

TRACEABILITY AND SUPPLY CHAIN MANAGEMENT FOR CAGE CULTURE INDUSTRY IN TAIWAN - THE CASE OF COBIA

Fen-Lan Chen¹, Ching-Ta Chuang², Sing-Hwa Hu³, and Fan-Hua Nan^{4*}

¹Department of Aquaculture

^{4*}Assistant Professor, Department of Aquaculture
National Taiwan Ocean University
No.2 Pei-Ning Road, Keelung, 20224, Taiwan

Tel : +886-2-2462-2192 ext. 5231

¹E-mail : fernlan@ms1.fu.gov.tw

^{4*}E-mail : fhnan@mail.ntou.edu.tw

²Professor, Institute of Marine Resource Management
National Taiwan Ocean University

Tel : +886-2-2462-2192 ext. 5603

E-mail : ctchuang@mail.ntou.edu.tw

³Director, Food and Fertilizer Technology center for the Asian and Pacific Region
5F, 14, Wenchow Street, Taipei 106, Taiwan

TEL : +886-2-2362-6239

E-mail : singhwa@fftc.org.tw

Abstract

In order to produce high quality protein from fish, it is urgent for Taiwan to conduct further research in the area of cage culture for the purpose of preparing the growing internationalization trade. In this research, we are leveraging on survey and Porter's competitive strategy to assess the development and competitiveness of the cage culture. Our analysis aims to provide the economic benefits of e-commerce system and the current status of traceability and the supply chain management in the cobia industry. According to this empirical results, it indicates that Taiwanese cobia cage culture should reduce the costs of fish larvae, artificial diet, and labor to enhance price competitiveness; Companies should invest in both the sales and the interflow of commodities to make a complete value chain of "production", "manufacture", and "sale". Additionally, Industrial policies should be initiated from traceability and supply chain management to promote the competitiveness, and finally strategies and suggestions of industrial adjustments are provided in this essay.

Keywords: Cage culture, Cobia industry, Supply chain management (SCM) , Traceability, Good aquaculture practice (GAP)

1. Introduction

The cage culture has been developed more than 20 years since 1975 in the shallow waters off Peng-Hu. The cage culture policy of Taiwan went through a drastic change due to the economic evolution. In 2004, the total area for cage culture was 1,026,887.5 M³; the total production and the value was 5,417 MT and NT\$ 1,016,866,000 [1] respectively. The operation of cage culture activities is being mainly concentrated in the Peng-Hu and Ping-Tung Prefecture. According to the floating collar system, the types of cage may be divided into traditional semi-flexible system, flexible system and submergible system. The main cultured species include Cobia (*Rachycentron canadum*) , Red Sea Bream (*Pagrus major*) , Grouper (*Epinephelus malabaricus*) , Red Drum (*Sciaenops ocellatus*) , and Amberjack (*Seriola*

dumerili). Concerning the economic efficiency and biological evaluation, the Cobia is the future star of Taiwan cage culture. [2] [3] [4].

With the limited water and soil resources in Taiwan, cage culture has become significant to the aquaculture in Taiwan. With Taiwan's accession into the World Trade Organization (WTO), we need to put emphasis on the importance issues in the cage culture industry in order to face the trade liberalization.

2. The Current Framework of Cobia Cage Culture Traceability and Supply Chain Management in Taiwan

The epidemic disease invasion will follow this era of digitization spreading from local or overseas and it may result the increasing challenges in the open market of agricultural product and may also result the improper usage of medicines. Additionally, it imposes threats on the consumers health and their confidence in our aquaculture products. It may require us to establish the management of traditional cage culture industry as well as leveraging application information management tool. Promote Good Aquaculture Practice (GAP) certification procedure, the examination certification system, an electronic traceability and supply chain management system are expected to be established in Cobia cage culture. By these approaches, we may meet the urgent needs of international trade on improving tractability of fishery product and may satisfy the demand of information transparency. The current framework of Cobia cage culture traceability and supply chain management in Taiwan is showed as figure 1.

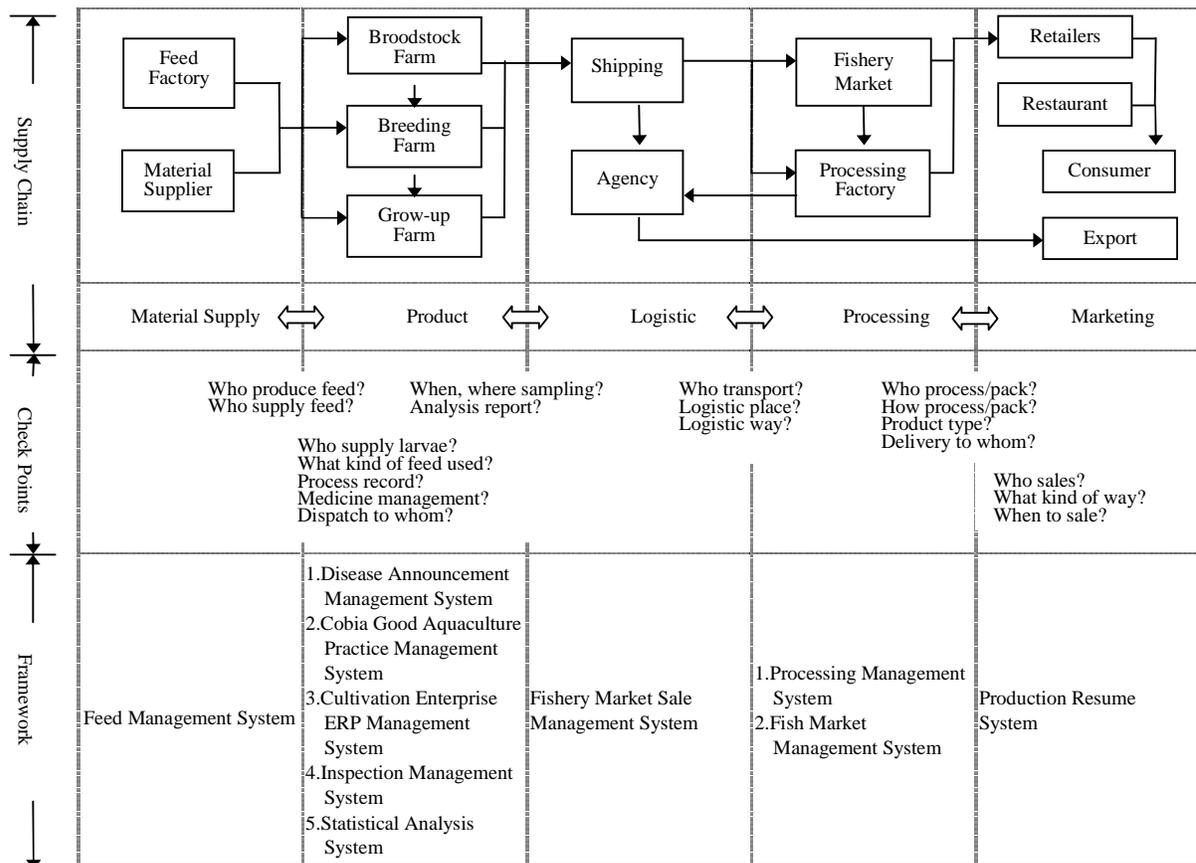


Figure 1. Framework of Cobia cage culture traceability and supply chain management in Taiwan

2.1 The Supply Chain of Cobia Cage Culture in Taiwan

In order to probe into the information management of Cobia cage culture in Taiwan, the establishment supply chain pattern is the priority work which includes supplier of raw material and drugs, feed factory,

brood-stock farm, breeding farm, grow-up farm, logistic, storage, food processing, shipment, retail sales, restaurant and consumer [3]. Each stage has its unique product packing type and transmission ships way.

1.Feed factory

The feed manufacturers will send the product to brood-stock farms, breeding farms and grow-up farms. The types of feed package include small and big bags, giant hundred-ton stack board. Alternatively, the product may be shipped by bulk way.

2.Brood-stock farm

The brood-stock farm aims to sell fertilized fish eggs to breeding farms. Some preparations are conducted by the brood-stock farms before delivering to breeding farms, that are, the egg quality grading, the packing with trunk or box and so on. Afterwards, the brood-stock farms transport the fertilized eggs to the breeding farms by air or land delivery.

3.Breeding farm

The breeding farm, the location of breed hatching, receives and preserves fish eggs. By implementing some operations, the eggs can be fertilized. When the eggs enter into the raising phase, they will be delivered to grow-up farms. Finally, the breeding farm delivers the juvenile fish by the stable boat ship to the grow-up farms.

4.Grow-up farm

The juvenile fishes are raised in the grow-up farm stage. The adult fishes are also transferred by trough loading, case loading or firm boat ship from a grow-up form to a processing site.

5.Food processing

The fishery products, in this stage, will be processed through cutting, adding salt and boiling. Afterwards, the fishery products are packaged and being transported to a processing manufacturing site through sea, land or air delivery. Alternatively, the product can be directly sold after being packaged. The tapes of package, that are, box and stack board package, will be decided by fishery products supplier.

6.Wholesale business

In this stage, the wholesaler is responsible for the purchase and the sale. They trade the aquatic product to other enterprises or the consumer. They also practise raw materials or products trade in each stage of the supply chain.

7.Retailers

The retailers will trade the aquatic products to the general consumers instead of other enterprise systems. The nature of the fishery products may also be changed by the retailers (such as eliminating the internal organs, the depilation, fries and so on) before consumers' purchase. The products may also be packaged into small packs or be ready to eat.

8.Consumer

The consumer purchases and eats fishery product directly.

2.2 The Lead-in Method for Cobia Cage Culture Traceability and Supply Chain Management

The lead-in tool for Cobia cage culture traceability and supply chain management is EAN.UCC., which inputs data to the computer in every stage of the supply chain, and then forms a traceability system. By the information exchange, bar code label and industrial information manage the platform correlation, it may automatic monitor product real flow , and may deliver the path with record product system, and constitution traceability and supply chain management system [5]. The systematic insertions way are described as follows.

Step1: To specify the fishery products code and name; that is, providing Global Trade Item Number (GTIN) and Global Location Number (GLN) for product and farm code only. GTIN is functioned as the foundation of the product identification with Fisheries Agency's species code. It is regarded as fishery product code number (Table 1) by the Fisheries Agency. The GLN code is basically, according to GAP, used as an address code of feeding farm (see Table 2).

4	7	1	1	2	4	4	0	2	9	0	0	4
Taiwan			Fisheries Product			Classification Code		Species Code			Chick Digit	

Classification Code : Depending on the origin of product (culture, catch) or product types (egg, brook-stock, whole fish, unpreserved, frozen, processing...) to define the code.

Fish Species Code : The combination with Fisheries Agency fish type code and FAO Fish type code to define the code.

Table 1. GTIN rule for fishery products - case by Cobia

4	7	1	1	2	4	4	9	0	1	7	4	4
Taiwan			Fishery Party Classification Code				Farm Code				Check Digit	

Fishery Party Classification Code : Depending on Fishery party character such as farm, processing factory, feed factory etc. (1244 and 1245 stand for Fishery Farm) .

Farm Code : a serial number stand for different farm.

Table 2. GLN rule of aquaculture farm - case by Tan-Hou Ocean Development Co. Ltd.

Step2: After the code and name of fishery products is melting, we may use the encoding method ,EAN-128, that is, to add those data including the production batch number, serial number, net weight, quantity, date and so on. It can form the fishery products bar code label (see Figure 2).

SPECIES	EAN No. 4711244901744
Cobia	BATCH No. : A0105040001
SIZE (Kg)	SSCC : 05043000001
6-7	
PCS	(01)4711244029004(3101)000258(30)04
4	
PROD. DATE	(11)050430(10)A0105040001(21)05043000001
2005.04.30	
NET W. (Kg)	
25.8	

Figure 2. The bar code for Cobia cage culture

Step3: After completing the code work, it must implement the operational procedure automatically by recording product data, establishing the automatic management and catching the electron data processing. The advantage is that it can track and traces the position of products and its situation in the supplying chain.

2.3 The Framework for Cobia Cage Culture Traceability and Supply Chain Management

The overhead construction at present is the framework for Cobia cage culture traceability and Supply Chain management inducts, including (1) fishery product production management system: The detailed content includes Cobia GAP management system and Cultivation enterprise ERP management system. (2)The correlation management system in the supply chain: The detailed content embraces the feed

management system, the fish market management system, the processing management system and the fishery market sale management system. (3) Food security and hygienic management system: The detailed content includes the inspection management system and the disease announcement management system. (4) Fishing politics management and inquiry system: The detailed content, that is, the content manages system, the statistical analysis system and the production resume system.

Through these management systems, the operator in every stage of the supply chain may keep the record of the required information.

2.4 The Check Points for Cobia Cage Culture Traceability and Supply Chain Management

In order to achieve the spirit of "From Farm to Table", the Cobia cage culture traceability and supply chain management are derived from the spirit of the Hazard Analysis and Critical Control Point (HACCP) and formulation GAP management. The goal conforms to the production responsibility, the independent management, and food security. At present, the examination operation is conducted by the professor organisation form by the Taiwan Fishery Economy Development Association. The organisation is divided into a national examination professor group and regional examination professor group. The professors are expected to carry out examination in the different stages of the Cobia cage culture supply chain. The examinations of the Cobia cage culture traceability and Supply Chain management are as follow, (1) Feed production & Culture production stage : Who produce feed ? Who supply feed ? (2) Culture production & Testing analysis stage : Who supply larvae ? What kind of feed used ? Process record? Medicine management? Dispatch to whom ? (3) Testing analysis and Transport (Shipment) stage : When, where sampling ? Analysis report ? (4) Transport (Shipment) and Processing (Pack) stage : Who transport ? Logistic place ? Logistic way ? (5) Processing (Pack) and Sale (Consume) stage : Who process (Pack) ? How process (Pack) ? Product type ? Delivery to whom ? (6) Sale (Consume) stage : Who sales ? What kind of way ? When to sale ?

3. The Application of Cobia Cage culture Traceability and Supply Chain in Taiwan

Due to the links between product bar code label and supply chain management system, it may provide more precise basic record of materials for Cobia cage culture quickly. Therefore, this research applies to the data from this system and can present the analysis of produce cost. Meanwhile, Using Likert scale [6], it can design questionnaire survey and carry on the investigation of the traceability and the supply chain management in each stage for Cobia cage culture. Finally, using Porter's competitive strategy to examine the development and competitiveness of cage culture in Taiwan [7] [8]. Empirical results are described as follows. (as Figure 3)

1. In the aspect production cost analysis : The Cobia cage culture is a profitable business in Taiwan. Nevertheless, it may be necessary to take into account the lost caused by Typhoon, low temperature and thieves. Hence, it is suggested that the industry should reduce the cost of fry, feed and salary for the purpose of changing the statue from profit balance to competitive ability [9] [10]. The cost of Cobia cage culture by item shows as Table 3.

Unit: NT/KG; 1US\$~33NT\$

Species	Cobia	Red Sea Bream	Grouper	Red Drum	Amberjack
Brood-stock	5	8.02	20.23	10.21	31.44
Feed	45	57.51	55.68	39.67	51.24
Labor	7.03	21.62	22.27	11.77	15.81
Others	27.06	6.04	5.65	3.16	3.73
Depreciation	13.72	7.33	9.5	4.98	5.73

Interest	2.27	4.62	6.07	3.14	3.54
Total	100.08	105.14	119.4	72.93	111.49

Table 3. The cost of cage culture by item

2. In Porter's competitive strategy analysis aspect :

- (1) The cost leadership strategy shows that with accelerating research and development of the most suitable feed for cobia, it will hence the competitiveness. The conformity of each link in the industry supply chain produces a horizontal and vertical alliance. It can facilitate the price and payment negotiation to reduce the operating cost [11] .
- (2) The differentiation strategy analysis indicates that the a good variety marketing strategies can be deployed in the products because of the delicious taste of cobia. Cobia can be processed into many types of food, that are, Sashimi (raw fish), smoked fish, baked fish or whole fish (head, skin, bone and internal organs). All these are the majority fishery products in the domestic market. The majority fishery product types in the foreign market include fresh fish, headless fish and frozen fish in low temperature storage. The cobia industry in both domestic and foreign market has achieved great competitiveness [12].
- (3) The focus of strategy analysis reveals that it should invest the overseas market and logistic system while concentrating manpower, material resources and financial resources on the cobia industry.

3. Internal environmental analysis: Value chain

Based on the internal environmental analysis and the principle of the value chain, we suggest that cobia farmer should invest on both the sales and the interflow of commodities to make a complete value chain of "production", "manufacture", and "sale".

4. Five forces analysis :

- (1) The analysis with the threat of new entrants' shows that if the producer of the supply chain can cooperate with raw materials industry, the reduction of the feed and fry cost can be achieved. .
- (2) The analysis with the threat of substitute products or service indicates that if we can maintain the advantage of technology, cost and price, and combine the systems of marketing and processing, the cobia products may not be replaced by the other imported fishery products.
- (3) According to the analysis with the bargaining power of buyers, it is found that the major export market of the cobia product is Japan, followed by the American-European market. Both markets require high negotiation ability, especially in Japan. Therefore, we should further study the transportation and sales stage of the supply chain and analysis the market demand, characteristic, trades activity and consumption habit in Japan and American-Europe market. By deploying these strategies, it will facilitate the negotiations.
- (4) The analysis with the bargaining power of suppliers, we may find that it is necessary for the domestic cobia industry to improved the negotiation ability. The industry is used to have sharp price reduction to enhance their competitiveness. This may give a chance for the buyers to obtain high-quality produce with low price. We should take methods to have a sustainable development in the industry, that are, to integrate supply chain system of the industry, to carry on the strategically alliance and cooperation, to have information transparency, and to raise the negotiate chip and space for price. It will enhance the industry's profits and the international competitiveness.
- (5) The analysis with rivalry among the existing firms industry competitor points out that the member on the supplies chain, if can form the strategic alliance among the same trade further and can manage the industry , may achieve i international competitiveness enhancement.

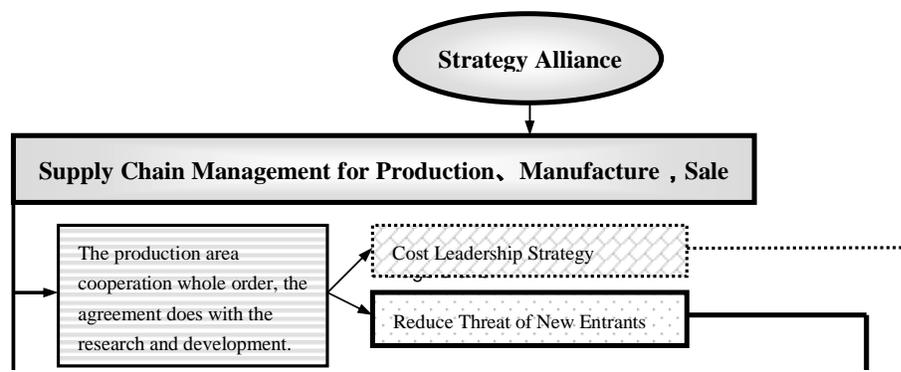


Figure 3. The Competitions of Cage Culture

4. Discusses and Conclusions

There are several advantages can be found through the establishment of the traceability and supply chain management system. (1) Producers: The one can find the problems and can provide consultation through the examination conducted by the examination team. At the same time, the producers can obtain more systematic production record data about production cost analysis and the management. On the other hand, because of the GAP with distinguish characteristics, the producer can set up higher price and can acquire the consumer confidence. (2) Logistical can grasp more information to modify the marketing strategy, to reduce the management cost and to promote the quality of managing. (3) The Cobia industry, which can achieve the well-sound production and marketing systems to regulate with planned production. When facing problems, it can reduce industry's risk with the traceability to pinpoint the problematic products and to distinguish responsibility effectively. (4) Consumer can increase consumption confidence and reduce the consumption risks through the Internet to have enquiries about the relevant producing and selling information immediately.

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