Feasibility Survey on a Cold–Chain Development in Tho Quang Fishing Port in Da Nang

Summary

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Chapter1. Outline of the related country or sectors, etc.

1-1 Economic and social facts of Vietnam

Vietnam has achieved rapid economic growth through its DOIMOI (renovation) policy; in 2018 GDP growth rate was marked at 7.1%, the highest in the previous ten years. In one aspect economic growth was driven by foreign development aid including from Japan. Currently, however, the value of the implementation of new ODA projects is expected to remain low because the volume of public debt is rising every year.

However, Vietnam is currently positioned in a demographic dividend period and expected to have robust economic growth for some time in the future. In the ASEAN region, as of 2017 Vietnam had third largest population of 93,670,000, ranked only after Indonesia and the Philippines. Out of the 55 million working population, 70% live in rural areas. However, both the employment population in and the ratio of the agriculture, forestry and fishery industries are decreasing yearly, while people with high or medium level of income are increasing. Looking at the change of the penetration rate per household of durable consumer products, the penetration rate of color televisions and refrigerators has been rapidly increasing, and in response to an increase in consumer spending, retail markets and the tourism industry are developing rapidly.

Since the circumstances such as widening income and demographic disparities are similar to those of Japan in the past, Vietnam is now at the stage of expanding demand for frozen foods and fresh foods, and we can consider that Vietnam has entered a situation requiring a “Cold Chain”. It is not difficult to imagine, however, that it is necessary to transition from the era of mass production, mass consumption, and mass disposal.

1-2 Outline of the targeted sector for project

The fisheries catch for Vietnam is increasing on an annual basis, and the catch of 2017 marked 342 million, cultivation 386 million and export earnings of 8.03 billion USD. From 1991 to 2000 the growth rate of the fisheries sector, which consists 4-5% of GDP, on average marked 7.05%, and from 2011 until now marked 10%, approximately. At the same time, decreased resources along the coasts is an existing issue. For this reason, in recent years Vietnamese fisheries are mainly boosted by culture fisheries of Pangasius and shrimps in Mekong Delta area.

1-3 Situation of targeted area

Da Nang, a compact city with undulating geographical conditions, is a hub in central Vietnam. It works as hub and has a lot of potential advantage for economic sector development including transport and logistics. MOT recognized that Da Nang has much of potential for logistics. This is not only in the
south area where resort hotels are located but also in the downtown area that has a construction boom for business hotels. Additionally, Vietnamese are inviting more companies for industrial areas.

The “Da Nang city economic development plan to 2020”, which was based on Mid- and Long-term plans and visions shows three goals, including:

(Goal 1) Da Nang city will play an important role in central area economic development strategies with progress of the marine economy and international economy.

(Goal 2) Implement economic policies to improve the quality of development for modernization and rapid industrialization.

(Goal 3) To guarantee rapid and sustainable development, and interlock socio-economic development and environmental protection.

Chapter 2. Analysis of Current Situation and Needs

2-1 National and Local policies trends

The Central Government sets the “Master plan for fisheries” to target modernization up to 2030 and industrialization up to 2020. The numerical target for the catch is planned to increase to 7 million by 2020, and 9 million by 2030. However, the ratio of surface sea fishing remains at 35% of the planned numerical goal in 2020, and even decreases to 30% in 2030, which shows that after 2020 the overall main contributor for production increase will be the cultivation industry.

According to the master plan mentioned above, so as to accelerate modernization, measures are set as objectives such as reconstruction of the Fisheries Value Chain, prioritization of high value-added products development, improvement of food quality, safety and environmental protection. Additionally, numerical goals such as to reduce the loss after fisheries down to 10% and triple the income of fishery workers. The break down of numerical targets are as follows:

- 45% of total export volume 1,32 million tons, will be exported of frozen fish in the frozen process products section (Numerical Target for frozen fish products)
- Out of 950,000 tons of total domestic processed marine products, 310,000 tons will be frozen marine products. That shows goals are set both in quantity and quality for fishery development.

Also, in the masterplan mentioned above, ports are designated in areas such as Keen Gang, Ba Ria-Vung Tau, Nha Trang city, and Hai Phong to develop Fishing Port Centers and also some measures are to be taken, such as to alleviate environmental pollution, to adopt upsizing of fishing boats, to improve of marine product related facilities including fishing nets and machinery, or to improve of
fish markets, and cooling systems, and so forth.

Da Nang city, after accepting the masterplan, drew up a sea coast economic development plan which was designed to develop and conserve neighboring fishing ports and fisheries. This plan includes the redevelopment of the Tho Quang fishing port neighboring area to become an international port. Da Nang Port (Tien Sa Port) will be reorganized as a port specialized for cruise ships, and Rienchuu as a port for cargo ships only. It also designates by 2025 a 12-13% increase of cargo ships using Tho Quang fishing port, a 13% increase of tourists and a reduction of waste loss for the fishing production business to be more environmentally conscious.

### 2-2 Cold Chain Development needs analysis

Current situation for fisheries delivery system around the Tho Quang fishing port is as follows:

![Diagram of Current fisheries delivery situation around the Tho Quang fishing port](image)

**Figure 1. Current fisheries delivery situation around the Tho Quang fishing port**

**Current condition and situation of fishing Boat Dock**

[Tho Quang fishing port]

This fishing port was constructed in 2004 and is managed by the committee management of Tho Quang fishing port which works under the authority of the agricultural development agency of Da Nang city. The port has 55 fishing boats coming in per day, and a 200,000 ton catch per year. It also has 300 trucks coming in and out every day. Also, behind the port is an industrial district for fisheries related products, where 20 fishing related companies produce 100,000 tons per year.

Freshness of the fisheries is not so good, relatively. Normally, caught fish are stored in ship holds with ice. It usually takes more than a week to get back to port, however, and for relatively extended periods of time fish are not chilled or frozen to keep freshness. In other words, there
is no existing Cold Chain at the pre-distribution stage. Though there are three warehouses to refrigerate fish in the venue, temperature is not properly controlled.

[Ports and fish markets other than Tho Quang fishing port]
Just a few restaurant owners have business channels to buy fresh fish from brokers, however transaction volume is quite limited and only exclusive restaurants or resort hotels buy fresh seafood directly from brokers on the beach.

**Current situation of Seafood Processing**

[Seafood factory]
Most companies that start in Tho Quang Industrial district are engaged in seafood processing related businesses such as canned or fish paste processing. In many cases, local seafood volume cannot serve the entire production need, and companies import seafood and materials. For this reason, the Tho Quang fishing port is unlikely to be a hub for expensive seafood and more likely to be a hub for raw material processing. Some retailers there buy frozen seafood from Japan to sell throughout the country. Japanese restaurants buy them too.

[Cold storage warehouse current situation]
Construction of cold storage warehouses, especially in big cities like Hanoi or Ho chi Minh is increasing, as import and export from fisheries is expanding together with demand increasing for frozen products.

Relatively new warehouses have similarities to Japanese refrigerated warehouses such as a front room and dock shelter, unit cooler system, and so forth. Old warehouses, however, are not managed properly and in some cases, there are load collapses.

![Figure 2. Examples of relatively new and old cold warehouses in Da Nang](image)

**Current situation of markets**

[Public Markets]
There is no room to argue that people in Vietnam like to eat fresh fish, though chilled fish are appreciated more than frozen fish in Vietnam. Additionally, they prefer to eat fish raw rather than frozen. Thus, frozen foods are regarded as products frozen to maintain freshness after time has passed and fish can no longer keep original freshness.

Some public fishing ports have comparatively fresh seafood as from fishing boats that return within a day and from fishing methods such as fishing rods or nets at the seashore. In addition to these, retailers handle a small volume of seafood and the cycle from catching the fish to selling them is a lot shorter than for a big market. This is why the freshness can be maintained in some public markets.

![Figure 3. Fisheries in public market in Da Nang](image)

[Seafood restaurants]

Many Vietnamese seafood restaurants have water tanks with living fish inside. Customers can make orders after selecting fresh fish from the tank. This style is seen commonly in Vietnam. In Da Nang, few fish are caught in the port and many are transported from other areas. We see many fish cultured in cities like Hue. Crabs and squids are supplied frozen as they cannot live in water tanks.

In recent years, Da Nang city has more Washoku Japanese style restaurants; in 2018 approximately 100 exist in the city. 40 have Japanese owners and they buy frozen seafood via Hanoi or Ho Chi Minh.

[Resort hotels]

Many resort hotels in the city provide fresh seafood have water tanks, and as buffet style breakfast with seafood is common in the city, demand for frozen seafood high at any time. Some hotels have their own facilities to store frozen products or fresh fish after buying on a regular basis from retailers or big retail firms.

[Big retail shops]
Comparatively, fresh fish is more popular than frozen seafood. Though Da Nang has more imported seafood than local. For example, frozen food such as salmon or squid, etc. Most of the stores have similar seafood.

**Current logistic situation**

The World Bank 2014 annual report says there is a limit to business expansion and distribution capacity in the Vietnamese logistic business sector, as out of 130 companies 70% are 1PL and 2PL services and small size businesses have a capacity limit. However, as regulation relaxation progresses, recently we can see many Japanese companies entering and expanding in the sector. As more than 8,000 people die per year in traffic accidents, the central government strives to raise traffic safety awareness and provides traffic safety training for private truck drivers with 300 drivers attending the training. For these reasons we can expect more and more needs for securing high quality distribution and logistics services today.

Most trucks using Tho Quang fishing port are reefer (refrigerated) vehicles, though most of them are second-hand vehicles and refrigeration often does not work properly. Some big logistics companies have modern reefer trucks, but the number is still small.

**2-3 Understanding the issues to improve Cold Chain**

In summary the Tho Quang fishing port has problems in two areas when looking from the perspective of processing and distribution of fishery products, a) problem of handling volume which is a problem of freshness, and b) quantity of fisheries products transaction volume which is the quality aspect of fishery products to be landed, and furthermore, cold transportation capability of the fishing port. These can be compiles as:

1) Problems dealing with freshness related to fishery products
   - Fishing period lasts too long, and fish are kept without freshness, sometimes including fish that are almost rotten.
   - One day fishing boat does not come to Tho Quang for unloading.
   - Inappropriate handling of seafood inside the port.
   - Selection and categorization of fish are not properly done by freshness.

2) Problems of transaction volume of high-quality fish.
   - Unproper handing after the catch, no commercial fishing boat equipped with proper processing capacity to process fish immediately after catching.
   - Broker or retailer who needs fresh seafood with high quality does not use Tho
Quang fishing port.

• Though high value fish are unloaded in the fishing port, it is not fully used.

3) Refrigerated transportation capability.

• They do not chill nor refrigerate the fish being transported.
• Low awareness of necessity for refrigeration while distributing.

Measures to address issues
In order to improve the freshness of fisheries, day trips must be unloaded at the Tho Quang port or provide transportation and distribution system from nearby ports to Tho Quang port, especially to include fresh fish. The most realistic approach is to maintain freshness in the fishing boats.

Many fishing boats have space for refrigeration, and some have water tanks. However, at the moment the demand for fresh fish or raw fish is limited and space in the ships or boats is not fully utilized. If the price of above-mentioned type of fresh fish becomes reasonable for cost and work load, more fishing boats will unload at the port in the future.

Improve transportation quality
Educating drivers is important to improve the quality of fish, as with last minute delivery or transport of unloaded fish which sometimes deteriorates the quality of products with improper temperature control, etc.

2-4 Future view of the frozen fishery products market in Vietnam

Though Vietnam has abundant catch of fishes, due to the lack of freshness maintenance, fishes end up being used as fish powder or livestock feed.

In Da Nang we can see a lot of imported seafood, however, if locally caught fishes can be distributed with freshness preserved, consumers will buy locally grown fishes instead of expensive imported ones. There is high chance that local fishes are distributed as frozen or fresh fish. Generally speaking, in Da Nang, frozen foods have bad quality due to unadvanced freezing techniques. However, food culture to eat delicious fishes is common and widely recognized so, the distribution system which we study in this report will have significantly big impact in the future. Thus, the key to success in participating the frozen seafood products market is to prepare and develop Cold Chain infrastructure to satisfy the needs.
Chapter 3  Technical feasibility Study

3-1 Verification of infrastructure system introduced for Cold Chain improvement project

Verification of Business Image

If we can store fish immediately after unloading with appropriate freshness control, the fishing industry will be prosperous in the future. However, local fishers do not actually feel the price of fish would increase if freshness were preserved. We would assume that there are many places such as expensive seafood restaurants, hotels, and large-size retail shops where they prefer to use local fish instead of high cost imported frozen food. We assume there will be many opportunities to distribute local fresh seafood if freshness is maintained.

However, we need to add that frozen seafood are not regarded as high value-added commercial products, because of insufficient quality and quantity of seafood supply. This insufficiency is attributed to a shortage of seafood to be processed. Additionally, infrastructure to handle mass commercial products are not developed in the area to provide distribution services. This is the main problem.

Taking these conditions into account, we need to enlarge the size of market itself to participate the seafood market (business). In order to do so, we need to change the perspectives of local people to put more importance on frozen food and shift the existing consumption style that puts high value on fresh or raw foods. Then we need to apply policies to make people eventually change their perspective to appreciate frozen foods more in the future.

Therefore, by avoiding price competition by entering the small existing market of the Danang refrigeration and storage service business and creating a market with a new high profitable structure for Danang, we believe that measures to ensure profitability of creating highly profitable businesses are realistic for the distribution of high value-added frozen seafood processed products.

Here we conducted feasibility study on Cold Chain infrastructure facility’s business profitability to bring success for primary stage of small size project implementation which was designed with development stages as follows:
Candidate fishery products to be frozen

After carefully setting the rational of “adequate freshness” and “within the range of standards”, we selected 5 fish types for the following reasons; these are locally unloaded fish at the Tho Quang fishing port.

Table 1. Characteristics and reasons for the selection of 5 fish types

<table>
<thead>
<tr>
<th>Fish Type</th>
<th>Characteristics and Reasons for selecting</th>
</tr>
</thead>
</table>
| Oval squid         | ・Comparatively fresh (unloaded in the area as fresh as Japanese ones according to the survey conducted with local Japanese restaurants).  
                    | ・High market value regardless of seasons at seafood restaurants and resort hotels.                         |
| (Auxis) Frigate tuna | ・It has high demand in the area but is supplied with imported frigate tuna.  
                        | ・Speed of quality deterioration is fast and freezing is appropriate for distribution.  
                        | ・Retail price is low but volume of fisheries are secured to provide stable supply.                     |
| Flying fish        | ・Fishing season lasts only few months in spring and this fish is believed to be a lucky charm in the area.  
                        | ・(It is fortunate to have flying fish).  
                        | ・Value and annual demand fluctuate a lot.  
                        | ・Main material for popular menu of seafood buffet in resort hotels, so a certain degree of demand is expected even if flying fish are frozen. |
| Spanish mackerel   | ・Very popular nationwide especially during Chinese new year and for guests to serve as lucky charm; there is a need for round type mackerel. *“Round” type* is a whole fish not sliced or cut in portions.
| Swordfish          | ・High impact when processed frozen.  
|                   | ・Market price is relatively high.   
|                   | ・Retail price goes up and down seasonally.  
|                   | ・Fishing boats exclusively designed for swordfish fishing exist, therefore fish can be kept alive in fish tanks after catching, then unloaded with freshness preserved at the port. High impact when processed frozen |

3-2 Business model

Estimated business contents are two of the following: refrigerated warehouse service business with income from handling fees, and frozen food processing business with sales income. These two businesses will be conducted simultaneously. The two business have distinctive characteristics. The first one has stable income and the second one has high risk with high return. However, the second business was selected as main business, as the first business will most likely to encounter cost competition because the service unit price in already existing markets remains low.

Business type

There are two methods to found a new company: FDI or Indirect Investment through JV or SPC. Direct investment requires a complicated authorization process to acquire business operation permission for which the Da Nang city People’s Committee has authority. Additionally, land acquisition will be difficult. For this reason, we selected indirect investment through SPC or JV with a partnership of local firms to consider feasibility.

Company A, located in the Tho Quang fish processing industrial park, is mainly doing business in frozen food processing, and collaboration will bring a lot of benefits such as business know-how, access to local market, sales channels and so forth. For this reason, we selected the company A to study business feasibility. However, as collaboration with Company A may or may not be regarded as a new business by the previously mentioned Da Nang city People’s Committee, it is undecided till the authority makes judgement.

Review of business scale

[Volume of frozen food processing]

The business operating income for frozen food processing business will be determined by the gap between the sales price and transaction price at the Tho Quang fishing port. As we will be using the freezer to rapidly freeze the seafood to maintain quality for longer term, we will have comparative advantage for off-season sales. Thus, we estimate the business model to sell when market has less stock of seafood to sell at a higher price.

The average catchment of the selected five fish types are as follows, in the last three years.
Figure 5. Monthly average catchment of the selected five fish types

Setting of the capacity of cold warehouse

We estimate two different volumes according to the two business models previously explained in 3-2.

According to the estimate based on the previous total volume of storage, minimum will be 194.86 tons and maximum will be 620.12 tons. As the peak season of fishing for 5 types of fish differ, we need to estimate the maximum volume of total quantity with designated factors.

Figure 6. Cumulative stock volume curve

Our business is designed to provide additional supply to improve the current shortage of supply through building Cold Chain infrastructure to attract demand for frozen foods. Even if the unloading of fisheries at the port remains rather low, the scheme to sell fisheries at higher price
is realized, fishers or retailors will catch and sell fresh fish or seafood and expect high price. Thus, at the 1st stage of our business, we set the volume of cold warehouse at the highest as 620.12 tons to meet prospective demands.

Additionally, considering 70% occupation rate for services of restoring frozen foods, capacity was set as 800 tons.

**Site for cold warehouse**

We estimate a warehouse and processing factory with a size of 800 tons, and negotiated with Company A. As a result, we concluded to proceed with a renovation plan for an already built factory which requires no application for changing the business purpose and continue to use facilities as they are.

![Figure 7. Factory to be renovated for cold warehouse](image)

**Facility design**

The existing factory site was redesigned as follows, with two entrances for delivery of raw material for frozen food processing and two entrances and four exits for cargo and trucks to deliver processed frozen foods. Please refer to the charts below.
Figure 8. Horizontal plan (1st floor)

Figure 9. Horizontal plan (2nd floor)
3-3 Rough Estimate of business costs

A total initial cost amounts for approximately 3 million USD including construction cost, procurement cost and preparatory cost for staff education for 6 months at the beginning of the operation.

Operational costs counts for approximately 3.5 million USD per year for purchasing cost for seafood, as well as monthly operational costs as approximately 40,000 USD for factory operation and delivery.

3-4 Financial analysis

**Condition setups**

| Ratio of investment and lending | Setting as follows, 0% fund on hand and the rest will be |
provided by the lending or loan from private bank

<table>
<thead>
<tr>
<th>Loan ratio</th>
<th>Set as using loans would be provided by Vietnamese private bank, we selected Vietcom Bank as many Japanese companies have business with them. We fixed the fixed interest rate as 6.8% and variable interest rate as 4% per year and set term of deferment equals to construction period.</th>
</tr>
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<tbody>
<tr>
<td>price increase rate</td>
<td>Set as 4%</td>
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**Income**

**[Sales of frozen process foods]**

Price fluctuations are interlocked with the catch, as follows we fixed the appropriate sales price of designated five types of fish or seafood products as a maximum sales price to estimate the costs.

Then, we calculated the estimate number by multiplying the monthly catch ration as coefficient to proportionally distribute to annual catch in each month. Thus, we had annual total estimate of 31,254,000 JPY when price increase rate set as 0%.

![Figure 12. Estimated monthly income from five types of fish or seafood production](image)

**[Service to store frozen processed foods]**

Estimated total costs for storage service will be 1,419,000 yen when the unit price 600,000 VND/t which is applicable for 70% of occupancy rate of warehouse for seafood production.
Result of Analysis

The following chart shows result of estimated financial analysis based on conditions set up in the previous column. At the second year, positive balance in FY will be achieved and at the fourth year cumulative loss will vanish and in the fifth year internal rate of return reaches 7.28%, and at the tenth year goes up to 30.59%.

![Chart showing financial analysis result](image)

**Figure 13. Business Financial Analysis Result 1**

This result is estimated with the minimum number ratio for five types of fish or seafood mentioned in the previous section

In the future, we expect the ratio to rise as the business brings a successful result, or fisher’s awareness for preservation of food freshness is boosted. If the largest number ratio is applied as follows, the result will be as the chart below.
In conclusion, there are some risks for securing the catch, but the business models for which frozen food processing is the main business have high business income and profitability. Thus, from the investor’s point of view, feasibility is estimated to be high.

3-5 Expected application of policy support measures

This business operation has no infrastructure development and is a private project, and thus supports such actions as dispatching professionals from Japan or providing technical assistance from Japan that may be applicable in addition to financial support for insurance to cover damages for overseas’ projects or risks for loans or investment overseas.

From the perspective of business feasibility, possibility is confirmed to be high according to financial analysis. However, natural conditions may cause the business income to fluctuate and purchasing fish or raw material requires a lot of cash. Thus, overall business operation to attain capital or money is still difficult.

When a company considers investing in such business, it will likely to seek for a fund-raising scheme from the Japanese government. Japanese governmental fund-raising schemes are provided when business feasibility still remains low and difficult and the scheme is targeted on projects that normally private investors or firms are reluctant to take risk to support, as fund raising for such cases is very difficult. Somehow, when applying such schemes, we need to have accountability to match the
objectives of business and the financial scheme provided by Japanese government.

In this specific case, we have the chance to apply for above mentioned schemes as we have the following reasons.

- Implementing and introducing energy saving devises and machines form Japan such as refrigerated warehouses.
- Providing high quality of training and education for HR for logistics and distribution sectors
- Positive economic impact in the fishing industry and for the life of the fishing community with high value-added seafood processing products
- Preventing the decline of the fishing industry that depends on old fashioned fish catching techniques by introducing new technologies and frozen food production machinery which Japanese middle or small size companies developed to maintain the freshness of seafood.

We can probably take a good look at Private Public Funds such as Cool Japan Fund which had invested for similar projects in Vietnam in the province near Ho Chi Minh to develop refrigerated warehouse with JV and a food processing business project in Taiwan and China in 2016. Also we would like to note that Japanese companies can proactively apply for the scheme of JOIN which invested in Indonesia for a similar business project in 2017.

Chapter 4 Business performance evaluation

4-1 Advantages of Japanese companies in business

**Product and technology advantages**

In 2016, mass death of fish caused by the water pollution from Taiwanese steel company in the Northern Central region struck Vietnam as shocking news. Awareness of food safety was boosted, thus services provided by Japan or Japanese products will have high advantage in brand competition.

In Vietnam some major Japanese logistics companies are already stated business in the field of refrigerated warehouse and many Japanese construction companies also exist where Vietnamese banks provided loans accordingly.

**Advantage of PPP approach**

Yokohama city has an Inter-city MOU with Da Nang city; based on the MOU, strong partnership is maintained. So far, each year either city hosts “Da Nang city urban development forum” and it’s been 8 years since they started. In the forum, the development plan of port area
including Tho Quang fishing port is included as discussion theme, and the Vietnamese side expects a lot from Japan to provide information and knowledge regarding port management and administrative procedures as Yokohama is an international city with port. Thus, we can proceed with project formation in such areas to provide support for HR training or technological transfer in various fields which Japanese have expertise through this inter-city partnership, in addition to that, Tho Quang fishing port has accepted the JICA’s grass roots assistance provided by City of Kushiro of Hokkaido. Thus, the connection and bonding with Japanese local governments is strong.

As local business permission is finally granted by the Da Nang city People’s Committee through a primary permission of Da Nang city related agencies, obtaining the friendly relation with Da Nang local government is very important for Japanese local government in order to encourage Japanese companies to start business in Da Nang.

### 4-2 Expected benefits when implementing the project

**Economic Impact**

The impact that Da Nang city is greatly expecting from this project is as follows; improvement of living and income of fishing related industries and business by adding high value to the local fishing products. Also, city authorities expect positive economic impacts from the project implementation. These positive impacts include increase of the catch in the region with freshness preserved and quality maintained. When attitude of local fishers is positively affected by boost of fishing products prices, they will be more aware to observe quality control measures to raise over all productivity in the fishing sector.

**Effect to prevent overfishing**

Overfishing prevention impact is expected as a result of high value-added fishing product distribution. It will restrain the overfishing from current net fishing method that overfishes the limited resources such as exploiting juvenile fish or small fishes. If a bigger size of fish is to be sold with high prices, there will be more incentives to catch big fishes and then the transitional change form “Catching everything any way” to “Catching only high value fish with quality” to prevent overfishing in the future. So, it will have a positive impact for natural conservation in seashore area.

**Effect to reduce of Food loss**

Since frozen food has not much waste when processing, positive impact to reduce food loss is estimated as frozen food can provide an appropriate amount of food when needed and shelf life will be prolonged with high quality frozen processing machine. Thus we expect great impact
on reducing the food loss

Also, when delivered, as the temperature is controlled while in a freezer, there will be less food loss.

**Effect to reduce energy**

The frozen processing machine that we use in this project has high processing speed to freeze the products. It takes only 1/20th of regular type of freezing machine or 1/8th of liquid nitrogen, thus it will contribute to cost reduction. Additionally, this machine does not have air loss while opening the door to put frozen foods as it has special techniques to prevent energy loss.

Even at a refrigerated warehouse equipped with a front room which works as a buffer this type of machine can be implemented to save a lot of energy. In conclusion, these energy saving policies have positive impacts for business operators for business profitability

4-3 Risk and impact analysis for environmental and social aspects

**Impact on existing fishing market systems**

At Tho Quang fishing port, the relationship between fishing boat owners and retailers or brokers are equally as strong as in other Vietnamese fishing market systems. So, brokers buy all the catch instead of selecting only fishes with high quality and freshness. Thus, if we implement the system to only accept high quality fresh fish, there will be a resistance or rejection.

So, we would like to suggest to secure the retailer or brokers business profit by fixing the appropriate purchase price

**Handling of waste or discharged water**

Due to the odor caused by the deterioration of water in the Tho Quang fishing port, the odor problem become a big social issue. So, we need to pay attention to water discharge from the facility for proper management. Though waste produced by food processing will be restrained as it has less food loss.

4-4 Prospective policies to progress development in neighboring regions and other countries.

The two points for project success are as follows:

- Secure the adequate volume of catch with high quality.
- Secure the market channel for high quality frozen food market.

If previously mentioned two points are feasible for implementation, further expansion to nearby countries is also possible.
Some of the fish or seafood unloaded at Tho Quang fishing port does not always have high quality, but they are superior in quality as material for processing. However, some production stages need improvement to fully use these fishing materials. Thus, we would like to suggest the following:

- Hold direct contract with one day fishing boats to improve the handling of fishes after unloading and maintain high quality catch and establish a system to produce or catch such fish.
- Provide service to supply living fish from fish tanks,
- Introduce distribution boats
- Introduce techniques to preserve freshness

This project is primarily aimed at starting a project with the smallest size. We also only targeted high value-added restaurants and resort hotels and big retail shops and limited markets.

Some big cities like Hanoi or Ho chi Minh, has bigger markets size, but special relations must be constructed to enter these markets. Thus, we need to conduct marketing activities.

4-5 Enforcement measures for Japanese companies to raise competitiveness when participating in project

Since we can locally purchase the cold storage warehouse except for a part of the units such as unit coolers and etc., we can reduce construction cost to a certain degree and expect competitiveness against local competitors. Somehow, in order to maintain the high quality of infrastructure projects, we can still provide part of the facilities and equipment with Japanese products such as frozen processing machine and unit cooler, then also provide soft infrastructure implementation policy. In this aspect, it is a valid approach to facilitate soft infrastructure needs and introduce monitoring or remote management systems based on ICT utilization for educational training or HR development.

Chapter 5 Seminar

5-1 Seminar to relevant organizations at Vietnamese side

In January 2019, the study team held the seminar on the result of the survey to the officials from Department of Agriculture and Rural Development of the Da Nang City (DARD) and other departments. The Vice Director of DARD made comments as follows;

- We expects a success of such private business development and do the best to assist to the realization of the project, since this project might lead a contribution to the fishermen’s living y and an economic development of the area
• It might be no problem to receive a business permission from Da Nang People’s Committee (DPC), as long as environmental protection measures are satisfactory, though the city tends not to promote new business development in the Tho Quanng Seafood Processing Industrial Park as the area has been facing a serious environmental problem of inner sea water deterioration

• DARD will make report to DPC and request to issue the relevant permission and order to put the project forward.

Figure 15. Seminar meeting with DARD

Additionally, the Study Team held the seminar to the Ministry of Agriculture and Rural Development in January 2019, and received comments as follows;

• Ministry has longed for such business to business activities for technology transfer and human resource development in fishery industry

• Ministry will make necessary support and request DARD to provide a full and active support and assistance to the Team

Figure 15. Seminar meeting with MARD
The project will be reviewed by DPC in due course and followed up thorough Danang City Development Forum that has been held in collaboration with Yokohama City every year.

5-2 Seminar to relevant organizations at Japanese side

Study Team held the seminar and exchange opinions on the result of the survey with the Ministry of Ministry of Land, Infrastructure, Transport and Tourism and the Ministry of Agriculture, Forestry and Fisheries of Japan, and exchange opinions on the possible collaboration with knowledge sharing in the future.