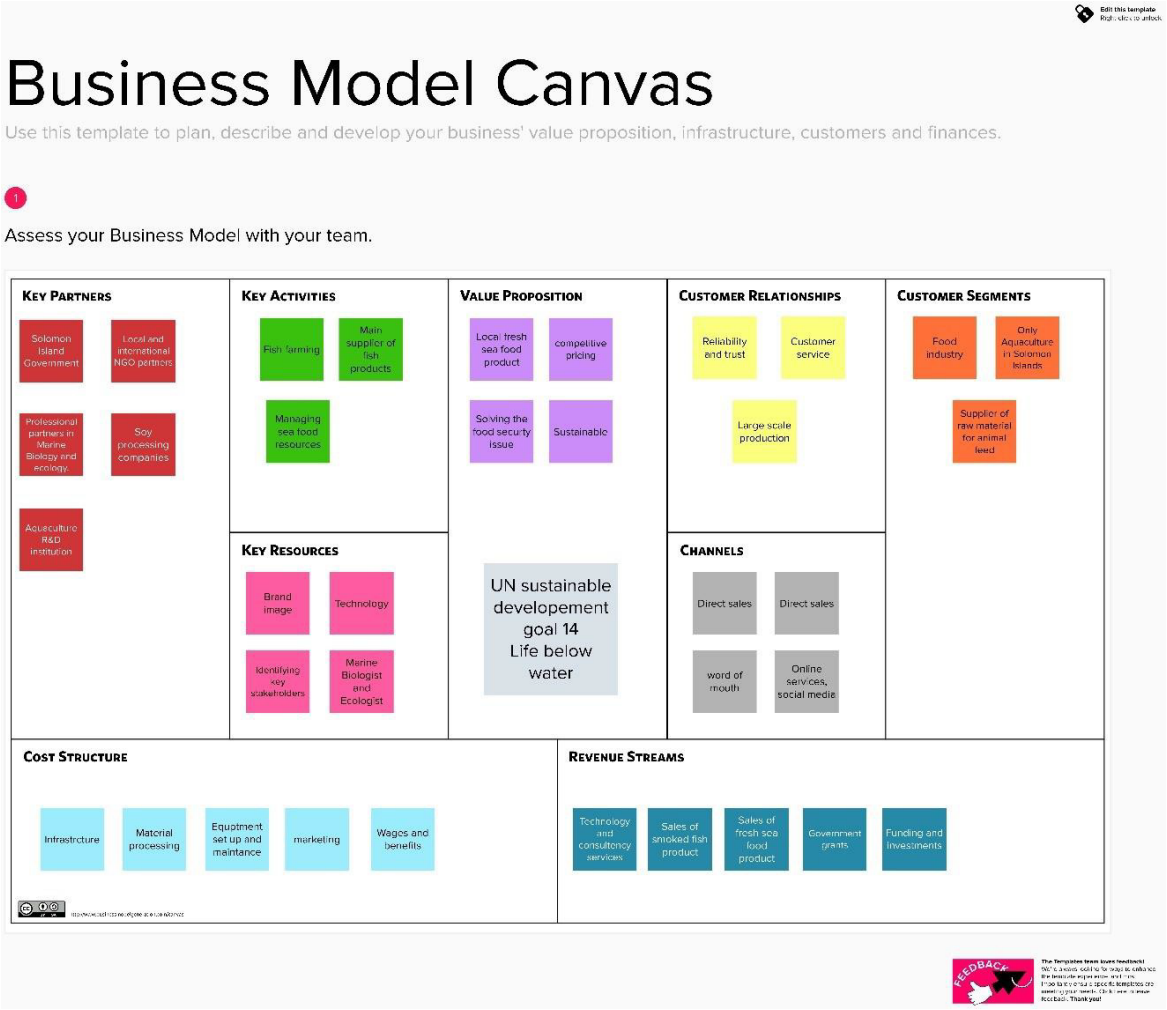

Figure 15 Business Model for Solomon Fish (mural by HAMK)

4.4 KEY PARTNERS

4.4.1 SOLOMON ISLANDS GOVERNMENT

Solomon Islands government is our important partner. There are feasibility studies done already. Our partnership with them can introduce us to aquaculture infrastructure. Aquaculture is a type of farming and government agricultural lending institutions are more likely to finance than commercial banks.

4.4.2 WWF

The World Wildlife Fund (WWF) is one of the largest and most recognizable conservation groups in the world. Since 1995, WWF has been working in the Solomon Islands particularly in the Western province, which is a high marine biodiversity area with one of the most biological rich ecosystems in the Solomon Islands. The WWF Pacific Solomon Islands office have a strong focus on community Based Resource Management which is a critical and central strategy of the Solomon Islands government for securing benefits of marine and terrestrial resources under their National plan of Action (NPOA). (Solomon Island government. 1. 2017)

4.4.3 AQUACULTURE R&D INSTITUTION

We live in a technological advance world. Research and development have come a long way. There are institutions who specialise in certain areas especially when it comes to data collection. It is easy to compare and trash certain factors that affect our environment and animal behaviour.

4.4.4 SUPPLIERS OF FISH FEED

The Aquaculture sector has witnessed significant growth and development worldwide over the past couple of years, partly to the rise in consumption. For billions of people worldwide, fish is an essential component of their diet. The fish feed has been the main driving force of a thriving aquaculture sector; they are an essential source of nutrients and minerals, boosting the fish's overall development. (Bygore GmbH 2021)

Obtaining right feed for the right species is an essential connection to make with suppliers. There is a potential to get the ingredients locally. One of our goals is to produce the fish feed by ourselves.

4.4.5 MANAGEMENT TEAM

Max Maetoloa and Schulte Maetoloa are brothers who have 50/50 shareholding of the company. Company is registered as Solomon Fish Limited company in the Solomon Islands. Schulte had different business ventures in the past. Recently he had an idea to add value to one of Solomon Islands local product, the yellowfin tuna. He smoked and sold it, and it became a hit product. There is potential. Together we adopt the United Nation Sustainable Development Goal (UNSDG) to steer our business venture. UNSDG 14 “Life Below Water”- We are custodians of the Ocean; therefore, we are to use it sustainably.

4.4.6 KEY ACTIVITIES

The key activity is specialising in sustainable fish farming. Solomon Fish is a Supplier of Fish farming and general fishing equipment’s in the Solomon Islands. Apart from Farming fish our other activities are connecting with locals and sharing our knowledge directly with local fishers. The Solomon Fish is planning to Franchise their business idea around the Solomon and the Pacific.

4.4.7 KEY RESOURCES

Solomon Fish is dedicated to building a strong brand. They will Utilize latest technology and committed to managing the ocean resources. As demand for fish is high and population increases.

4.4.8 VALUE PROPOSITION

Solomon Fish is aiming to be the main supplier of locally farmed fisheries with competitive pricing. Adding to the food security. And building on sustainable fish farming principles. Adopting the UN sustainable development goals. Fish farmers must look to develop niche markets where they can sell limited quantities of high valued products.

4.4.9 CUSTOMER RELATIONSHIP

Customers are important partners; Must build a mutual relationship based on trust and reliability. Customer service is their number one priority. Aim to be the number one provider of sea food products, on a large scale. Demand for fish is high. Solomon fish takes customer feedback very seriously. Our customers are important to us.

4.4.10 CHANNELS

Solomon Fish Farm sale directly to customers either at their location or bringing the product to the fish market. They sale to Restaurants, hotels, retailers. They use social media and local media to advertise they products, and of course the classic “word of mouth” media. To be successful, fish farmers must be proactive in the marketing of their products.

4.4.11 CUSTOMER SEGMENTS

Solomon Fish is sea food industry. They recycle waste raw materials as ingredients for animal feed and other high valued product. They are the only aquaculture in the Solomon’s therefore they utilized their business for educational purposes.

4.4.12 COST STRUCTURE

Solomon Fish understand in order to build a sustainable fish farm it will take time. Potential fish farmers must learn about the industry and technology needed to produce a product. Learning, planning, testing, and evaluating are steps in the process of developing a successful fish farm. Investment in Fish farming infrastructure is of crucial importance. Profit might not come instantly. Hard work might pay at the end.

4.4.13 REVENUE STREAM

Figure 16 Schulte Maetoloa's fish shop logo (photo by Schulte Maetoloa, 2019)

My business partner Schulte Maetoloa is already operating a fish shop. Specializing in smoked fish and can fish product. Our business will merge. Solomon Fish farm will be the main supplier. Sales of fresh and smoked fish. They add value to their product, e.g. smoked, cooked, and packed. Other means of revenue through government support, funding opportunities, Technology and consultancy services and Banks.

Figure 17 image by Schulte Maetoloa

Figure 18 image by Schulte Maetoloa

4.4.14 BUDGET

Aquaculture is capital intensive. Financing is generally needed to construct ponds, raceways, wells, building, and other specialized equipment. Capital investment for a 100acre baitfish farm according to CEO Yrjö Lankinen from Savon Taimen Oy in Eastern Finland, is estimated around 2 to 3 million euros. Solomon Fish budget start-up estimate at 1 million euro. (Phone conversation with Mr. Yrjö Lankinen, 2021)

Figure 19 photo from Internet Google image search

4.4.15 PROFITABILITY

Table 1 Profitable budget

PROFITABILITY BUDGET			
	In month	In year (12 m)	
TARGET RESULT (own need for net income)	2500.00	30000.00	+ €
+ Business loan abbreviation	833.33	10000.00	+ €
= NET INCOME	3333.33	40000.00	= €
+ Tax of your own income	500.00	6000.00	+ €
= FINANCING NEED (own gross income)	3833.33	46000.00	= €
+ Business loan interest	1250.00	15000.00	+ €
A = IN TOTAL	**5083.33**	**61000.00**	= €
BUSINESS FIXED COSTS (without VAT)	In month	In year (12 m)	
entrepreneurs pension insurance (Sol Island)	175.00	2100.00	+ €
other insurances	75.00	900.00	+ €
own employees' salaries	333.33	4000.00	+ €
salaries' sidecots (appr. 40 %)		0.00	+ €
rent + electric	833.33	10000.00	+ €
marketing	200.00	2400.00	+ €
phone, internet	20.00	240.00	+ €
travel/boat expenses	50.00	600.00	+ €
book keeping	10.00	120.00	+ €
office expenses	20.00	240.00	+ €
education	50.00	600.00	+ €
magazines etc.	5.00	60.00	+ €
fixes	20.00	240.00	+ €
entrepreneurs unemployement fund cost		0.00	+ €
others	20.00	240.00	+ €
B = FIXED COSTS IN TOTAL	**1811.67**	**21740.00**	= €
	In month	In year (12 m)	
A+B NEED FOR GROSS MARGIN	6895.00	82740.00	= €
+ Purchases (without VAT) goods trade, manufacturing		0.00	+ €
= SALES	6895.00	82740.00	= €
+ VAT (usually 24 % of sales)	1654.8	19857.60	+ €
= TOTAL SALES / TOTAL TOTAL BILLING	**8549.80**	**102597.60**	= €
BILLING TARGET		102597.60	
In month (appr. 11 m/year)		9327.05	= €/kk
In day (e.g 20 days/m)		466.35	= €/pv
In hour (e.g 6 hrs/day)		116.59	= €/h

F

4.4.16 INVESTMENT FUNDING

Table 2 Investment and Funding table

Investment & funding		
NEED FOR MONEY (before you start your company)		**€**
INVESTMENTS	If you buy an existing company, €	
	Capital Investment	200,000
	Tools / IT	50,000
	Phone	5000
	Installations (own office)	30,000
	Boat & engine	40,000
	Fish farming materials	400,000
	permits	200,000
	transportation	50,000
	Start-up costs	
	Marketing	10,000
WORKING CAPITAL 1-3 MONTHS	Rent/quaranteed rent	1500
	Leasing	
	Your own salary	7500
	Employee's salaries	6000
INVENTORIES AND FINANCIAL ASS	Initial stock	
	Cash	
NEED FOR MONEY		**1000000**
SOURCES OF MONEY (how do you arrange funding?)		**€**
OWN CAPITAL	Own tools	5000
	Owner's equity	50,000
	Capital stock	
	Capital Investment	200,000
LOAN CAPITAL	Bank loan	300000
	Gov Funding	400000
	Finnvera	35000
	Other loans	10000
MONEY ALL TOGETHER		**1000000**
In order to start your business NEED FOR MONEY = SOURCES OF MONEY		**€**
Difference between of Need for money and money and Sources of money		**0**

4.5 SWOT ANALYSIS

4.5.1 STRENGHT

Availability of the ocean (water and land) Water is not an issue. Farmer can freely build a fish farm depending on the size of the farm. Water is an important resource for their product and there are plenty of it. Availability of technology and know-how. Building a good relationship with the stakeholders in order to acquire the best tool for a particular product. It is locally owned, therefore, understanding of the local culture and habits are important.

4.5.2 WEAKNESS

Building a Fish Farm in rural Solomon Islands meant starting from scratch. It will take time to build farming infrastructure. It will take few years before the farmer can rip some benefits. Many months of testing what works and what doesn't work. Feed is expensive, whether they produce it locally or import it. Depends on finding the right balance and ingredients.

4.5.3 OPPORTUNITY

The Ocean has a lot of products. With hard work farmers can develop niche markets where they can sell limited quantities of high valued products. Working together with the government authorities to implement strict regulations to safe guide the over exploitation.
Opportunity to promote sustainable fish farming. Working with climate advocates to educate buying local sustainable fish which bear proven labels that promote sustainable food production.
Opportunity to franchise the brand around Solomon Islands and also the whole of the South Pacific Ocean. Teaching new farming skills to locals.

4.5.4 THREATS

Threats are inevitable, when it comes to setting up business in the outdoors of the tropical country. You have threats of cyclones, tsunami, volcanic eruption, predators like sharks, crocodiles' other sea creatures. Man made threats like spilled oil tanker near the farm vicinity or other harmful chemicals etc. When Fish farming is in the open ocean it is vulnerable to every threat that has to do with the ocean. Climate change affecting high tides, sea bleaching. Availability of government support for aquaculture. Availability of suitable financing for aquaculture development. Poaching and/or vandalism and issue concerning regulatory authorities.

4.5.5 KEY TO SUCCESS

There is no quick success. Aquaculture requires hard work and commitment for success. Recognize that fish are live animals and need to be treated as such. Human resource, management skills and drive to succeed are essential. Start small to reduce risk of loss while learning about aquaculture. Grow a high-value high-quality product and provide good service. Business experience and knowledge are needed. Marketing your fish is where the money is made. Aquaculture is a high-risk business. It takes a long time to make a profit in aquaculture. Work only with proven fish production technology. (Frank R. Lichtkoppler, Ohio state University)

"What does it take to succeed? (They) must be able to visualize the (business) environment they are working in and have the vision, drive to succeed, and flexibility to work out the items needed to reach their goal" (Gred Passewitz, leader small Business, Ohio Cooperative Extension Service).

5 CONCLUSION

Sustainable Ocean

Sustainable Fish Farming in the Solomon Islands will work together with their key partners to provide food security without having to sacrifice the environment. To do this we are working with fishers to create sustainable suppliers, reduce negative environment imparts, promoting economic growth and create policies that enable sustainability. Fishing is central part of life in the Pacific. For reef fisheries, we are working alongside communities to reform ocean management.

Sustainable Fish Farming supports fishery improvement projects by engaging with fishing communities, government, and key industry partners to demonstrate successful models of fisheries reform that are re-enforced and sustained through policy and markets.

Solomon Fish is not only about money but also building relationship with local communities. Create jobs and educate coastal communities to manage the ocean resources.

Solomon Islands is often blessed with diverse and often pristine marine, coastal and freshwater environment. Supported by low labour cost, access to good quality water, and fast improving communication technology. There is opportunity for aquaculture to flourish. The sustained operation of rural seaweed farming industry over recent years, and ongoing interest of rural entrepreneurship in farming of freshwater, brackish water and marine fish and marine resources, suggests that aquaculture, has potential to develop further as one platform to secure food and nutrition security as well as create rural livelihood and national revenue-generating opportunities.

To use natural resources today and at the same time safeguarding them for future generations in environmentally and socially sustainable ways is one of our times biggest challenges.

key source of protein

Seafood is a key source of protein and essential nutrients, especially where they’re in short supply from other locally accessible foods. But climate change is already driving species towards the North and South Poles (UK the conversation) This may lead to serious declines in seafood catches by 2050 and negative effect millions globally, with the most severe impacts in development countries and among coastal Indigenous Peoples. Projected declines in seafood, may lead to inadequate intakes of several vitamins, minerals and fatty acids for

coastal First Nations, according to United Nations. When diets shift to processed foods, high in calories and sodium, the risk of developing Type 2 diabetes and cardiovascular disease increase (United Nation)

Feeding the world doesn't have to take such a heavy toll on the environment, though. When incorporated into a balance diet, wild seafood alleviates some of the demands for red meat and supplies a healthy source of protein and micronutrients. Marine fisheries currently play a role in food security and nutrition for more than 700 million people around the world, and a restored ocean could feed 1 billion people a seafood meal every day. (Oceana protecting the Worlds Ocean) Fish as an animal protein produces little carbon dioxide, doesn't require arable land, and provides healthy protein at a cost per pound lower than beef, chicken, lamb, or pork, and it is accessible to the world's poor. (FAO)

Many knowledge gaps need to be filled to pave the way for a transformation of small-scale fisheries. Knowledge is power. The farmed seafood industry needs be part of the climate change solution and we need to start thinking of responsible aquaculture as also meaning low Green House Gas (GHG). Whether it is shrimp from a pond, mussels from the coast, or trout from a lake, its critical that producers know their carbon footprint and can demonstrate that their products and their production systems fit in a carbon-constrained world.

With the advance of technology, the knowledge can travel fast from COP conferences to communities that are affected. Changes can happen when people feel ownership.

Solomon Fish is a Sustainable Fish Farming venture that will contribute to protecting our Ocean. If we can all do our part, we will start to see positive change. Our small beginnings can be a significant driving force.

6 RECOMMENDATIONS

This is not an in-depth research. However, it's a step towards the right direction. Healthy oceans and seas are vital to sustainable development, for both current and future generations. The strong support for dedicated sustainable development goal on oceans, seas and marine resources is evidence of the importance of places by the global community on conservation and sustainable management of oceans and seas.
Unfortunately, studies show that irresponsible fishing has reduced many wild fish populations to historically low levels right now when the world needs its ocean more than ever. (Ocean Hub)

Students and future generations should be educated on sustainable fishing and seafood that has been caught sustainably. Communities must create public campaigns to spread the word which will hopefully influence food supplier chain management

Many wild fish populations are on the verge of collapse due to overfishing and habitat-related issues. Your choice can make the difference. As you shop or dine at restaurants, just remember to taste to become an informed, conscientious consumer.

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8 Appendix 1: CLIMATE CHANGE AFFECTING COOK ISLANDS (South Pacific Ocean)

Figure 20 Cook Islands online News. Photo Al Williams/21071912

COOK ISLANDS NEWS

Restaurant owner Ray Roumanu of Ray's Hut says there a shortage of fish on Rarotonga at the moment. He stocked up on fish prior to winter and has only about 10 kilograms of mahi-mahi left.

"Fishing boats are coming back mostly empty, some of the people affected say it's normal while others say it's the worst it's ever been."

9 Appendix 2: EFFECT OF HUMAN BEHAVIOUR - LOGGING

According To Global Witness Solomon Islands is one of the poorest nations in the Pacific region which is heavily dependent on the forestry sector and yet the country's forests continue to disappear faster. Solomon Islands exported more than 3 million cubic meters of logs in 2017, more than 19 times a conservative estimate of the annual sustainable harvest, according to Global Witness. A recent report commissioned by the Solomon Islands' Ministry of Finance suggested that if logging activities continue at their current pace, natural forests will be exhausted by 2036. Satellite images by Global Witness show that logging in the Solomon Islands is twice as long as the Yangtze River in China who imports 82% of logs the Solomon Islands exports.

Figure 21 logging activity Solomon Islands (photo Solomon Star News)

SHRIMPS AND THE ENVIRONMENT

De Mazancourt from French Ichthyological Society (SFI), based at the Muséum National d'Histoire Naturelle (MNHN), Paris, France, explained that shrimps are the cleaners of the rivers by sweeping the substrate. Thy limited the accumulation of organic matter and allow it to circulate in the food web when the are being eaten by predators such as fish or birds. He said shrimps play a significant role to the freshwater ecology and the environment in general. As without them, the rivers would have an excess of organic matter that could lead to eutrophication, with proliferation of algae that

often asphyxiate the environment and cause the disposition of many animals, fish in particular but also their predators. (Govan H. 2015)

Figure 22 photo Solomon Star News

“De Mazancourt said the main threats to these shrimps are actually threats to their environment. And there are many examples, deforestation caused by mining or logging increases the soil erosion, which causes deposits of mud in the rivers which covers the biofilms that the shrimps eat and clogs their gills.”

“Deforestation can also cause droughts because of changes in the local climate, and these shrimps cannot survive without water in the river. Since these shrimps migrate between the sea and the rivers, the construction of dams or bridges can also be a threat if it doesn’t leave a way for them to circumvent it and colonize the upstream of the river” (Govan H. 2015)