I. COMPETITIVENESS AND SUPPLY CHAIN MANAGEMENT STUDY ON TAIWAN GROPER INDUSTRY

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ABSTRACT

Grouper fish is one of the major aquaculture products in Taiwan. However, we need to streamline the process in production, further enhance marketing activities, and boost or strengthen channels of distribution for grouper to develop an efficient and effective strategy in promoting the grouper industry. Thus, integrating the producing and marketing channels including the consumers’ needs, order from manufacturing, products certification, and transportation and sailing systems are important factors to be considered. This paper conducts questionnaire surveys and in-depth interviews, and it examines the competitiveness and supply chain system of the Taiwan Grouper Industry. Empirical results show the major key factors that can improve the intercalation of leading supply chain management into this industry successfully are as follows: 1) Government should promote collaboration between industry and academic community in bioscience research and strengthen their partnership; 2) Industry should set up a center for handling goods and materials at the place of production in order to construct a supply chain network; 3) Productions should establish an e-business management system; 4) Members of the supply chain must establish a common understanding to form partnerships; 5) The grouper industry must comply with the GAP and HACCP systems, and open up the international market and aim for sustainable development. Finally, this research provides recommendations for development, and market strategy to the grouper industry in the future.

Key words: competitiveness, Taiwan, grouper industry, supply chain management

INTRODUCTION

Grouper is one of the major aquaculture products in Taiwan. There are more than 20 species of groupers in the current waters around Taiwan, including the Malabar grouper, Humpback grouper, Potato grouper, Brown-marbled grouper, King grouper, and others, including the Orange-spotted grouper, Tiger grouper, and Leopard coral trout etc. Among them, the King grouper culture has developed in the last few years and is growing continuously at a strong rate. All these groupers are warm-water fish. The optimal temperature ranges from 24 to 30°C, with the most able to tolerate a range of 15-35°C. Juvenile fish, 30-40cm, and 0.5-1.0kg [1], are the favourable product size in Taiwan, Hong Kong, Shanghai, Singapore and other parts of Asia.

Currently, Taiwan has taken the leading role in grouper culture. According to a report by the aquaculture organization of the United Nations in 2004, the culture grouper production in Taiwan was 13,219 tons, which was more than 80 percent of total culture grouper production in Southeast Asia. The main challenge that the global grouper culture industry is facing is insufficient and unstable supply of groupers (fry and juveniles). The deficiency in the processes of producing and marketing channels are calling for deeper integration of production and marketing channels, incorporating the consumers’ needs, order form manufacturing, products
certification, transportation and sailing system. This paper conducts questionnaire survey and in-depth interviews, and examines the competitiveness and supply chain system of Taiwan Grouper Industry.

LITERATURE REVIEW

Huang (1999) discussed the productivity and cost analysis on grouper industry. It shows that the aquaculture cost, and technology paves the way for the grouper cultivation in the future. This paper also analyzed the grouper industry and its development. It shows that the grouper industry should reduce the cost of operation, promote international trade competitiveness to become the main export species in Taiwan [2]. Lin (1999) used seven core resources, including land, money, credit, economic-net, professional skill, managing style, and the spirit of business, to analyze the key success factor in grouper fry industry [3]. Yeah's (1999) research showed that the fry cost is the highest (36 to 45 percent) in aquaculture stage. Therefore, reducing the fry cost is an important factor to consider in increasing the profit.

In marketing, Yeah suggested that fishermen should organize a marketing collaboration, and establish common transportation and sale system [4]. Fu (2002) found that feeding costs and fry costs are the two main expenses in grouper farms.

Fu also suggested that the industry should effectively reduce hectare-feeding rate and fry costs, cultivation density, and the increased area of cultivation [5]. Shih (2002) analyzed the elasticity of grouper in Taiwan, and research showed that the income elasticity of grouper is bigger than one. It means that a grouper can possibly be made into luxury goods and can have enormous marketing potential in the future [6]. Jung (2004) surveyed consumer’s seafood purchasing behavior. He found out that consumers are willing to pay more in buying safe and sanitized seafood [7].

THE FRAMEWORK AND SUPPLY CHAIN OF GROUPER INDUSTRY IN TAIWAN

The Framework of Taiwan Grouper Industry

Taiwanese grouper aquaculture farms are distributed in Pingtong (74 percent), Kaohsiung, Tainan and Chiayi County. In 2004, the production was about 13,000 metric tons, and the output value is about NTD 2,700 million [8], [9]. Taiwanese are cautious about their seafood, especially the expensive variety (including groupers). In Hong Kong, live groupers weighing 0.5-2.0 kg costs USD22 to 44 per kg (wholesale) depending on the species. Due to grouper’s excellent taste, the demand is high and the grouper is always found on the menus of gourmet restaurants. To meet the demand, Taiwanese started cultivating groupers in Penghu, across the Taiwan Strait in 1975.

Now, Taiwan has taken the leading role in grouper culture [10]. According to the reports by the agriculture organization of the United Nations, in 2000, the grouper production culture in Taiwan was 5,053 tons, which was more than 50 percent of the total culture grouper production in Southeast Asia (9,488 tons). The main obstacle of global grouper culture industry is insufficient supply of fry and juvenile grouper. In Southeast Asia, most groupers were grown up juveniles.

Due to high demand in Southeast Asia and the (seasonal) shortage of grouper fry, the price of grouper fry is more expensive than other species. Taiwan has already been analogous to achievements on a kind of reproduction in grouper industry. Nowadays, Taiwan hatcheries produced 300,000 brown-marbled grouper and two million king grouper juveniles. However, about one-third of the groupers are not grown in hatcheries. In 2000, 33 million fry and a record 323 metric tons of live groupers had been exported. Taiwan’s live groupers have been found not only in the restaurants of big cities, such as Hong Kong, Shanghai, and Singapore, but also in the inner cities of China, such as Chongqing, Chengdu, Wuhan and Xian. In 2004, more than 400 metric tons was exported, which is 3.6 percent of the production. The total value of export was about NTD34 million (mostly exported to China and Hong Kong). Taiwan is expected to maintain this leading role in grouper culture and global supply in the years to come.

The Supply Chain of Grouper Industry in Taiwan

Marketing can be defined as a series of services performed between times that producer usually sells his product and the time it is purchased by consumer (Brunk & Darrah, 1995). Marketing involves a series of marketing activities and functions
that additional utilities are being created or increased and then can be viewed as a social system (Chen, 2001) [11].

The performance of Taiwan marketing system is predominantly decided by many internal and external factors. Internal factors which are emanative from or dependent on the nature of something, such as culture, diet habits, population, politics, public attitude and opinions, commercial-minded heritage, government policy, social structure and market structure. External factors, which are not directly relevant to the marketing system such as producer’s organizations (e.g. fishermen and farmers’ associations, marketing cooperatives), marketing infrastructure (e.g. assembling, grading, packing, strafing, processing, transporting, selling, financing, information, risk-bearing, etc.), wholesale markets (help for transaction prices control), marketing technology (e.g. computerized auction bid system, utilization of automatic machines and market information reporting system for seafood marketing), legislation, government organization, administration and policy. Typical marketing channel for the regular seafood products can be shown in Figure 3 [11], [12].

There are two stages of grouper marketing: transportation and sales stage. There are three main types of transportation and sales in Taiwan grouper industry: (1) through fishery marketing cooperation sales to the fish market or export; (2) selling to wholesale fish markets by farmers themselves; (3) selling to the shipping trader and then sale in fish market, restaurant or export. The third type is the main model in Taiwan grouper industry. Grouper marketing is mostly all managed by the shipping traders, and most of the shipping traders manage only grouper business.
In addition, major cities of grouper consumption are Taipei, Taichung, and Chiayi. According to Shih's (2002) and Shen's (2003) calculation, 59.55 percent of the groupers are sold to shipping traders, 20.43 percent are sold to the fishery marketing cooperation, and others are sold to wholesale fish market (13.57 percent). Based on Chen's (1999) research, 52 percent of groupers are sold to shipping traders, 20 percent are sold to the common transportation, and others are sold to the wholesale fish market (12.6%) [13], [14], [15].

Because of the dissymmetry of market information, the shipping traders are usually price makers and the aquaculture farmers are price takers. Also some transportation and shipping traders could easily reduce their transportation and sales cost and earn the extra profit by manipulating fish prices.

Moreover, there are mutually beneficial relationship between the farmers and factories. Whenever the production surplus happens, the ability of negotiation of a factory is higher than that of the farmers. On the contrary, when the production amount reduces or is in shortage, the producers have better negotiable power to raise price. Therefore, if we could provide symmetric market information for everyone (including farmers, shipping traders and factories) in the supply chain, we could make more profit.

THE TRANSPORTATION AND SALES PROBLEM IN THE GROPER INDUSTRY

Grouper is a high-priced fish, and mostly sold while still alive. The major marketing style is that shipping traders collect live groupers from farmers and then sell the living fish to other trader and restaurants in big cities [13]. It is sold less to the wholesale fish markets. The major problems that the grouper industry is facing are described as follows:

1. The traditional marketing method still dominates in grouper supply chain system. The shipping traders are the main body in the supply chain, and they control most of the transportation and sales of the grouper industry. Under this system, the transportation and sales efficiency, industry’s supply and demand that groupers industry supplies do not interest the traders.

2. 20 to 40 percent of groupers are sold to Mainland China and Hong Kong. Since export
should be transported through a third location, the transportation cost is high so the shipping traders usually export through smuggling. Not only this is a high risk in transport, but also the market is very unstable and can be possibly cut off at any time.

3. The major selling type of grouper is whole live fish which consumers prefer. This makes the supply costs remain high, especially in export. Therefore, the crucial issue is how to decrease the transportation and sales cost, to raise the survival rate, and to conform the safety certification standard of the products.

4. Aquaculture farmers’ lack of organization and marketing ability in sales. Although there are a lot of fisheries selling centers in Taiwan, most fisheries spend money in building seafood factories. The ability in establishing supply chain system is relatively insufficient as well.

5. Consumers tend to buy high-quality foods. Besides quality, freshness, processing degree, security hygiene and manner of packing, etc. will have an influence on consumers’ willingness to buy.

Otherwise, the traceable system and barcode label is now used in the grouper industry for each stage (Fig. 4). The establishment of traceability system and production resume information for aquatic products includes feed production, breeding production, testing analysis, transport/wholesale, processing/pack, and sale/consume. If there is something wrong with a product, this traceable system would help us find problems that happened in which chain it occurred. In sale/consume part, we may check when the products are sold and who sells it and via what method. If there is no problem in this part, and then we will trace it to the process/pack part. We would check who process/packs and how they do so. We would also examine the product types and to whom they deliver the products to. If there is nothing wrong in this aspect, we may inspect the logistic place and method and who transports the damaged product [16].

Problems may also occur in the testing analysis part. We would survey when and where it was
sampled and the results of the analysis. If problems could not be found in this part, we will trace it to the aquatic production to see who supplied the larvae, what kind of feed was used, (process records, medicine management) and whom they dispatched to. The final review is for feed factories, including who produces feed and who supplies feed.

In the track/trace flow of grouper product production system, when an event happens, we may use the barcode label to trace the batch number, serial number of fish farm, and track the defective products by using a production resume database system.

FINDINGS AND SWOT ANALYSIS

Taiwan grouper farms are mostly managed by small farmers, and small-and-medium enterprises. That’s why the cost of personnel, man-hour restrain, restriction, environmental protection is higher than other Asian countries. Under this situation, if we want to cut down on costs effectively, we should improve our management skills in order to provide efficient and effective service.

Also, the processes of producing and marketing channels are complicated and lack efficient mechanism. The residues are sometimes examined in fisheries (e.g., grouper) products. Consumers are paying more and more attention to food safety and health, and so do governments in many countries. And it has already become a global issue. In fact, there is a system of hazard prevention for food safety and hygiene under World Trade Organization (WTO) Regulations, and the traceability of aquaculture and fisheries product history is also being demanded in the international trade.

Consumers require information transparency of aquaculture and fisheries product. The modernization for aquaculture management is urgent, and quality, image, market sales and logistic efficiency of fisheries products should be enhanced, too.

In the recent years, HACCP system has been developed as a quality assurance system for processing safe foods. In many countries, such as European Union members, United States, Canada, and Australia, these countries mandate the processors to process seafood under HACCP-based control. The exported seafood is specially required to follow the Agreement on Sanitary and Phytosanitary Measures (SPS). Currently, Taiwan (2002/1/1) has to be a member of the WTO. Globalization and liberalization are important factors on trade, including the fishery industry. It is urgent to promote seafood inspection and certification in seafood industry. Concerning the outlook for fisheries in view of the agreement on the SPS, Taiwanese seafood trading must follow food safety standards. Recognition of the urgent need for a framework to judge the equivalent of HACCP-based food control systems from different countries for seafood international trade in Taiwan.

In fact, the technique of Taiwanese grouper breeding is well-developed, and the quality of grouper products has already achieved a leader status in the world [14]. However, the grouper industry lacks scarce produce, disease prevention and selling channel between China and Taiwan. Thorough grouper farmers fare of disease and build constructing, and sound variety protection system [17].

According to this research, we analyzed Taiwan grouper industry’s SWOT as follows:

Strength

1. The fish maw itself contains abundant protein, unrighted acid (DHA). The fat on the fish is rich in glue quality, sodium and potassium. Dissociate amine base sour and core sweet sour content high fingerling very too (?). Not only the meat is tasty, but it is also very nutritious.
2. The cultural technique is superior compared with other countries.
3. The reproduction technology of the fry is fast and efficient. It can produce continuous supply all year round.

Weakness

1. The shipping traders control the main transportation and sale of grouper.
2. Shipping traders have the huge ability to control the selling prices, but there are too many traditional transportation methods and sales strata.

Opportunity

1. The government supports the groupers established strategic alliance.
2. The grouper business is profitable and has potential in export that attracts interested businessmen to get involved and has already received the attention of relevant parties.
3. Grouper has gained popularity due to expanding capacities of supermarkets and diverse marketing channels.

**Threats**

1. Grouper industry may face severe competition from Southeast Asia (China, Vietnam and etc.).
2. Grouper may be substituted for other fishes.
3. The threats of low quality, unhygienic control products from other countries.

According to the results of SWOT analysis, the feasible strategies mainly come from: (1) utilizing the present advantage to hold the future chance and dissolve the possible threat, if possible maintain advanced technology continuously, to produce stable supply of high quality grouper products; (2) improving weaknesses such as cooperation between the grouper industry and academia, strengthening technology and facilitating the supply chain management system with higher capacity and efficiency.

**CONCLUSIONS**

This study examines the supply chain system of grouper, and evaluates the processes and structures of producing and marketing in Taiwan. The study also provides recommendation on how to increase the supply capacity and improve efficiency of marketing channels. It will also serve as a reference to enhance value to the industry. The major key factors for success are:

1. The government must promote further collaboration between the industry and the academic community and research in the area of bioscience, at the same time, build up and strengthen partners' relationship of supply chain.
2. Grouper industry or government should set up a trading center for proper handling of groupers and related materials for production, and establish the supply chain infrastructure. It must also promote efficiency in flow of goods and to fortify rapid response to meet consumer demands—these are the three measures crucial to aquatic productions.
3. The production of marketing of grouper should introduce the electronic and parcel delivery service, traceability of fish, and certification system to ensure quality control, integrity in the system and expansion of the marketing framework.
4. Members of the supply chain must have consensus to form partnership.
5. Industry must establish a system to project productions and boost marketing, stabilize the source of fry, so to put in place an effective system.
6. The government should support the strategic alliance of grouper, and establish a data base of production and marketing.
7. Aquaculture farms must comply with Good Aquaculture Practice (GAP) or HACCP, and processing factories must comply with HACCP and participate in international foods exhibits. The grouper industry opens up the international market and aims for sustainable development.

Finally, this research provides recommendations for development, and market planning to the grouper industry. And the results of this study can be a reference for the policy makers and related strategic managers. With the time and cost constraints, this research focuses on competitiveness and the SWOT analysis on grouper’s supply chain. In further research, we will incorporate cost analysis in the whole supply chain and consumer’s survey for further discussion.

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