

TOPIC AREA:
MARKETING, ECONOMIC RISK ASSESSMENT & TRADE



ASSESSMENT OF TILAPIA VALUE CHAIN IN GHANA

Marketing, Economic Risk Assessment & Trade/Study/09MER07PU

FINAL INVESTIGATION REPORT

Kwamena Quagraine and Jennifer Dennis
Purdue University
West Lafayette, Indiana, USA

Steve Amisah and Gifty Anane-Taabeah
Kwame Nkrumah University of Science & Technology
Kumasi, Ghana

ABSTRACT

The performance of farmed tilapia value chain in Ghana can be used to achieve sustainable food production and poverty alleviation through improvements in market access and competitiveness. The study was conducted to assess the value chain of farmed tilapia in Ghana; specifically, characterize the current farmed tilapia value chain, analyze the performance, identify areas of improvement, and provide recommendations for strategic improvement of the value chain. Data was collected from a survey conducted in 2012. Key actors in the tilapia value chain in Ghana were identified, and information was obtained on their activities and roles, the flow of products and information, costs and margins, and external influences. The key chain actors identified were input suppliers (brood stock developers and hatcheries, feed suppliers, pond and cage constructors, and net suppliers); producers (pond and cage grow-out farmers); processors; marketers (distributors and retailers); and food services (restaurants, food vendors, etc.). A Benefit-Cost Analysis was used to assess the performance of input suppliers, fish farmers, marketers, and food services. The results revealed that all chain participants had a benefit-cost ratio higher than 1 except fish farmers, suggesting that fish farming is less profitable compared with the other value chain activities. Input suppliers appeared to make the most profit. The study also used Factor Evaluation Matrix to compare the competitiveness of the different value chain participants in terms of the traditional five marketing factors, i.e., product, place, price, promotion and procurement (process). Input suppliers also had the highest self-evaluation performance in terms of Porters' 5 forces framework and had the strongest sector in the value chain. The success of input suppliers in the value chain may be attributed to their efficiency in terms of having well defined payment transactions with customers, having persistent relationships with customers, and keeping good records of costs and revenues. Other chain actors could form strong persistent linkages among themselves to improve the relationships among actors and ensure efficiency in the value chain. Fish farmers could also prioritize record keeping of costs and revenues to enable them to track their performance in terms of profit margins. To ensure quality products and services are supplied along the chain, the Fisheries Directorate of Ghana should consider setting and enforcing quality standards along the chain, especially for hatcheries and processors.

INTRODUCTION

Aquaculture production has the potential to contribute to alleviating hunger and poverty in Sub-Saharan Africa (Kaliba et al., 2007). Ghana has made tremendous improvements in the aquaculture industry with

large commercial production of tilapia (*Oreochromis niloticus*) from cage culture and the traditional earthen pond culture. The aquaculture industry in Ghana has therefore demonstrated improvements in competitiveness, producing tilapia species that feed low on the food chain in well adapted, environmentally friendly, and profitable farming systems.

The performance of tilapia value chain in Ghana can be used to achieve sustainable food production and poverty alleviation through improvements in market access and competitiveness. For example, smallholder fish farmers through linkages among the different stakeholders such as the input suppliers, processors, traders, and other retailers can manage the flow of goods and services to enhance their economic wellbeing (Christiaensen et al. 2011). Proper linkages could result in increased productivity and efficiency and provide access to new markets. Value-chain linkages improve information flow and learning capacities and also help to reduce transaction costs (Trienekens, 2011). Improved value chain increases productivity in terms of value and profitability, which in turn could generate increased incomes in a sustainable manner. Value chain collaboration then becomes very important for smallholder producers in developing countries to ensure access to new and profitable markets.

The objectives of this study are to:

1. Characterize current tilapia value chain in Ghana
2. Analyze tilapia value chain performance in terms of cost-benefits comparisons
3. Identify areas for improvement in value chain
4. Provide recommendations for strategic improvements and long term sustainability

Study Areas

Data from previous studies in Ghana show that aquaculture is concentrated in five major regions: Ashanti, Brong Ahafo, Western, Eastern, and Volta regions (Anane-Taabeah, 2012). Cage aquaculture is predominant in the Eastern and Volta regions, whereas the other three regions are predominantly pond-based aquaculture. This study therefore covers these five regions to provide an overview of the farmed tilapia value chain in Ghana.

Data Collection

Secondary data collection

Secondary data from the Department of Fisheries and Watershed Management, KNUST, and interaction with relevant stakeholders revealed that the farmed tilapia value chain involved five key chain actors: those who supplied inputs such as fingerlings and feed to farmers; fish farmers; processors; traders; and food services. Information was also obtained about the major market centers for farmed tilapia, as well as contacts and locations of other key value chain actors in Ghana.

Primary data collection

The primary data was collected in two phases using surveys. The first stage involved surveying fish farmers from the Ashanti, Brong Ahafo, and Western regions who participated in a national workshop on pond aquaculture best management practices. The second stage involved surveying cage farmers in the Eastern and Volta regions, and the other key actors in the value chain, including input suppliers, fish marketers, and food services.

Questionnaire design

Five survey questionnaires were designed for the actors identified as key players in the tilapia value chain in Ghana. The questionnaires were previously developed for a similar study in Kenya involving women in aquaculture. The first few questionnaires administered for each group were pretested with a small sample

of actors. Their responses were then used to modify the final versions of the survey instruments accordingly. The questionnaires were designed to obtain the following information:

1. Key players and their major activities
2. Major routes of products
3. Information flow
4. Payment flow
5. Value chain performance using Cost Benefit Analysis, SWOT analysis and other metrics

Data and Information Analysis

Flow chart analysis and supply chain maps were used to characterize the farmed tilapia value chain in terms of the key players and their major activities, product flow, information flow, and payment flow. Descriptive statistics, and qualitative and quantitative analyses were used to assess the performance of the value chain.

Characterization Of The Farmed Tilapia Value Chain In Ghana

Key players and their activities

A Value Chain Analysis (VCA) map plots the flow of goods and services in the chain to illustrate how behavior plays a role in success (Kaplinsky & Morris, 2000). The maps provide information on specific activities and services at each stage of the chain, key players, flow of product and information, nature of transactions among stages of the chain/actors, and other external influences to the chain performance (Humphrey, 2005; Jamandre et al., 2011).

The key chain actors identified in the farmed tilapia value chain in Ghana were input suppliers; producers; processors; traders and food services. The total number of respondents surveyed in the study is presented in Table 1. The key chain actors and a summary of their major activities are presented in Figure 1.

Table 1. Number of survey respondents in the tilapia value chain.

Key players	Number of respondents
Input suppliers	19
Producers	93
Processors ¹	2
Wholesalers/distributors ²	5
Retailers ²	53
Food services ²	46

¹ The processors surveyed were members of a particular group but they provided responses representative of the activities of other groups.

² Of the number presented for retailers, 6 traded only farmed tilapia, whereas 47 traded both farmed and wild tilapia, and 2 did not know the origin of the fish. For the food services, 29 purchased only farmed tilapia, and 17 purchased both farmed and wild tilapia.

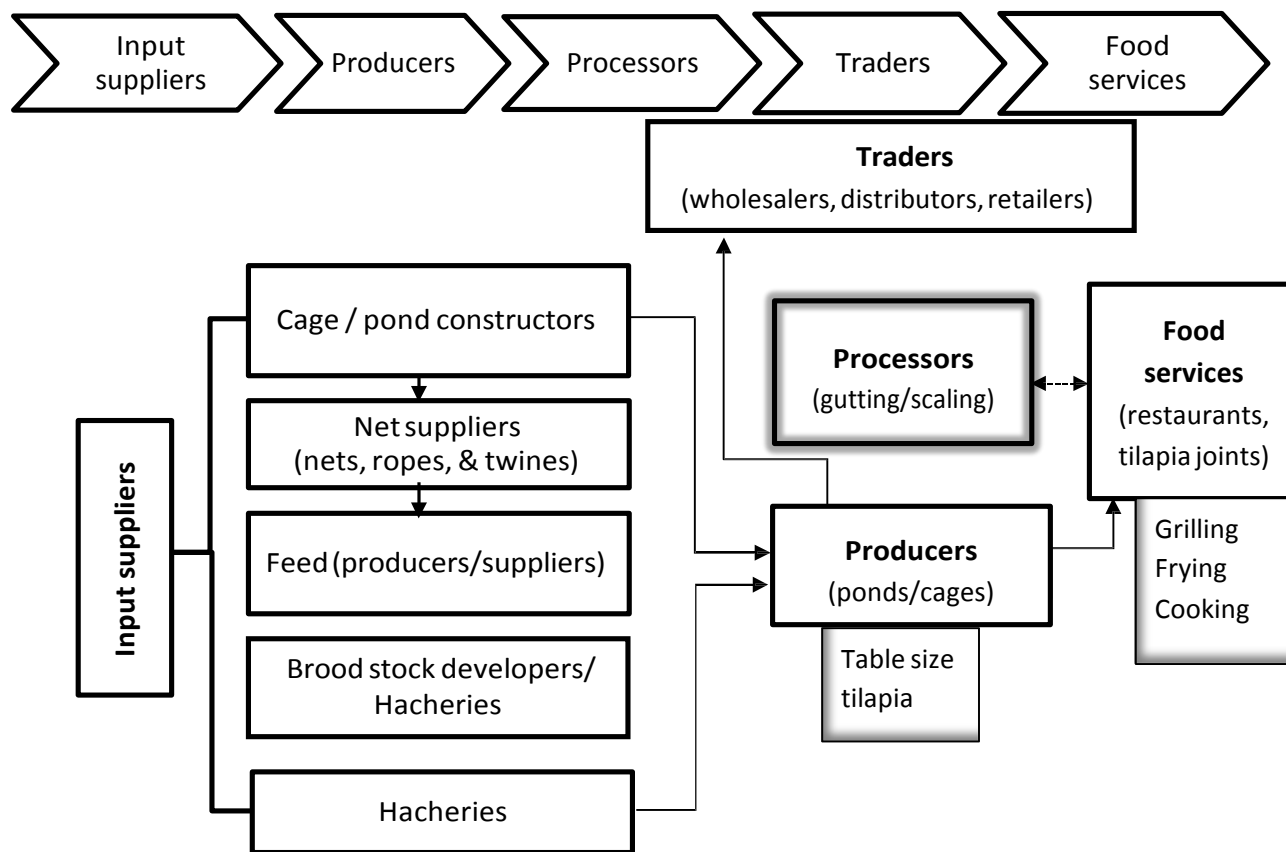


Figure 1. Key players and their major activities.

Input suppliers

The input suppliers consist of brood stock developers (who also sell fingerlings), fingerlings producers (hatcheries), feed producers/suppliers, pond and cage constructors, and net suppliers. Input suppliers market their products and services mostly through delivery and/or wholesale and retail outlets. Apart from the net suppliers whose primary target market are fishermen, fish farmers are the primary target markets for all the input suppliers. With the exception of the brood stock developers and hatcheries, which are a mixture of government and private businesses, all other input suppliers are private individuals and organizations. The majority of the feed producers and suppliers are relatively newer to the aquaculture business compared to the other input suppliers. Over 85% of the feed suppliers started their business within the last couple of years. The input suppliers are optimally located in four regions: Ashanti, Brong Ahafo, Eastern, and Greater Accra regions, close to where major aquaculture operations are situated.

The pond and cage construction business is composed of individual businesses as well as group or cooperate businesses. The pond constructors have been in the business longer than cage constructors, which is expected considering that cage aquaculture is relatively new in Ghana compared to earthen pond aquaculture. For a pond of about 300m², it takes a single individual about 1 month to complete a manual construction. Mechanical excavators can reportedly do the same job in a relatively shorter time. For cages, it takes about 3 weeks for an individual to construct a 25m² fish cage. Both pond and cage constructors were located close to ‘hot’ spots of aquaculture. The pond constructors identified in this study are located in the Ashanti, Brong Ahafo, and Western regions, even though we were only able to survey those in the Ashanti and Brong Ahafo regions. The cage constructors were located in the Eastern region, specifically, in the Asuogyaman district, where majority of cage farming operations are situated.

Commercial net supply to fish farmers is still a burgeoning business depending heavily on the development of cage aquaculture, since most earthen pond farmers use few nets. Net suppliers retail imported products such as nets, ropes, and twine mostly from Korea and Vietnam.

Only one feed supplier produces fish feed locally. All other suppliers import fish feed mainly from Brazil, Netherlands, and United States. The fish feed suppliers provide feed suitable for use by brood stock developers, hatcheries, and fish producers.

Both the brood stock developers and the hatcheries provide aquaculture training and general technical advice to farmers and the public. Depending on the nature of training and duration, these services could be free or attract fees. Some large scale fish producers develop brood stock and produce fingerlings but only for their own use. Only one commercial brood stock developer was encountered during the study, who also supplied fingerlings to farmers. The majority of the hatcheries produce and supply sex-reversed tilapia fingerlings of about 5g to farmers. However, the supply of 2g fingerlings, especially to cage fish producers, is common since demand is high and it takes about 7 to 8 weeks to obtain 5g of sex-reversed fingerlings. Typically, farmers have to place orders for fingerlings, and depending on the size of orders, it can take weeks to have their orders fulfilled. Since the major brood stock developer is responsible for producing and supplying the improved 'Akosombo' strain of the Nile tilapia to hatcheries across the country, it can be assumed that the 'Akosombo' strain of the Nile tilapia is the major strain cultured in Ghana.

Producers

Two primary categories of producers were identified; pond and cage grow-out farmers. However, a few cage farmers also operate ponds. Cage farmers produce only tilapia, whereas some pond farmers culture additional species such as *Clarias sp*, *Heterotis niloticus*, and *Parachanna obscura*.

Cage farmers are characterized by intensive production and may be grouped into small scale (< 10 cages), medium scale (10 to 50 cages), and large scale (> 50 cages) operations. Pond and cage grow-out farmers focus on producing table size tilapia for sale to traders, food service providers, and final consumers. Some grow-out tilapia producers also double as hatcheries, marketing fingerlings to fellow grow-out farmers. It usually takes cage farmers about 6 months to grow fish to obtain 2-3 pieces of fish per kg. However, pond farmers may obtain 4-5 pieces per kg for the same period of time. The difference in productivity can be attributed to a number of factors. Cage farmers grow sex-reversed fingerlings and though 100% all male fingerlings are presently not attained in Ghana, the cage environment does not support prolific breeding of tilapia. Conversely, pond farmers use both mixed and sex-reversed tilapia and have problems such as overpopulation and reduced growth in their ponds. Whereas cage farmers use high quality commercial fish feed, only a limited number of pond farmers consistently use commercial feed because of capital constraints. Cage farmers have relatively shorter and specialized marketing channels compared to pond farmers. Ninety-five percent of the cage farmers surveyed sold their fish exclusively at the farm gate and mostly to retailers, whereas many pond farmers have varying customer types and only about 31% sold exclusively at the farm. Thus, cage farmers may have higher efficiency than pond farmers because of the reduced transaction cost in their marketing.

Processors

Farmed tilapia is mostly marketed fresh compared to wild tilapia, which may be smoked, dried, or salted. There appears to be no demand for live fish in Ghana. Thus, processors of farmed fish, who are predominantly women, are engaged mainly in gutting and scaling of the fish. The processors are central to the value chain because, apart from the input supplies, they interact with all key actors in the value chain. Even though they do not purchase the fish themselves, they provide ready services to traders, food service providers, and consumers at the point of sale of the fish. Gutting is usually done on the farm for a fee. Scaling may be done together with gutting if the buyers are food service providers or consumers.

Otherwise, the service is usually offered at distribution points or sales outlets. These processors may be local residents around farms and sales outlets or may commute to such places to offer their services. They are mostly individuals accountable to themselves but may work in a group. A group of 10 female processors is not uncommon and one can observe up to 4 of such groups at Galilea market, a busy tilapia (both wild and farmed) sales outlet close to Kasoa in the Central Region.

Traders

Marketing of farmed tilapia occurs through three key traders: wholesalers (who may also retail), distributors, and retailers. Wholesalers buy large quantities of fish. Some tilapia producers also wholesale their fish at sales points. Wholesalers sell at a designated location in owned or rented stores. Typical wholesalers supply fish to both distributors and retailers, and are usually the traders who deal directly with the farmers. Distributors typically sell smaller quantities of tilapia compared to wholesalers and usually deliver to retailers, sell at cold stores, or deliver to restaurants. Retailers trade in small quantities of tilapia and usually sell in the community markets directly to consumers. Retailers sell in stalls (owned or rented), on table tops, or in pans. Some retailers also hawk their wares as a means of increasing sales. The main value addition performed by all the traders is packaging and facilitation of product movement from supply centers to demand centers. However, retailers also scale fish free of charge to customers as a strategy to increase sales. Customers may also obtain limited free ice from wholesalers, distributors, or retailers to preserve their fish.

Foods services

Food services identified were restaurants, tilapia ‘joint’ operators, and ‘chop bar’ operators. A supermarket was identified that traded in both frozen and processed (grilled) farmed tilapia, but they were not available for the survey.

Restaurants are either standalone entities or within hotels. Most restaurants perform a variety of value addition activities including cleaning, dressing, and seasoning. All the restaurants surveyed had grilled tilapia and ‘banku’ on their menus, while some also had boiled tilapia served in soup. The restaurants are noted for requiring large size tilapia (400g and above) because of their customer base. Consequently, cage farmers tend to have an advantage when their target market is restaurants compared to pond farmers.

The tilapia ‘joint’ operators are the individuals or groups that specialize in grilling tilapia. The grilled tilapia is usually sold with ‘banku’ and has a reputation of being a luxury meal for the middle income group. Tilapia ‘joints’ may be found at roadsides of busy towns and operate typically between 1600hrs and 2300hrs. Tilapia ‘joints’ are increasingly being situated near pubs and drinking bars to take advantage of the customers that frequent there.

Compared to restaurants and tilapia ‘joints,’ ‘chop bars’ are affordable eating places where one can purchase cheap tilapia. Most ‘chop bars’ are noted for their wide range of local Ghanaian dishes. Thus, most ‘chop bar’ operators tend to boil or steam tilapia in contrast to grilled tilapia.

Product flow

The major supply centers for inputs in the value chain are the Ashanti, Brong Ahafo, Eastern, and Greater Accra regions. The inputs are supplied across the entire country to producers but fish production activities are concentrated within the Western, Brong Ahafo, Ashanti, Eastern, and Volta regions. The majority of the marketable fish produced in the Western, Brong Ahafo, and Ashanti regions are consumed within these regions. Since these regions are predominantly pond-based aquaculture, it is possible that the quantity of fish produced is not enough to allow export outside these regions.

In the Eastern and Volta regions, where cage aquaculture has a strong presence, production volumes are significantly higher than the other major supply centers. Within the Eastern region, the town of

Akosombo is a major demand center. Other demand centers in the Eastern region include Akuse and Asutsuare. Interestingly, the bulk of fish produced within the Eastern and Volta regions are sold outside of those regions. This is because some farmers have wholesale and distribution points within the Greater Accra region where demand for ‘banku’ and tilapia is relatively high. Specifically, Accra, Tema, and Ashaiman, which are major metropolitan areas, are the major demand centers within the Greater Accra region. Kasoa in the Central region is another important demand center for fish from the Eastern and Volta regions. The presence of a vibrant market for fresh tilapia at Kasoa has attracted farmers and wholesalers alike to this demand center where distributors, retailers, and consumers converge to transact business. Figure 2 shows the major supply and demand centers of products in the value chain.

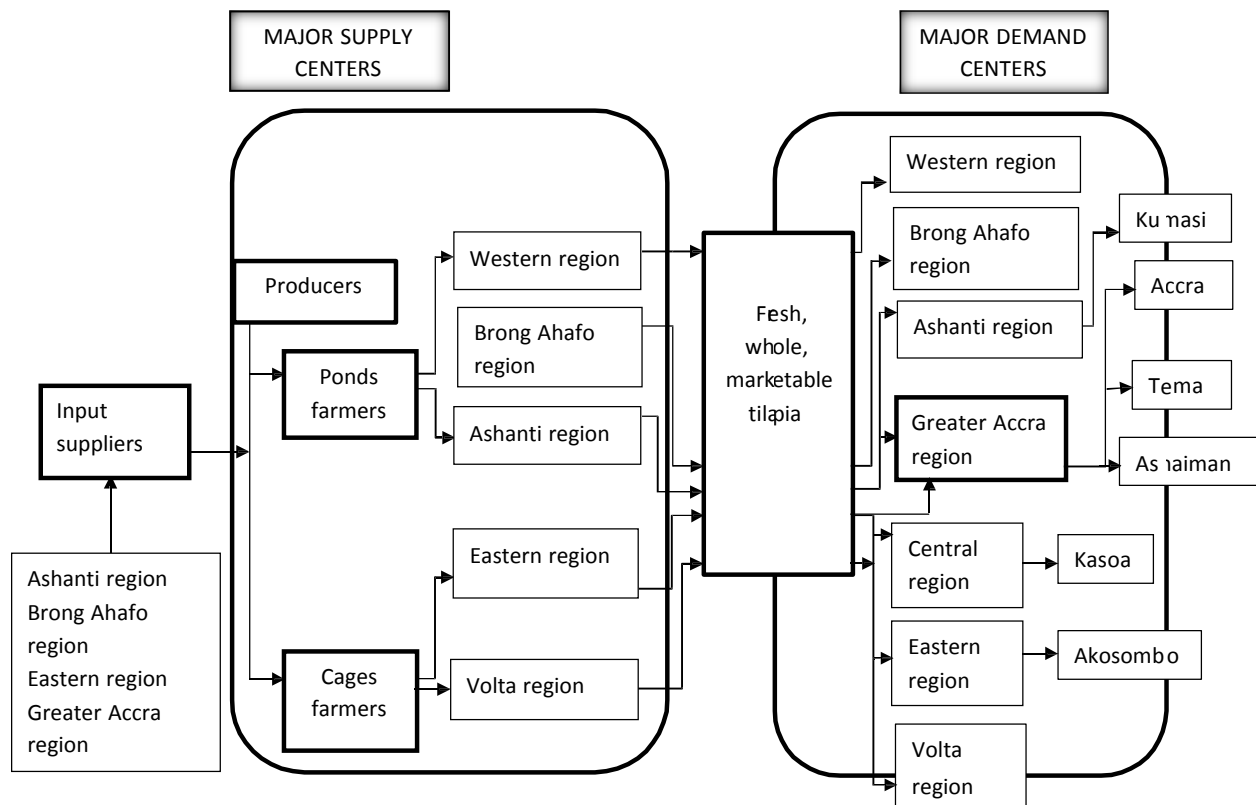


Figure 2. Major routes of the tilapia value chain.

Payment flow

Payment for products and services along the value chain is mostly cash and carry or cash in advance of service. Payment flexibility such as buying on credit for a few days and doing business on contractual basis exists among a few chain actors that have well defined trust relationships. Figure 3 shows the major payments transaction modes existing among chain actors.

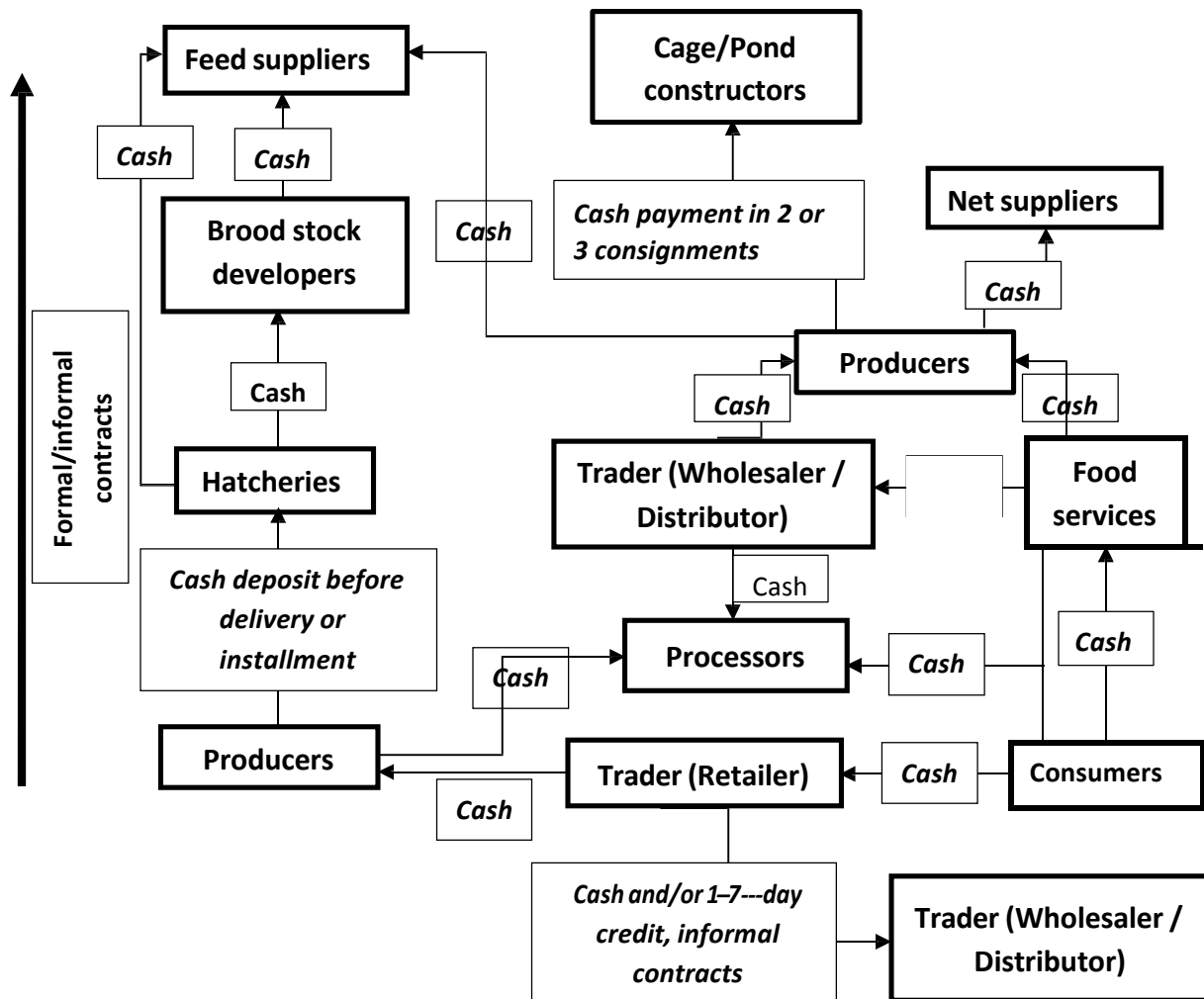


Figure 3. Payment transactions in the tilapia value chain.

Information flow

Figure 4 provides a description of information flow among the key actors in the tilapia value chain. Face-to-face interaction and mobile phone use are the primary means of communication between key actors in the value chain. The major information required by key actors is prices, quality, sizes, availability, and sources.

Prices of inputs are generally unstable due to the fluctuations of the local currency to the American dollar. In recent months where the cedi has seen constant depreciation, producers had to contend with high prices of imported feeds. However, unlike traders, the majority of whom use cost plus to determine their prices, farmers face the unpleasant situation of maintaining marginal profits.

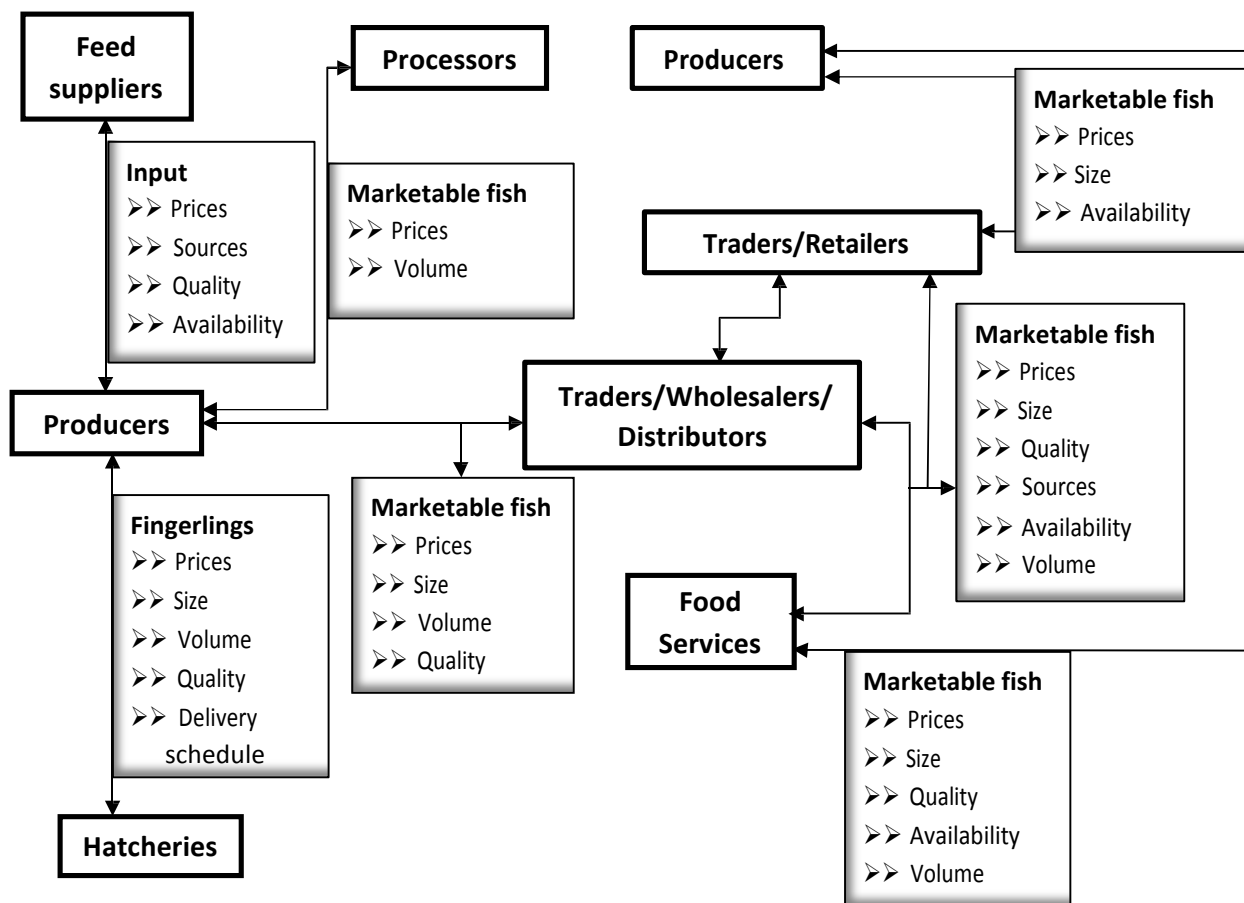


Figure 4. Information flow among the key actors in the tilapia value chain.

Quality of inputs such as feed and fingerlings are essential to produce quality marketable fish. Feed is the single most expensive input and suppliers have to ensure that quality feed is available to farmers for the production of marketable-size fish. Quality feed helps fish to attain market sizes in the shortest possible time. For traders, the ability to convince customers of the freshness and quality is central to their sale success.

Size requirements are important to everyone in the value chain. For instance, feed sellers supply feed of specific sizes for different stages in the growth of the fish and must ensure that the required sizes are available. For the producers, the appropriate fingerling sizes would determine the production duration and wellbeing of the fish. With increasing demand for fingerlings, especially among cage farmers, producers often have to settle for smaller size (2 g) fingerlings. The costs incurred under such conditions include higher cost of feeding and/or mortalities. Wholesalers, retailers, and the food service sector all have their size requirements for the fish and they furnish the producers with that information before fish is supplied.

Availability and quantity of products that can be supplied are essential for efficiency in the value chain. When feed suppliers and hatcheries renege on supply agreements, the entire chain is affected. For instance, traders are affected when producers are unable to provide the desired quantities of fish and may result in trading in wild fish, which affects the aquaculture industry.

The source of products is tied closely to quality and greatly influences the flow of products in the value chain. An important consideration is that of the type of fish, whether farmed or wild caught. Some distributors and retailers are indifferent to the source of the fish. However, others consider the source of

the fish because their customers demand it. Taste, texture, price, and availability are four important factors that were found to affect the choices traders and food services made regarding source. Some opined that wild fish were tastier, more available, and firmer than farmed fish, thus they only traded in wild fish. Price apparently favored farmed fish. Nonetheless, farmed fish face some marketing challenges because of rumors that farmed fish are boosted with chemicals to grow abnormally faster than wild fish.

Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis

The SWOT analysis involves assessing the external factors for perceived opportunities and threats at each stage in the value chain as well as evaluating the internal strengths and weaknesses (Zhang et al., 2007).

Input suppliers

Input suppliers have one key strength: the ability to control the prices at which they trade. Input suppliers primarily determine their price using the cost plus approach. Hence, the majority of the input suppliers reported that they have observed an increase in their income within the last 5 years. Another strength identified for input suppliers is the ability to market multiple products and services. Many of the input suppliers have varied knowledge and experience in fish farming. Thus, they are able to provide farmers with training and information, whereas others supply two or more inputs.

The lack of defined contracts between input suppliers and their suppliers, the lack of flexible payment plans, expensive transportation, and pricing constraints are the major weaknesses of the input suppliers. High transportation costs arise from importing from overseas or outside the vicinity of the input supplier, delivery costs, and travel to and from to conduct business.

The major opportunity for input suppliers is the government support in the form of the removal of taxes on aquaculture imports. This provides leverage against the expensive transportation cost associated with imports. The lack of import duty also encourages high private initiatives amongst input suppliers, serving as an avenue for job creation.

The major threat for input suppliers is the fluctuation in the local currency, against the American dollar. The Ghana cedi depreciation against the US dollar affects pricing of goods and services. This results in customers' demand for price reduction which affects income and profit of input suppliers. Another threat some input suppliers face is the delay in shipping and clearing of goods. Input suppliers also face the threat of competition from new entrants.

Producers

The major strength for producers is access to resources such as land. About 85% of the producers own land suitable for aquaculture. This presents enormous opportunities for expanding their production capacities. Another strength identified for the producers is the ability to produce their own fingerlings. Due to some challenges producers face with fingerlings purchased from hatcheries, some producers have started their own hatcheries and many others express desires to do likewise in order to meet their fingerling needs.

The major weakness for producers is that fish farming is capital intensive without many opportunities for loans. Where loans exist, interest rates are so high that the loans are unattractive to farmers. Another major weakness is marketing constraints. Many producers complain that due to high costs of inputs, it is sometimes impossible to sell fish at profitable prices. Only large scale farmers, especially the cage farmers, make reasonable profits because of economies of scale. Marketing was a major weakness also because some farmers often had no idea to whom they wanted to sell their products.

A number of opportunities exist for producers. These include the flexibility of changing existing technology and species to improve production. For pond farmers, polyculture of tilapia and catfish, as well as *Heterotis niloticus*, is increasingly becoming necessary since monoculture of tilapia in the pond environment has proven to be unsatisfactory to some farmers. Another opportunity for producers is the flexibility of changing sources of input such as fingerlings and feed. With over 6 major hatcheries and about 7 different feed brands available on the market, producers have many options in terms of where to get major fish farming inputs.

The major threats producers face are high cost of inputs and feed shortages. Even though inputs are available, farmers find them too expensive to purchase, resulting in their inability to sell their fish at profitable prices. Feed cost is a major challenge, primarily because over 70% of the feed on the market is imported. Another major threat for producers is shortages in the numbers of fingerlings supplied. Counting fingerlings pose significant challenges, thus, hatcheries estimate the numbers based on a previously known number and weight which results in shortages in fingerlings supplied. This greatly affects farmers because feeding and final yield depend on the initial stocking densities. Other threats that producers face include predators, poaching, lack of extension services, and high mortalities of small sized fingerlings.

Processors

Processors' major strength is the ability to operate within a niche market in the value chain. Apart from input suppliers, processors interact with all levels in the value chain, providing regular business and inflow of income. Presently, they also face little or no competition. Processors also benefit from an informal agreed pricing among themselves.

The lack of a formal association is the major weaknesses for processors. When they operate as individuals or informal groups, opportunities for government support and expansion of their business are limited. There are limited avenues for loans and grants for processors if they apply as individuals rather than as formal groups or associations. Processors will also have a unified voice in discussing issues affecting them with authorities if they were to be formal cooperative groups.

The major opportunity for processors is the ability to expand as aquaculture develops. Increasing demand for farmed tilapia will increase demand for processing. This will eventually open up a market for additional processing methods which will benefit current processors if they position themselves strategically in the value chain.

The major threat processors face is the lack of adequate food safety knowledge. The current processing activities are done with little regard for food safety. Processors wear no protective gear such as gloves, nose masks, and hair nets. Sanitation at processing sites is also inadequate. As the aquaculture industry grows and food safety regulations become mandatory, processors face the risk of losing their jobs without adequate food safety training. Processors also face the threat of future competition. Currently, the market is able to absorb the volumes of fish produced, and there is minimal need for other value additions. However, as fish production capacities increase, other processing methods will be needed. Processors will therefore have to place themselves strategically by adopting additional processing techniques. This will help them take advantage of the changes in the aquaculture industry in order to remain competitive.

Traders

The major strength for traders is their ability to control the prices of fish and make profit. Since traders predominantly use cost plus in determining the price of fish, they rarely incur losses.

The major weakness for traders is the fluctuations in their income. The income fluctuations may be attributed to their unstable customer base. This is especially true for retailers because they experience

brief market interactions with customers. Since they almost always have no contracts with customers, neither their customers nor their sales are guaranteed.

In terms of opportunities, the majority of the traders believed little opportunities existed for them to succeed in their trade. They reported that they had no knowledge of any government interventions that will encourage their business. The major opportunity identified for traders is the ability to source loans for expansion. However, some traders believed that the loans threatened their businesses because of the high interest rates.

Traders face several threats, the major threat being an increase in crime and robbery on the roads. The disruption of business due to rainfall is also a major threat for retailers. During rainstorms, the traders are often helpless in protecting their wares. Moreover, traders located at poorly planned markets also get cut-off from customers if footpaths leading to them become muddy, thereby reducing their sales. The inability to operate in their own stores or stalls in market centers is also a threat for retailers. These traders face constant risk of evacuation by city task force officials because they sell in unauthorized places such as road sides and pavements.

Food services

Food services have two major strengths, their locations and their products. With regards to location, food services are often strategically placed to take advantage of target customers. Not surprisingly, food service providers rated their location as excellent or very good in their overall performance as a business. In terms of product, the food service providers perceived that they provided customers with well-prepared tilapia which they relished. Thus, in most cases, food service providers reported that their high quality meals promoted their business.

The major weakness of food service providers is their limited investment in advertisement, which apparently is affecting patronage. Other weaknesses identified for food services include unstable customer base and fluctuation in income.

In relation to opportunities, many food service providers perceived that radio and television presented advertising opportunities that they could adopt to promote their businesses. Some large food service providers such as restaurants and hotels currently advertise through billboards and radio but felt that their promotional methods were inadequate. Other opportunities reported include addition of live music bands to encourage patronage, adoption of discounts and other promotional strategies, and extending business hours.

The major threat food service providers face is the risk of evacuation from their current locations. This threat affects primarily the tilapia 'joints' and 'chops bar' operators who may be situated at unauthorized locations. Tilapia 'joints,' which are mostly operated in unsheltered places, are often disrupted by rainstorms. Other threats faced by food service providers include smoke inhalation, high costs of goods, irregular power supply leading to fish spoilage, and customer misbehavior.

SWOT Framework in the form of Factor Evaluation Matrix (FEM)

The factor evaluation matrix (FEM) is commonly used to quantify and summarize qualitative SWOT analysis (Ehlers and Lazenby, 2004). This study used FEM to compare the competitiveness of the different value chain participants in terms of the traditional five marketing factors, i.e., product, place, price, promotion and procurement (process). Product refers to product offered by the value chain participant; place refers to the location of the business in relation to strategy; price refers to the respondents' negotiating power and method of price determination and margins; promotion is whether or

not participants perform any promotional and advertising activities; and procurement (process) refers mainly to raw material purchases as it affects production.

Each value chain participant was asked to rate the importance (out of 5, where 1 is not important and 5 is very important) of the five marketing factors to their business. With a separate score, respondents were also asked to evaluate their business and rate their performance (out of 5, where 1 is poor and 5 is excellent) in terms of the five marketing factors. Table 2 presents the average ratings by various value chain actors.

Table 2. The Factor Evaluation Matrices.

		Input Suppliers	Distributors / Wholesalers	Marketers / Retailers	Restaurants / Food vendors
Place	Importance - Rating	4.05	3.24	4.54	4.40
	Performance - Rating	3.95	4.00	2.76	4.41
	Weighted Performance	0.20	0.25	0.17	0.23
	Weighted Score	0.82	0.80	0.79	1.03
Price	Importance - Rating	4.42	4.40	4.42	4.03
	Performance - Rating	3.58	2.10	2.53	3.84
	Weighted Performance	0.18	0.13	0.16	0.20
	Weighted Score	0.81	0.57	0.71	0.82
Product	Importance - Rating	4.68	4.10	4.29	4.22
	Performance - Rating	4.32	4.29	4.25	4.57
	Weighted Performance	0.22	0.27	0.27	0.24
	Weighted Score	1.04	1.09	1.15	1.02
Promotion	Importance - Rating	4.26	2.52	2.47	2.66
	Performance - Rating	3.68	3.05	3.10	2.84
	Weighted Performance	0.19	0.19	0.20	0.15
	Weighted Score	0.81	0.48	0.48	0.40
Procurement	Importance - Rating	4.63	4.05	3.17	2.17
	Performance - Rating	3.89	2.67	3.19	3.26
	Weighted Performance	0.20	0.17	0.20	0.17
	Weighted Score	0.93	0.67	0.64	0.37
	Total Performance Rating	19.42	16.10	15.83	18.91
	Total Weighted Score	4.42	3.62	3.77	3.63

Input suppliers generally perceived the importance of all five factors very high – rated above 4 – and also evaluated their relative performance quite high. In particular, the average rating for product is 4.32, the highest among the other factors (less than 4 but above 3) suggesting that they value highly the product they offer to fish farmers.

This observation is not surprising because the input suppliers in the farmed tilapia value chain are a highly specialized group with a target market. Apart from the net suppliers who also sell to fishermen, all

the input suppliers target fish farmers. Thus, their products are tailored for fish farmers, which ensure that good quality products and services are supplied. Additionally, because the input suppliers, especially feed suppliers and hatcheries, face the threat of competition from new entrants, they may be constrained to provide quality products to remain competitive. Moreover, the increasing need to produce large size fish and in great volumes, especially for cage farmers, has provided a justification for the supply of premium products, particularly feed.

Apart from promotion which received a low rating of 2.52, distributors / wholesalers generally perceived the importance of all the factors as above average or high (3.24 and above). In terms of performance, place and product received high ratings, promotion was rated around average, whereas price and procurements were rated below 3, 2.1 and 2.67, respectively. Since distributors and wholesalers generally are strategically placed, they may depend on their customers (most of whom are retailers) to promote their products by word of mouth, and hence will have little need for other promotional methods. The relatively low rating of price may be because of the presence of many small scale distributors among our sample who compete with a few large scale distributors or wholesalers and are, thus, forced to sell by the market price. The large scale wholesalers usually are subsidiaries of fish farms, hence they have the advantage when they use existing wholesale market price. The low rating of procurement in terms of performance can be attributed to the fact that distributors/wholesalers feel unsafe on roads due to high incidents of robbery.

Restaurants/food vendors generally perceived the importance of all factors high – rated 3.26 and above with the exception of promotion and procurement which were rated 2.66 and 2.17, respectively. They also evaluated the relative performance of the factors quite high, 3.26 and above. Only promotion received a relatively low rating of 2.84, suggesting that even though restaurants/food vendors did not perceive promotion as very important in the success of their business, they still believed that they needed a certain level of promotion to sustain their business. In particular, the use of advertisement media such as radio was perceived as an avenue to promote their business, in addition to introducing sales discounts.

On average, markets/retailers perceived location to be very important and ranked it the highest, 4.54 among the various value chain groups (Table 2). For marketers, location is very important to selling their products and it is not surprising that, to them, place is ranked the highest, followed by price (4.42) and then product (4.29). However, in evaluating their business, product was ranked the highest (4.25), with place and price being rated below 3, at 2.76 and 2.53, respectively. The fact that marketers perceived that they procured good quality products, but ranked their sales locations and product prices below average supports the earlier findings that many marketers perceived their sales locations and prices as threats and weaknesses, respectively. Marketers usually sell in the open market and their wares are frequently at the mercy of the weather. Thus, they are sometimes forced to reduce their prices to enhance sale, hence the recorded low average rankings for place and price.

The average self-evaluated performance ratings for the marketing factors were used to assign a weight ranging from 0 to 1 to each marketing factor (weighted performance in Table 2). The weight was then multiplied by the average importance rating to obtain the weighted score. Higher scores indicate a better performance of the value chain group (Ehlers and Lazenby, 2004). The indices help to evaluate the strengths and weaknesses in marketing mix of the businesses. From Table 2, the weighted scores suggest that product offering appears to be the strength at each stage of the value chain. The weighted score for product is 1.04 for input suppliers; 1.09 for distributors/processors; 1.15 for marketers/retailers; and 1.02 for restaurants/food vendors. Restaurants/food vendors also have a weighted score of 1.03.

A total weighted score well below 3 suggests a weak business with regards to the marketing mix. Scores significantly above 3 indicate a strong marketing position. Thus, from Table 2, input suppliers have a

relatively stronger sector within the chain with a total weighted score of 4.42. The other stages in the tilapia value chain also have strong marketing position, given that they each have a score of over 3.0.

Relationships among key actors

The types of relationships among actors in the value chain influence the efficiency of the chain. A common relationship between actors is a business relationship which may be referred to as a linkage. Linkages may be vertical or horizontal. The former occurs between actors along the value chain whereas the latter occurs between actors at the same level of the chain. In the farmed tilapia value chain, both vertical and horizontal linkages are important for efficient movement of products through the chain. However, due to competition, and subsequent lack of information flow among actors at the same level in the chain, vertical linkages are the primary linkages existing in the value chain. Thus, trust building, which is responsible for efficiency in the value chain because of reduced transaction cost, depends solely on vertical linkages. Strong linkages that exhibit trust among key actors are encouraged by factors such as having contracts and flexible payment plans between suppliers and customers; preference for dealing with a particular individual among actors at one level of the chain; and efficient flow of information. In this study, because the mode of payment of goods and services in the value chain is mostly cash, many chain actors have short interaction time among themselves. Thus, it appears that the lack of contracts and the inability to obtain products and services on credit constrains the building of trust and stronger relationships among actors.

Apart from input suppliers and producers, and sometimes food services and traders, who show preference for particular actors, many of the chain actors appear not to have strong preferences for dealing with each other. The relationships between actors in the value chain may, therefore, be described as weak relationships, somewhere between spot market (where interactions are shorter) and persistent network (where interactions are continuous) relationships. Figure 5 shows the possible relationships existing among key actors in the farmed tilapia value chain in Ghana. Continuous lines in the figure indicate persistent network relationships whereas broken lines indicate spot market relationships.

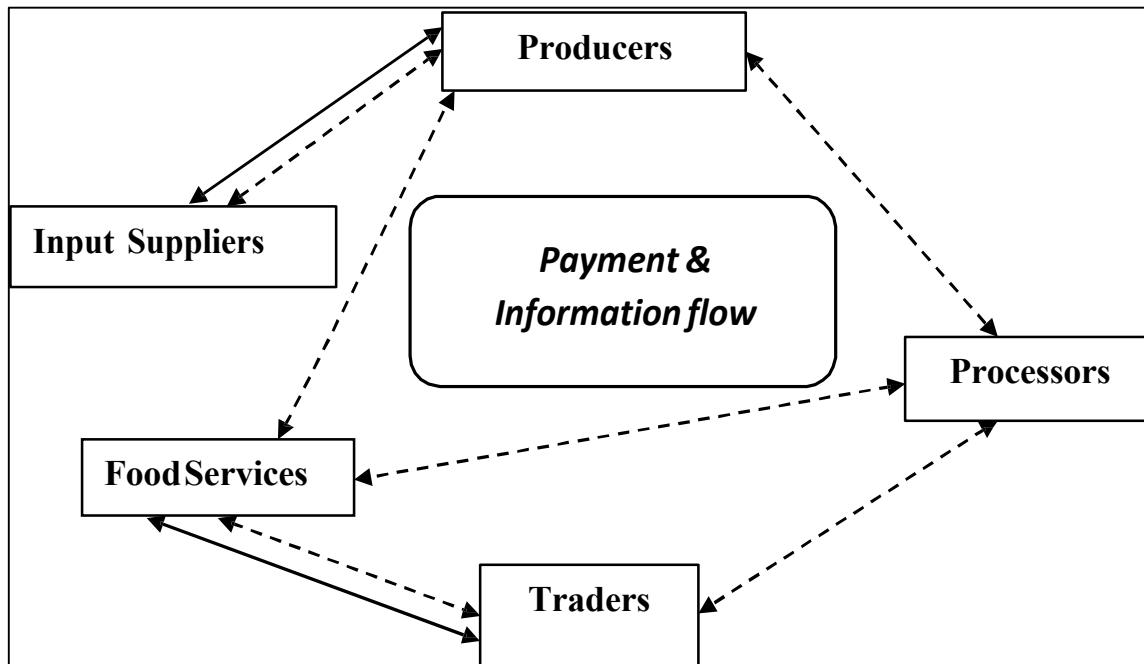


Figure 5. Relationships among key actors in the tilapia value chain.

Cost Benefit Analysis (CBA)

A CBA is used to measure all costs and benefits in financial/monetary values (Ghana cedis – GHC) to assess performance in the form of a benefit cost ratio (BCR). Ideally, the present values are used under the assumption that money available now is worth more than money in the future, and the value of the ratio of the present value of benefits to costs greater than one indicates profitability (Campbell & Brown, 2003; Watkins 2010). From Figure 3 however, almost all transactions are conducted as spot market with cash, therefore BCRs are first calculated without discounting the revenues and costs. However, Ghana's economy generally experiences positive inflation and the average inflation reported by the Ghana government in October 2012 was 9.2%. The BCRs for the value chain participants were calculated first without any discounts and then with inflation rate for revenues (Table 3).

Table 3. *Benefit-Cost Ratios for farmed fish value chain participants.*

	Revenue (GHC)	Cost (GHC)	BCR (Unadjusted)	BCR (Adjusted)
Input Suppliers	187,433.83	83,718.70	2.24	2.05
Fish Farmers	31,012.66	44,454.05	0.70	0.64
Distributors / Wholesalers	23,018.86	10,917.80	2.11	1.93
Marketers / Retailers	1,956.79	1,496.96	1.31	1.20
Restaurants / Food vendors	1,022.26	757.16	1.35	1.24

The major cost incurred by input supplies include stocks, transportation, space rental, packaging, electricity, staff emoluments, input costs, and taxes.

The major costs incurred by fish farmers include feed, hired labor and family labor, fingerling stock, electricity, transportation, licensing, rental of space and machinery/farm equipment, harvesting cost, net repair, feed processing, and fingerlings packaging. The major cost incurred by distributors/wholesalers include stock, transportation, packaging, electricity or ice cost, wages, and tax. The major costs incurred by marketers/retailers include stock, electricity or ice cost, transportation, wages, packaging, and space rental, and tax. The major costs incurred by restaurants/food vendors include stock, wages, packaging, transportation, tax, electricity or ice cost, input cost, cleaning, and space rental.

Apart from fish farmers who had a benefit cost ratio of 0.64, all other value chain participants had a ratio higher than 1, with input suppliers having a ratio higher than 2. Thus fish farming appears unprofitable whereas input supplying seems very profitable contrary to what other studies found (Asmah, 2008; MacFadyen et al., 2012). Further investigation was conducted to explain why fish farmers may be making losses compared to the other chain participants. The investigation revealed that the method of price determination used by fish farmers may be the major contributor to their inability to make profit. About 64% of fish farmers priced their products using the prevailing market price, compared to 19% or less for all the other chain participants. Conversely, only about 18% of fish farmers used either cost plus or percentage markup to determine their pricing, compared to 74% and above for the other chain participants. By using the prevailing market price approach, fish farmers face the risk of pricing their fish without taking into consideration the cost of production per fish. This is particularly problematic for small scale farmers, especially pond farmers, who do not have the advantage of economies of scale.

The major reasons why input supply appear to be more profitable relative to the other chain activities include: 1) well defined customer payment transactions, 2) strong customer base, and 3) good record keeping. Input suppliers ensure that they receive prompt payments for the goods and services they provide. In addition to operating on a cash and carry basis, input suppliers are the only chain actors who reported that they receive cash in advance of goods or service provided. This is especially the case for fingerling producers who receive orders and payments months in advance before they deliver. Well-defined payment transactions with customers are also consistent with having contracts, whether formal or informal, with customers. This, in turn, strengthens the relationships between input suppliers and their customers, making them more efficient, and their business more profitable. Compared to the other chain participants, input suppliers also had better records in terms of their revenues and costs which helped them track their profit margins. It appears that chain participants who dealt with fewer items kept better records. This is probably why fish farming appeared to be unprofitable compared with the other chain activities.

CONCLUSIONS AND RECOMMENDATIONS

This study shows that apart from fish farming, all other major chain actors identified (input suppliers, traders, and food services) had a benefit-cost ratio higher than 1.00, suggesting that fish farming is less profitable compared with the other value chain activities. Input suppliers appeared to make the most profit and had the strongest sector within the value chain. To improve the value chain and ensure that the chain is sustainable, we recommend that key actors be encouraged to have well defined payment transactions with customers and adopt flexible payment methods. Chain actors should also form strong persistent linkages among themselves, such as identifying particular actors and dealing consistently with them. These would improve the relationships among actors and ensure efficiency in the value chain. Farmers should also prioritize record keeping of costs and revenues to enable them to track their performance in terms of profit margins.

As far as institutional support is concerned, we recommend that the Fisheries Directorate of Ghana set and enforce standards that will regulate the activities of chain actors, especially hatcheries and processors, to ensure quality products and services are supplied along the chain. Providing safety patrols on major roads that traders use for purchasing and supplying fish will also improve the value chain tremendously. Additionally, food safety training should be provided for key chain actors, especially processors, to ensure the fish products supplied to consumers are safe. Finally, providing access to capital, particularly low interest loans, for all key actors could aid in business expansion.

REFERENCES

- Anane-Taabeah, G., 2012. Harnessing the opportunities and overcoming constraints to widespread adoption of cage aquaculture in Ghana. Unpublished Master of Science Thesis, Virginia Polytechnic Institute and State University, Blacksburg, Virginia
- Asmah, R., 2008. Development potential and financial viability of fish farming in Ghana. Unpublished PhD Thesis. University of Stirling, Stirling, UK.
- Campbell, H.F. & Brown, R.P.C. (2003). Benefit-cost analysis: financial and economic appraisal using spreadsheets. Cambridge University Press, Australia.
- Christiaensen, L., Demery, L. & Kuhl, J. (2011). The (evolving) role of agriculture in poverty reduction- An empirical perspective. *Journal of Development Economics*. Vol. 96. p239–254.
- Ehlers M.B. and Lazenby, J.A.A. (eds.), (2004). *Strategic management: Southern African Concepts and Cases*. Van Schaik Publishers, South Africa.
- Grant, R.M. (2010). In *Contemporary Strategy Analysis*. 7th Edition. John Wiley & Sons, USA.
- Humphrey J. (2005). *Shaping Value Chains for Development: Global Value Chains in Agribusiness*. Trade Programme, Sectoral Project Trade Policy, Trade and Investment Promotion Sectoral

- Project Agricultural Trade. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ). Eschborn, Frankfurt.
- Jamandre, W.E., Hatch, U., Bolivar, R.B., Borski, R.J., 2011. Improving the supply chain of tilapia industry in the Philippines, in: Liping, L., Fitzsimmons, K. (Eds.), Proceedings of the Ninth International Symposium on Tilapia in Aquaculture, Shanghai, pp. 132-150.
- Kaliba, A.R., Ngugi, C.C., Mackambo, J.M., Osewe, K.O., Senkondo, E., Mnembuka, B.V., Amisah, S., 2007. Aquaculture International: Journal of European Aquaculture Society 15(6), 445-459.
- Kaplinsky R. & Morris M. (2000). A Handbook for Value Chain Research, International Development Research Centre (IDRC).
- MacFadyen, G., Nasr-Alla, A.M., Al-Kenawy, D., Fathi, M., Hebicha, H., Diab, A.M., Hussein, S.M., Abou-Zeid, R.M., El-Naggar, G., 2012. Value-Chain Analysis – an assessment methodology to estimate Egyptian aquaculture sector performance. Aquaculture, Vol. 362-363, pp. 18-27.
- Trienekens, J.H., 2011. Agricultural Value Chains in Developing Countries: A Framework for Analysis. International Food and Agribusiness Management Review, 14 (2), 51-82.
- Watkins, T., 2010. An Introduction to Cost Benefit Analysis. URL: <http://www.sjsu.edu/faculty/watkins/cba.htm> Published by San José State University, Department of Economics.
- Zhang, H., Zhao, R.M., Zeng, Q., 2007. Strategic research and design for enterprise development in western China region based on SWOT analysis, in: Yuan, C.Y., Li, H.M., (Eds.), Proceedings of the 2007 International Conference on Management Science and Engineering, Finance Analysis Section. Sydney, Australia, pp. 917-921.