Improving Supply Chain Opportunities for Tilapia in the Philippines

Marketing, Economic Risk Assessment, and Trade/Study/09MER03NC

Wilfred E. Jamandre and Remedios B. Bolivar
Central Luzon State University
Science City of Munoz, Nueva Ecija, Philippines

Upton Hatch and Russell J. Borski
North Carolina State University
Raleigh, North Carolina, USA

ABSTRACT

This study was designed to evaluate and develop an efficient tilapia supply chain to foster the development of viable fast food and supermarket purchases of tilapia from small-scale producers; with the following specific objectives. Phase 1 – Evaluation: (1) Develop tilapia supply chain maps for each market level, i.e., producer, wholesale, restaurant, supermarket, fast food stores, etc., to identify specific activities and services, key players, logistical issues, external influences, and flow of product, information and payment among market levels; (2) Analyze tilapia supply chain performance for efficiency, flexibility and overall responsiveness; (3) Identify areas for improvement in supply chain, i.e. behavioral, institutional and process; and (4) Provide recommendations to improve the tilapia industry in general and its specific supply chain elements. Phase 2 - Development Undertaking: (1) Design specific improvement measures based on the identified areas of improvement from Phase 1; (2) Test the improvement measures in the market place, then assess and refine the improvement measures; and (3) Design and implement measures to ensure the sustainability of the improved supply chain of tilapia.

The country’s tilapia industry supply chain is composed of the following parts: the hatchery and nursery farms which are responsible for the introduction of improved brood stocks to commercial or backyard fish farms, which in turn, are responsible in providing improved quality tilapia fishes for the end-users such as consumers and institutional buyers. The institutional buyers could be further decomposed into processors, consolidators or traders, supermarkets, specialty shops, food chains, restaurants, bars and canteens, among others.

The provinces of Pampanga, Batangas and Laguna are the major tilapia sources while the cities of Metro Manila, Angeles and Baguio are the major demand centers. Dagupan City, Pangasinan being known as “bangus” or milkfish capital is a major transshipment point of tilapia and other seafood for the Northern Luzon provinces including Cagayan Valley and the Cordillera Administrative Regions. In addition to the major supply center, Camarines Sur of the Bicol Region is becoming a key source of tilapia fries. The product flow of tilapia fries from the hatchery to the nursery farms generally follows a continuous 18-day cycle while tilapia fingerlings from nursery to commercial or backyard farms follows thirty- to forty five-day cycles depending on fish sizes required by the customers. Direct buying and selling, wholesaling, and retailing at central markets through agents and “consignacion” are the most common marketing operations of the tilapia industry. Consumers generally prefer whole live fish with size ranging from 250 – 300 grams per fish (or 4-5 pieces per kilogram) but the requirements of institutional buyers are more varied depending on their customers’ preferences. Filleted tilapia requires about 2-3 pieces per kg or equivalent to 450 – 750 grams per fish. Grilled and barbequed tilapia are now becoming more popular recipes in the major demand centers.

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The major concerns of hatcheries and nurseries are the high cost of outbound logistics, which is exacerbated by high competitive pressures of inferior quality but inexpensive stocks (e.g., non-sex reversed) and high levels of mortality due to environmental and cultural factors.

The fish farms’ major concerns include expensive but low quality feeds (at times mislabeled) and other inputs as well as very low fish recovery and longer culture periods to attain larger fishes. Their transaction costs include the cost of waiting for buyers, delays in delivery, in-transit mortality, toll fees or “goodwill” as well as shrinkage losses. In addition, the lack of cold storage and transport vehicles equipped with tanks and aerators or refrigeration facilities delimits them from taking market opportunities. Interestingly, many farmers adopt a “circuitous” production technique to take advantage of markets preference of tilapia with darker skin.

The major concerns of processors are too few farms that could provide regular supply of the desired quality and volume of tilapia, the lack of capital for market expansion, and competition with cheaper imported counterparts.

The concerns of traders including “consignacion”, suppliers or consolidators are: (a) meeting the product quality and quantity orders on schedule, (b) high logistics and transaction costs of consolidating and distributing fishes from sources to destinations, and (c) absence of product grades and standards.

The following are some recommendations to address the various issues and concerns of the various chain players: (1) encourage the establishment of more nursery farms for better quality brood stocks while intensifying technology transfer to farmers for better health and management of tilapia; (2) conduct market promotion activities highlighting the various niche opportunities of tilapia among growers and consumers; (3) motivate the participation of small farmers in supply chains by setting up an incentive scheme through a mix of patronage refund and profit sharing; (4) institutionalize an accreditation program for feed manufacturers, hatcheries, processors and the like to improve the quality assurance of products and services; and (5) provide capital windows to improve facilities and reduce logistics and transaction costs in the entire supply chains of tilapia.

**INTRODUCTION**

Tilapia culture is widely undertaken in the Philippines with regions III and IV of Luzon Island constituting the major production areas. Due to the product attributes and productivity as offshoots of research and development (R & D) efforts and programs beginning in the mid 80’s, tilapia production has been a dynamic aquaculture enterprise in the country. Markets for tilapia remain vibrant with encouraging growth potentials. All major demand areas such as cities of Metro Manila, Baguio, Angeles, among others, are now preferring other product forms and shopping venues for reasons of convenience and availability than the traditional marketing mode.

Recently, efforts to sustain the industry’s growth momentum have been focused on the genetic improvement of broodstock through cross breeding of different strains. Likewise, improved stock management and cultural practices have been developed to decrease mortality and to maintain growth vigor.

However, in the midst of the global economy, the tilapia industry remains sluggish with regard to serving new market niches such as supermarkets, food chains and exports. This is because small stakeholder producers that are scattered throughout the country dominate the tilapia industry. High mortality, small marketable body size and slow growth performance are still prevalent in the industry and this has limited expansion to new markets.
This existing condition of the tilapia industry amidst pressures brought about by global competition necessitates a development framework that views the industry in a holistic manner that would bring about visible and concrete improvements in production, handling and distribution processes or activities. It is of utmost consideration that the various players of the industry are coordinated to achieve a more efficient, cost-effective, profitable and sustainable industry that thrives in an environment of increased competition due to liberalized markets.

**OBJECTIVE**

This study was designed to evaluate and develop an efficient tilapia supply chain to foster the development of viable fast food and supermarket purchases of tilapia from small-scale producers. More specifically, objectives are organized as evaluation and development undertaking.

Phase 1 – Evaluation:
(1) Develop tilapia supply chain maps for each market level, *i.e.*, producer, wholesale, restaurant, supermarket, fast food stores, etc., to identify specific activities and services, key players, logistical issues, external influences, flow of product, and information and payment among market levels.
(2) Analyze tilapia supply chain performance for efficiency, flexibility and overall responsiveness.
(3) Identify areas for improvement in supply chain (*i.e.*, behavioral, institutional and process),
(4) Provide recommendations to improve the tilapia industry in general and its specific supply chain items.

Phase 2 - Development Undertaking:
(1) Design specific improvement measures based on the identified areas of improvement from Phase 1.
(2) Test the improvement measures in the market place, then assess and refine the improvement measures.
(3) Design and implement measures to ensure the sustainability of the improved supply chain of tilapia.

**METHODOLOGY**

This final report summarizes the literature review, methodology and project results. For more detail, see Jamandre et al. (2011).

**Study Areas and Coverage**

The study covered Regions III, IV and Metro Manila (*e.g.*, National Capital Region, NCR). In order to draw the major tilapia routes, at least one shipment in each of these regions, from the supply center to the ultimate end-user was traced.

Table 1 shows the total number of respondents covered, for each of the supply chains mapped. There are five chain players that perform either one process or a combination of processes depending on the degree of coordination in the chain, decomposed as follows: 5 hatchery and nursery operators, 28 farmers, 4 processors, 24 traders/consolidators/shippers and 11 institutional buyers.
Table 1. Number of respondents covered in the tilapia supply chains

<table>
<thead>
<tr>
<th>Routes of SC mapped</th>
<th>Supply Chain Players</th>
<th>Number of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicol-Laguna-Batangas-Manila-Baguio (Chain 1):</td>
<td>Hatchery and Nursery Operators</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Fish farmers</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Processors</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Traders/consolidators</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Institutional buyers</td>
<td>5</td>
</tr>
<tr>
<td>Pampanga-Pangasinan-Ilocos and Isabela - Baguio and Manila (Chain 2):</td>
<td>Hatchery and Nursery Operators</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Fish farmers</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Processors</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Traders/consolidators</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Institutional buyers</td>
<td>6</td>
</tr>
</tbody>
</table>

Data Collection and Requirements

Primary data were obtained through survey, key informant interview and focus group discussions (FGD). FGD was also conducted to validate secondary information and to answer more specific questions related to supply chain mapping. A questionnaire was designed to answer key questions, among others:

- Who are the key costumers and what are their product requirements (especially quality standards)?
- Who are the key players and what are their respective roles?
- How do product, information and money flow through the supply chain?
- What are the activities and services provided at each level in the supply chain?
- What are the critical logistics issues?
- What are the external influences?

Secondary data series on tilapia statistics was obtained from various agencies such as the Bureau of Agricultural Statistics (BAS), Bureau of Fisheries and Aquatic Resources (BFAR) and other relevant agencies of the Department of Agriculture (DA). Previous studies on the production and marketing of tilapia also served as sources of secondary information (Jamandre et al. 2010). Likewise, Central Luzon State University and other relevant institutions served as sources of secondary information. Finally, officers and staff of appropriate government agencies and other industry personalities composed the key informants’ pool.

The following primary data were collected: the key players and their respective roles activities and services provided at each level the supply chain product requirements (especially quality standards) product, information and money flows critical logistics issues (including problems in production and marketing) extension services and external influences.

Data Processing and Analysis

Table 2 presents method of analysis for each objective. Areas for improvement in the supply chain were identified and specific policy recommendations were formulated with the end in view of improving the country’s tilapia industry, through an improved supply chain management.
Table 2. Objectives and methods of analysis

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Methods of Analysis</th>
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<tbody>
<tr>
<td>(1) To provide an overview of the tilapia industry</td>
<td>Synthesis of relevant studies and trends</td>
</tr>
<tr>
<td>(2) To map out the specific supply chain for tilapia</td>
<td>Flowchart analysis from downstream to upstream</td>
</tr>
<tr>
<td>(3) Analyze the performance of the tilapia supply chain in terms of efficiency, flexibility and overall responsiveness</td>
<td>Descriptive statistics, and relevant performance metrics (both qualitative and quantitative)</td>
</tr>
<tr>
<td>(4) Identify areas for improvement in the supply chain such as behavioral, institutional and process</td>
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<tr>
<td>(5) To provide specific policy recommendations to improve the tilapia industry in general, and the specific supply chain in particular</td>
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RESULTS AND DISCUSSION

The Philippine Tilapia Industry: An Overview

In 2008, Philippines tilapia production was estimated at 299,813 MT (BAS 2009). Out of this, regions III and IV contributed about 80% while the rest of the regions shared the remaining 20%. The top 5 producing provinces (in descending order) include Pampanga (37.68%), Batangas (21.06%), Laguna (4.64%), Rizal (4.06%) and Bulacan (3.58%).

Important inputs to tilapia culture are the quality of seeds and broodstocks. With the efforts of Research and Development (R&D) agencies such as CLSU, BFAR, GIFT foundation among others, many hatchery farms were established across the country. However, despite the combined production outputs of the hatcheries the demand for fry and fingerlings exceeds supply. Many producers directly stock fry, while others adopt indirect stocking or stocking of fingerlings to limit higher mortality rates and longer culture periods associated with growout of fry (Tan et al. 2009). Those who stock fry directly utilize a higher density per m² than their counterparts. Those who stock indirectly require larger-sized fingerlings from mesh size 17-14, hence, offering opportunities for nursery operations.

Other inputs consist of capital investments such as the land, water supply system, drainage system, pump and supplies or equipment (seine net, weighing scales, tubs/buckets). Inputs also include the operating capital – fingerlings, fertilizer (chicken manure and ammonium phosphate), supplemental feeding (fry mash, fish starter, fish grower, fish finisher), labor, fuel/lubricant and electricity. Each item affects the operation of the tilapia industry particularly particularly with regard to feeds, which accounts for about 73% of the operating capital (BFAR 2010).

Marketing systems of tilapia in the Philippines is as varied as the locations of the supply sources. The traditional marketing of tilapia in some places is relatively simple. Traders normally pick up the harvested tilapia at the farms. Most tilapia farmers sell their produce to wholesaler-assemblers. Some sell their produce to retailers, consumers, and brokers. In Central Luzon, some distributors and retailers procure tilapia in pakyaw or bulk on an unsorted basis and these are hauled from the supply areas. Moreover, there are some traders that take charge in harvesting the produce and pay all the expenses during the activity. This practice is very common in the province of Pampanga (BFAR 2002). Some traders, particularly wholesalers, finance small-scale farmers in order to be assured of a steady supply of fish. Under this arrangement, the farmer is mandated to sell exclusively to the trader at a pre-agreed
price. Major marketing issues for tilapia include fluctuating prices, irregular supply, nonpayment of debts by traders, informal levies (particularly when transporting the product), and seasonal off-flavors that render the fish less marketable.

Moreover, the supermarket phenomenon and more liberalized trading environment have induced the emergence of market niches such as the fillet, smoked, dried and other processed forms. Links with these new markets and increased participation of small-scale producers requires a new approach to tilapia marketing.

**Key Customers and Product Requirements**

The tilapia chain key customers are classified into two types: the institutional buyers (hypermarkets or restaurants/specialty food shops) and the household-level/end-users or consumers.

**Product form**

Generally, household customers prefer live whole tilapia with firm meat and with the size of 4-5 pieces per kg (200 - 250 g per fish). Also, regular tilapia consumers in Manila and Southern Luzon are indifferent relative to the source and skin color of tilapia. However, consumers in the Northern Luzon markets such as Pangasinan and Baguio exhibit similar product requirements except they prefer darker-skinned tilapia because they perceive that these fish have more belly fat and are tastier. The common food recipes for tilapia are charcoal grilled, fried, boiled and “paksiw”. Most of these customers buy tilapia from fish vendors at local public markets or stalls. Regular customers in Laguna require daily volume of about 1,700 kg while Manila customers require 2,500 kg per day.

Institutional buyers such as specialty shops, hypermarkets or malls, restaurants and food chains cater to relatively affluent customers with varied product requirements. Hypermarkets normally require live whole fish with size from 3-4 pieces per kg (250 – 350 g per fish). Institutional buyers of this sort are indifferent to the source of tilapia as long as suppliers meet the fish size, volume and delivery requirements as stipulated in the marketing contract. Hypermarkets in Manila and Laguna normally require 500 – 1000 kg of tilapia per day while Pangasinan and Baguio require a daily volume of 65-70 kg.

In the case of specialty shops and food chains such as Monterey shops and SM South Mall, Central Barbeque Plaza in Paranaque and Ineng’s Barbeque shop in Global City, tilapia fillet and whole frozen fish are more preferred than whole live fish. Specialty restaurants selling fish soups, tilapia belly and deep fried tilapia skin absorb by-products of filleting. The specialty shops require consistent fillet size and volume. The total volume requirement of these institutional buyers is 1000 kg daily with a fish size of 1-2 pieces per kg (450- 600 g fish).

**Volume Requirement**

The total volume requirements of the supply chains serving major customers in Luzon averages about 5,335 kg daily or approximately 1, 947,275 kg (or ~ 1,947.28 MT) annually. With the per capita consumption of around 3.81 kg (or ~ 323,850 MT), these chains could barely meet 1% of the consumption requirement of the country.

**Major Players and Their Activities**

The major players and their activities are highlighted in Figure 1. Hatchery and nursery operators supply fries and fingerlings as well as provide technical guidance to fish producer-customers. Both operators are closely linked and coordinated with each other. The hatchery handles about 3,000 breeders (Genomar crossed with IDRC strain) that produce 1.5 million sex-reversed fries every 18 days. The hatchery farms are located in Ligao City, Camarines Sur, which is around 600 km south of the nursery.
operator in Cabuyao, Laguna. Due to the travel distance, 33 plastic bags (i.e. imported from Taiwan) with no bottom corners, each containing 400,000 fries are used to reduce stress and minimize fry mortality while being transported in 4 rented trucks each with 6-ton capacity. Oftentimes, the hatchery operators pay “goodwill fees” to traffic enforcers on top of the regular toll fees charged by the superhighways in Manila. The operators also maintain nursery ponds to serve other farmer-customers requiring bigger fingerlings in nearby towns of Buhi, Baaao and Bato, Camarines Sur. These customers usually also require 400,000 fry every 18 days. Normally, the hatchery operators charge P0.05 higher than other competitors in the area because fry are already sex-reversed. Upon reaching Laguna, delivered fry are immediately unloaded to the conditioning pond for acclimatization. The nursery operators manage and maintain the fry until reaching marketable sizes of 14 and 12 as ordered by regular producer-customers (chain members) in Laguna and Batangas. Normally fry are maintained for 1 month and then it takes an additional 3-4 weeks to reach size 14 for sex-reversed fingerlings. Otherwise it takes 1 and 1½ months for non-sex reversed fish. The nursery ponds handle various tilapia strains since the regular customers tend to try other strains in their operations. Usually, the nursery operators deliver fingerlings 4 times per week to their regular customers. Also, the sizes of fingerlings delivered vary with “season” i.e. smaller size (22-20) during on-season months (May, June, July, August) while 14-12 on off-season (September, October, November, December). Finally, the nursery operator prefers tilapia nilotica as a better species compared with other tilapias.

The fish producers are the main “production centers” of the tilapia chain whose focus is to produce marketable tilapia for distribution through traders for end-users or consumers and processors for institutional buyers. The regular producer-customers usually take 2.5 – 3 months to grow their fishes to reach marketable size of 4-5 pieces per kg and about 3.5-4.5 months to reach 2-3 pieces per kg. Fish producers (chain-members) are aware of the product, volume and delivery requirements of their trader-customers. To reach markets in the Northern Luzon which prefer darker colored skin tilapia, fish producers grow the tilapia first in Laguna under semi-extensive feeding regime, say 2-3 months, then transfer the fish to Taal Lake in Batangas for conditioning, say in 3 weeks before harvest – a kind of “circuitous” production technique. Most fish producers do not have delivery trucks and facilities for cold

Figure 1. Major Players and their Activities
storage. Thus, they have to wait for their customers to haul their fish harvests from the farm site. Other producers (non-chain member) in Laguna and Batangas persist to stock non-sex reversed fingerlings since it is cheaper and it performs at par with sex-reversed counterparts as they claim, although it takes a longer time to reach equivalent weights or sizes to that of sex-reversed fingerlings. Hence, these producers are losing more in terms of low fish recovery of about 18-20% in Laguna Lake and 25-30% in Taal Lake. Additionally use of non sex-reversed fingerling results in higher feed costs. Occasionally, customers of non-chain members complain about the off-flavor taste of their tilapia. Accordingly, farmers’ knowledge on preventing repeat of such incidents is fairly limited.

Traders generally subsume the terms consolidators/wholesalers/retailers and brokers or agents a.k.a. consignacion since they are all engaged in the buying, selling and distribution of tilapia from sources to various destinations depending on which market level they operate. The consolidators are the big traders who regularly supply supermarkets and bulk buyers in major fish terminal markets (or transshipment points). At the terminal markets, the “consignacion” facilitate the transactions between the traders (shippers or viajeros) and bulk buyers (provincial traders) for a “commission fee”. Since they own a stall at the terminal market, they also act as gatekeepers of the traders and are key players in the price discovery process, thus, they also perform price monitoring and occasional small-scale trading. The wholesalers are themselves shippers or viajeros who buy tilapia from the terminal markets in bulk and ship them to other bulk buyers serving other geographical markets. Strategically, some wholesalers resort to backward integration by producing their own tilapia and contracting other farmers to meet market commitments and reduce supply risks. The retailers are the smallest traders in the market chain that finally cater to the end-users. They own stalls at public markets and small delivery vehicles such as tricycles and owner jeeps with aerators. Their sales volumes depend on the deliveries by local traders. Since they compete with many retailers, they handle about 100-150 kg of live fish (with average size of 5-6 pieces per kg) for easier disposal and to minimize unsold products for each transaction day.

Processors are those who regularly supply the specific product forms such as the fillet, cubes, whole frozen and choice portions or trimmings for institutional buyers (supermarket, specialty food shop, food chain, bar and restaurants, canteens, among others). One big processor, known as Fishda Enterprises, had been operating and registered in 1995. This processor has been incorporated and now named as Unavis. Its operation is accredited by Department of Food and Drugs. Product forms, volumes and deliveries depend on the arrangements with the various customers. Presently, the customers include Monterey specialty shops, SM Southmall, Metro Bank canteens, Central Barbeque Plaza in Parañaque, Ineng’s Barbeque at Global city, Setton Golf Club, etc. To maintain its customers, the processor ensures that raw materials meet the size, volume and meat quality requirements needed for processing. The processing plant has 1.5 - 2 ton capacity (processing-in -demand) with 6 – ton cold storage capacity of filleted tilapia. The plant maintains a safety stock level of 5 tons. The filleting process for a per kilogram raw tilapia (2-3 pieces per kg) yields the following: 30-35% fillet, 18% belly, 25% innards, 21% head and 1% skin. Because the cost of filleting is about P35 per pack (1 pack = 300 grams), cost recovery is taken from the sales of the by-products. The processor could not raise the price of tilapia fillet due to cheaper import alternatives like the pangasius and dowry fillets. To increase the shelf-life and maintain quality of products, quick or blast freezing is necessary. Increasing the present capacity of cold storage and blast freezers entails additional costs, which is unaffordable at the moment. Finally, only few tilapia producers can meet and assure volume, size and quality of raw materials, thus, the processor cannot expand market coverage. Many orders and inquiries from potential high-end customers including Philippine Airlines, Cathay Pacific, five star hotels and restaurants, etc. are not met.

Major Routes of Products
Figure 2 shows the tilapia supply chain’s major routes in Luzon. The cities of Malabon in Manila, Angeles in Pampanga and Dagupan are the major transshipment points of tilapia in Luzon. Cities in Metro Manila, Angeles and Baguio, La Union and Ilocos provinces, Isabela and Cagayan Valley
provinces and the Cordillera Administrative Region, are the major demand centers. Pampanga, Batangas and Laguna provinces are the major production centers while Pampanga, Laguna and Camarines Sur possess the major hatcheries.

Figure 2. Major Routes of Products

The geographical locations of the major routes are mapped in Figure 3. There are two major routes traced namely: (1) Laguna/Batangas – Manila/Baguio; (2) Pampanga – Pangasinan/Baguio. These routes normally take from 1 to 3 days to distribute from source to final destination points. The time period used to assemble the required volume of tilapia with consistent size is the bottle neck for meeting the entire delivery schedule.

Figure 3. Major routes of the Tilapia Supply Chain
Figure 4 describes the product flow of route 1. Eighteen-day old tilapia fry from Camarines Sur hatchery are brought to the nursery operators in Cabuyao, Laguna for conditioning and growth for about 45 days to reach fingerling size of 14-12. The fish are then be delivered to grow-out operators in Laguna and Batangas for 2-3 months before harvest. Fish sizes range from 4-5, 3-4 and 2-3 pieces per kg. Small fishes are sold to local markets in Los Baños and Pila, Laguna. The larger fishes are delivered to supermarkets in Calamba and Sta. Cruz, Laguna. Largest fishes are delivered to the processors in Los Baños, Laguna and Parañaque. Fishes intended for the Northern Luzon supermarkets such as Rosales, Pangasinan and Baguio City are transferred and conditioned in Taal Lake for a period of 3-4 weeks to ensure that fishes have dark-colored skin before marketing.

In the case of Batangas, fries with size 22-20 from Calauan, Laguna hatcheries are brought to grow-out operators in Tanauan, Talisay and other towns along the Taal lake. Large fish producers (with 500 cages) within the supply chain in Batangas usually stock 200 fish/m³. Their fish recovery in Taal lake ranges from 25%-30%. Furthermore, their feed conversion ratio (FCR) on the average is 1.5:1 while Laguna producers show even lower FCR. After 6-8 months culture period, marketable tilapias are picked up by wholesalers and brought to Malabon, in Manila, being the major transshipment point for seafood that caters to markets in Metro Manila and the rest of Luzon. Smaller traders and other provincial traders both procure their fishes from wholesalers through a consignacion in Malabon market. Fishes are then packed in iceboxes for distribution to supermarkets and far-flung markets.

The flow of products in route 2 is shown in Figure 5. Pampanga fish producers usually obtain their fry from nearby hatcheries and stock them directly in their grow-out ponds. After a 6-8 month culture period, tilapia are harvested using mesh nets since pond sizes range from 2-12 hectares. Some larger farms have about 25-100 hectares surface areas. Most farmers do not have trucks equipped with tanks and aerators, thus, they have to wait for traders through an agent to pick up their harvest and bring the fish to the terminal market in Pampanga, Angeles City as the major transshipment point of Pampanga.
Wholesalers and local traders including consolidators source their live tilapia at this market. Wholesalers bring their tilapia to the consignacion market in Dagupan City, Pangasinan serving as transshipment point for the rest of the Northern Luzon markets. Fishes usually reach this market alive, which is preferred by most, if not all, customers. However, once passed on to other provincial traders whose markets are farther, fishes must be stacked with ice to retain freshness upon reaching destination points. Normally it takes around 1-2 days to reach some markets in Ilocos and Isabela provinces together with Cagayan Valley and Cordillera Administrative regions.

**Payment Flow**

In general, payments are made on spot cash and cash-on-delivery (COD) between the local consumers and retailers; wholesaler and trader/consolidators; processor and producers; small-scale traders and producers. However, bank payments through 7 day post-dated checks are made among hatchery/nursery operators and producers; supermarket and processors/traders or consolidators (Figure 6).

Only the specialty shops make advanced payments to the processor for about 1-2 days before product delivery, as stipulated in a contract. On the other, the traders/consolidators who loan out feeds to producers and provide trading capital to small-scale traders adopt a different payment arrangement. The small scale-traders check on the exact harvesting dates of the farmer-borrowers. Upon harvest, these traders weight, transport and consign the tilapia harvest to the local retailers at an agreed price. After each transaction day, the retailers remit the net sales proceeds to the small-scale traders who in turn remit the same plus the trading capital equivalent to the fish volume purchases from the producer-borrowers to the trader/consolidator. After deducting the cost of feeds, the trader pays the producers the net sales value of their tilapia.
Information Flow

Figure 7 shows the flow of information among the supply chain members. Information exchange between and among the chain members and the mode of contact are done through face-to-face and mobile or telephones which are concluded in a short period of time. The price, sources, quality, availability and delivery schedules of tilapia are the major information required by the chain members. Farm gate prices are lower and more unstable than those in the wholesale and retail levels. Such behavior is prevalent because institutional buyers are slow to react with price changes. Additionally, the processor maintains a price level of two years ago for fear of losing customers with or without contracts. Retail prices tend to be sticky upwards but faster to adjust downwards.

External Influences

(1) Production and market support programs of the government

Recognizing the importance of tilapia to address poverty alleviation and development of the country side, the government has embarked on a tilapia upgrading program through genetic improvement projects espoused by CLSU, GIFT, BFAR and other international R&D agencies. This program had effected the participation and entry of many tilapia industry players. Additionally, the establishment of hatcheries and dispersal programs of BFAR had facilitated the extension of broodstock quality improvement of tilapia into the countryside. Likewise, training and capacity-building among tilapia farmers has been implemented. The training includes improved technologies in management, nutrition and health aspects of tilapia culture. The continuing improvement of broodstock and dispersal program will help foster the growth of the industry. On the other, the market support program of the government of the Philippines (GOP) is limited to market matching and participation in aqua fairs.
(2) Food safety through permits and accreditation

In preparation for globalization, BFAR has instituted an accreditation protocol for quality assurance of meeting export standards. However, many found it to be very rigid which restricts the potential exporters to qualify. Unfortunately, fish imports continually flood the domestic market which dampens further the competitiveness of the local industry.

(3) Presence of “rent-seeking” behavior of law enforcers

In addition to the toll fees in superhighways paid by traders or viajeros including hatchery operators, unreceipted fees are charged that serve as goodwill to rent-seeking law enforcers at check points. Such expense is usually passed on to the final consumer.

Issues and Concerns

The major concerns of hatcheries and nurseries are high cost of outbound logistics, which is exacerbated by high competitive pressures of inferior quality but inexpensive stocks (e.g., non-sex reversed) and high levels of mortality due to environmental and cultural factors.

Fish farmer concerns involve a broad array of production, processing and marketing constraints. Feeds and other inputs are often expensive but low quality (at times mislabeled) and there is very low fish recovery of about 25% in lakes’ cages or pens and about 60% in ponds system. In addition, the more pronounced fluctuations in climate pattern has induced more variability in production volume hence, overstocking became a “recouping mechanism” among fish growers. Contrary to research and extension trials and demonstrations, grow-out period for farmers often are much higher – ranging from 6-8 months to reach a marketable size of 250-400 grams per fish across production systems. Their transaction costs include the cost of waiting for buyers, delays in delivery, in-transit mortality, and “goodwill” or toll fees.
as well as shrinkage losses. In addition, the lack of cold storage and transport vehicles equipped with tanks and aerators or refrigeration facilities delimits farmers to take market opportunities in terms of value-adding and processing activities. Interestingly, due to the high consumers’ preference on “darker tilapia”, many farmers adopt a “circuitous” production technique, that is, fry from the hatcheries for example in Bicol (pond based) are transferred to nursery ponds in Cabuyao, Laguna then moved and raised in a semi-intensive grow-out environments in Laguna Lake and finally transferred and conditioned as “dark tilapia” within 3 weeks in another place like Taal, Batangas to take advantage of such marketing premium. This apparently inefficient production scheme is rational if consumers provide a sufficient price premium.

The major concerns of processors are too few farms that could regularly supply the desired quality and volume of tilapia at each process-in-demand period. Likewise, there is a lack of blast freezers to maintain higher quality products while maintaining longer shelf-life of products and other derivatives. In addition, due to high cost of filleting and low dressing recovery, processors are at a disadvantage in competing with the influx of cheaper imported alternative fillets like pangasius, sea bass and others, saved by the revenues derived from by-products such as heads, bellies and skin. Demand for choice portions and trimmings by high-end institutional buyers like Philippine Airlines and Cathay Pacific remain untapped. Also, tilapia nuggets and fingers are test markets that have not been met, yet show bright prospects.

The concerns of traders (“consignacion”, suppliers or consolidators) are: (a) regularly meeting the quantity and delivery schedules of their customers is undermined by their defaulting “contract tilapia farmers” (b) high logistics and transaction costs of searching, locating, assembling and distributing fishes from sources to destinations (c) lag responses in unexpected price movements and the absence of product grades and standards contribute to the difficulty of maintaining a “profitable” volume of operation.

RECOMMENDATIONS
Specific improvement measures have been designed, refined and implemented based on this market supply chain analysis (Phase 2). Improved sustainability and efficiency have been achieved through many of the programs outlined in the previous section and continued improvements recommended as a result of this study that address the issues and concerns of the supply chain participants include: (1) encourage the establishment of more nursery farms and better quality broodstock while intensifying technology transfer to farmers for better health and management of tilapia, (2) conduct market promotion activities highlighting the various niche opportunities of tilapia among growers and consumers, (3) motivate the participation of small farmers in supply chains by setting up an incentive scheme through a mix of patronage refund and profit sharing, (4) institutionalize an accreditation program for feed manufacturers, hatcheries, processors and the like to improve the quality assurance of products and services, and (5) provide capital windows to improve facilities and reduce logistics and transaction costs in the entire supply chains of tilapia.

The results of the supply chain analyses was presented to Philippine government officials of the Bureau of Fisheries and Aquatic Resources as well as to producers, manufacturers, other industry representatives and to the academic research and extension community through a workshop held at CLSU entitled “Tilapia Feeds and Feeding Strategies: Meeting Global Challenges”. Findings were also disseminated through presentations at the 9th Asian Fisheries and Aquaculture Forum - 9th International Symposium on Tilapia Aquaculture (Shanghai, China) and at the 23rd Agency In-house Review of Completed and On-going Research and Development Projects at CLSU.

LITERATURE


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