AQUACULTURE & INLAND FISHERY VALUE CHAIN IN PAKISTAN

State Bank of Pakistan
Agricultural Credit & Microfinance Department
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Preface

The value chain financing (VCF) is evolving as an attractive model of spreading the various risks in agri/ rural finance among different fund providers. Keeping this in perspective, and to sensitize lending institutions about the potential business prospects in VCF, SBP carried out a research study to identify the potential agri. value chains in Pakistan through reputable consultants. The study highlighted various layers and players within different value chains in terms of activities, potential for investments, issues & challenges in strengthening VCF.

The desired research study and its findings' report were completed in December, 2014. The report provides a detailed assessment of six main value chains in the country: i) Potato, ii) Tobacco, iii) Beef, iv) Dairy, v) Basmati Rice, and vi) Aquaculture and Inland Fishery.

This report on Aquaculture and Inland Fishery value chain in Pakistan is a part of that comprehensive report. Its basic aim is to enable financial institutions to more clearly understand the specific value chain dynamics and prepare their related strategy for increasing agri. financing thereto.

Executive Summary

Fishery plays an important role in Pakistan's economy and is considered to be an important source of livelihood. Although the share of fisheries in the GDP is very little but it contributes substantially to the national income through export earnings. The fisheries industry further supports almost half a million people (directly and indirectly), and contributes to the livelihood, employment, and household food security of, especially, Pakistan's communities close river , lakes and coastal regions.

In Pakistan, the fisheries sector is composed primarily of two categories: capture fisheries and aquaculture. Capture fishery is further classified as inland and marine fishery. At present, capture fisheries make up the bulk of the domestic fish supply. The phenomenal growth in aquaculture in Pakistan has kept pace with the global trends of being growing faster than the traditional capture fishery. The share of aquaculture in total production increased from 11% in 2003 to 24 % in 2010, accordingly it fell for the capture fishery.

The combination of Pakistan's large population with an annual growth rate of over 3 per cent, high meat/poultry prices, and rising incomes are driving the demand for fish consumption. The demand for captured fish species is especially strong. However, with both marine and fresh water catches declining; consumer is switching to farm fish which is slightly less expensive. Despite strong consumer demand for fresh local species, aquaculture production remains small, and has been unable to realize the enormous opportunity that exists for fish farmers.

The inland fisher is facing a number of problems on both production and marketing side. On production side, common problem is insufficient supply of quality fingerlings that effects productivity. Unlike poultry, feed industry has not taken off with standardized ready to use quality feed. Most of fish farms prepare their own feed often of poor quality. Other factors attributing to low production are water scarcity and its high cost and lack of technical assistance from government. On the marketing side, wide price fluctuations lead to uncertainties in securing favorable price upon harvest. Other problems are delayed payments by commission agents: relatively high transport costs and lack of knowledge on actual marketing condition. This last problem at times creates condition of unsold catch.

The large number of fish hatcheries in Pakistan is operating under a competitive market. The intensive culture of carp species has not yet been so far adopted, the major impediment to this development being the non-availability of low cost feed and to some extent the non-availability of intensive fish farming technology. The productivity of carp farms show marked differences across various provinces with Punjab having the highest per unit production followed by Sindh and KPK.

Like other value chains, inland fishery marketing is also dominated by Arthi (Commission agents) who provides financing for the working capital in returns for selling produce through him. The system is prevalent in all provinces but varies from province to province and even from one regional market to the other. For example financing the trout value chain, more than half of the agents in chain purchase fish on credit basis with payments made within 2-4 weeks to suppliers, whereas one-thirds of respondents purchasing fish on cash payment. In Lahore fish market, largest in the country, commission agents provide financing only at retail level.

The inability of the aquaculture sector to exploit growth opportunities rests on numerous constraints that hold back the sector. Lack of quality, cost-effective fish feed and shortage of quality, fast-growing fingerlings are two key factors that are the binding constraints on the sector. The combined cost of feed

and fingerlings along with rising water cost contributes largely cost of production. High cost of available inputs and uncertain output prices have served as a disincentive to small-scale producers.

In addition to feed and fingerling, there are other factors that add to expand cost of production of farmed fish. Many relate to production management or husbandry issues, which require targeted extension support and technical training to enable small-scale producers to break out of the current "low- input/low output" production system. The small fish producer is caught in this vicious cycle of low appetitive for risk, resulting in low investment, low productivity, low market orientation, low value addition and income discourages investment in innovative production solutions to take advantage of existing opportunities.

Fisheries Development Board is promoting Tilapia fish farming in Pakistan to enhance per acre production of fish from 1.5 ton to 5.0 ton per acre. For this purpose a number of successful experiments have been done and promising results are being obtained. The economics of Tilapia also works out very well with gross profits of Rs 800000 per acre as compared to Rs 200000 from traditional carp varieties.

Tilapia has advantage over traditional carp fishery production and provides a feasible opportunity to identify financing products that can support in (1) the need for improvement of tilapia broodstock for the production of high quality fingerlings, (2) the commercial production of economical feeds for intensive culture and (3) development of market strategies.

The policy framework charted with FAO support targeting extra production needed to increase fish consumption from 1.2kg to 5kg per capita per year. With capture fishery on the decline it is estimated that most of the production increases will come from aquaculture, from both inland and coastal areas.

The policy options proposed to develop a sustainable aquaculture include strengthening of inland aquaculture production through developing high potential zones for inland aquaculture, attract private sector investment in inland aquaculture production, encourage the production of aquatic species able to compete on domestic and international markets and to ensure that environmental concerns are fully taken into account in inland aquaculture development.

A thorough research/study is needed to work out the fish profitability with different ecological, technology in use and species would be quite helpful to both policy makers and investors. Further, established fish farmers may consider diversifying into input supply and value addition.

Methodology

As part of the study, a review of literature and past research on fisheries was conducted. Some useful data was obtained from various sources, including the Department of Fisheries in Punjab and Sindh Fishery Development Board in Islamabad and the Market Demand Analysis of Trout Fish, a project funded by USAID/Chemonics. Additional reports on FAO TCP project on fishery were very helpful.

Key informant interviews were organized in Punjab and Sindh. In Punjab FGD and Key Informants were interviewed during field visit to Ali Pur Chatta to meet cluster of fish farmers, traders and retailers and some other selected sites in Shiekupura and Chiniot. In Sindh apart from interviewing five farmers, visited hatcheries and training institute at Chilya, Thatta, Shrimp and Hatchery complex at Hawks Bay at Karachi.

In addition to interviews and farm visits, we also conducted a brief survey of farmers, commission agents, wholesalers, retailers (mainly market and caterers) and consumers both at farm and wholesaler markets. The team participated in fishery auctions at Lahore and Fish Markets at Ali Pur Chatta. These interactions provided a better understanding of the market for aquaculture fish value chain. It also helped to not only to identify constraints along the value chain, but to seek solutions from the chain stakeholders in the form of sustainable market driven intervention (with clear-cut activities), designed to address the identified constraints.

List of Abbreviations Used

Department of Fishery	DOF
United States Agency for International Development	USAID
Artificial Insemination	AI
Ministry of Food Agriculture and Livestock	MINFAL
Value Chain Analysis	VCA
Non Governmental Organizations	NGOs
United States Department of Agriculture	USDA
Agri. Business Support Fund	ASF
Gross Domestic Product	GDP
National Agriculture Research Council	NARC
Pakistan Standards and Quality Control Authority	PSQCA
Training Service Providers	TSPs
Khyber Pukhtoonkhwa	KPK
Federally Administered Tribal Area	FATA
Small & Medium Enterprise Development Authority	SMEDA
Zarai Taraqiati Bank Limited	ZTBL
Fisheries Research Institute	AFRI

Contents

Value Chain Overview

Fishery Resources

1. *Inland Fishery*

Fisheries play an important role in Pakistan's economy and is considered to be an important source of livelihood for the coastal inhabitants. Although the share of fisheries in the GDP is very little but it contributes substantially to the national income through export earnings. During the year 2010-11 (July- March), a total of 86,680 MT of fish and fishery products were exported to earn $ 197.3 million. Pakistan's major buyers are China, Thailand, Malaysia, Middle East, Sri Lanka, Japan, etc. (Pakistan Economic Survey, 2012)

Indus water and its tributaries provide a solid resource base for freshwater capture fisheries. The water resources consist of rivers, canals, lakes, ponds and reservoirs scattered over several thousand acres in Pakistan and account for more than 80 percent of total inland fish production. Six large reservoirs have been created in the past four decades through the construction of dams and barrages across rivers, which provide about 250 000 ha for fish production. In the Sindh Province alone there are more than 100 natural lakes of different sizes covering an area of about 100 000 ha. Among them Lakes Halijee (1 800 ha), Kinjhar (12 000 ha) and Manchar (16 000 ha) are quite important for fish production. (FAO 2009)

According to the latest estimates, the total area covered by fish farms across all provinces is about 60,230 ha, with Sindh having 49 170 ha, Punjab 10 500 ha, KPK 560 ha and the other provinces (Table 1). About 13 000 fish farms have so far been established across Pakistan, the size of these farms varies considerably; however, the average farm size ranges form 5-10 ha. No direct data on the number of fish farmers employed in this sector is available as fish farming in most parts of the country is carried out as an integral part of crop farming. According to best estimates, about 50 000 people are either directly or indirectly employed in the sector.

Table 1: Inventory Of Pakistan's Aquatic Resources By Province

Area	Sindh	Punjab	Baluchistan	KPK	Total
River	160,000	2940,000	-	2408	3102,408
Canal, drains & abandoned canals	312340	23700	-	1763	346803
Lakes	110,000	6700	4047	6362	127109
Dams &	110,000	6,700	40,047	6, 362	127,109
Waterlogged area	3000000	30000	-	1600	3,031600
Deltaic area	700,000	-	-	-	700,1000
Flood water area	1000000	-	-	-	1,000,000
Fish farms	49,170	10,400	100	560	60230
Territorial Marine Water	352*12	-	1129*12	-	1481*12

Source: FAO, National Policy for fisheries and Aquaculture Development, MINFAL, 2006

DOF GOP * WWF-Pakistan ** areas of fish farms are likely to be underestimated as many farms are not registered and no inventory system exists.

FAO (2009) reports that the riverine fishery management system is run by provincial fisheries departments and they enforce regulatory laws that restrict catch by size of fish and establish closed seasons. For example the Punjab Fisheries Department is responsible for the conservation, management and development of Natural Fisheries resources through the enforcement of Punjab Fisheries Ordinance and Rules, promote aquaculture practices in private sector to bridge gap of protein deficiency in the diet of common man, provide white meat to improve the health of people , utilize the untapped fisheries resources to obtain maximum production , increase share in the national economy.

2. Aquaculture

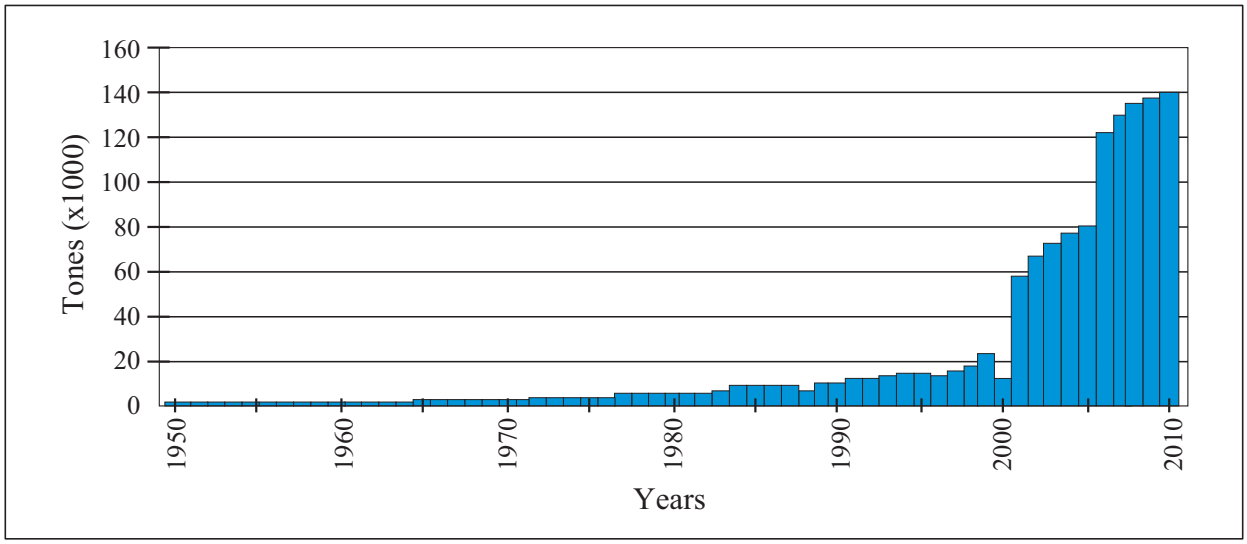
In Pakistan, the fisheries sector is composed primarily of two categories: capture fisheries and aquaculture. Capture fishery is further classified as inland and marine fishery. At present, capture fisheries make up the bulk of the domestic fish supply. For example, in 2010, Pakistan's domestic fish production reached approximately 593365 metric tons, of which 76 % was capture fisheries, and 24 % as aquaculture.

Freshwater carp farming is the major aquaculture activity in Punjab, Sindh and NWFP. In spite of diversified water resource base (fresh, brackish, lakes and dams) only carp culture has been promoted. The shrimp aquaculture also provides a good potential, which has not been fully capitalized. Trials conducted by Department of Fishery (DOF) in Sindh for shrimp culture in the Indus delta region did not succeed due to non-availability of hatchery-produced seed; now a shrimp hatchery is in place at Karachi providing the needed support. In Khyber Paktun Kuwan (KPK) and the Northern Region of Pakistan also have good potential for trout culture, the industry has been hard hit by ongoing conflict and more so by recent floods.

Aquaculture has also received substantial amount of government investment, and support through development of hatcheries and nurseries, training and research institutions, developing regional wholesale markets and now is at at a stage for a major future expansion. With the exception of trout culture in the North-West Frontier Province (NWFP) and the northern region, virtually all aquaculture consists of pond culture of various carp species. Pakistan has insignificant coastal aquaculture potential, which has not been exploited. According to National Aquaculture Sector Review (2007), the total area covered by fishponds is about 60 500 ha Sindh, 49170 ha; Punjab, 10500 ha; KPK, 560 ha; and the other provinces (Baluchistan, Azad Jammu Kashmir [AJK] and Northern Area [NA]), 240 ha).

According to National Aquaculture Sector Review as presented in graph 1, aquaculture production in Pakistan had a quantum jump during last decade, so has the inland fishery (figure 2). The rise in production is attributed to two factors, first the quality of inland fishery supported by water bodies (rivers, lakes and dams) has been on the decrease and secondly demand for fish is on the rise due to growing income and changing food habits.

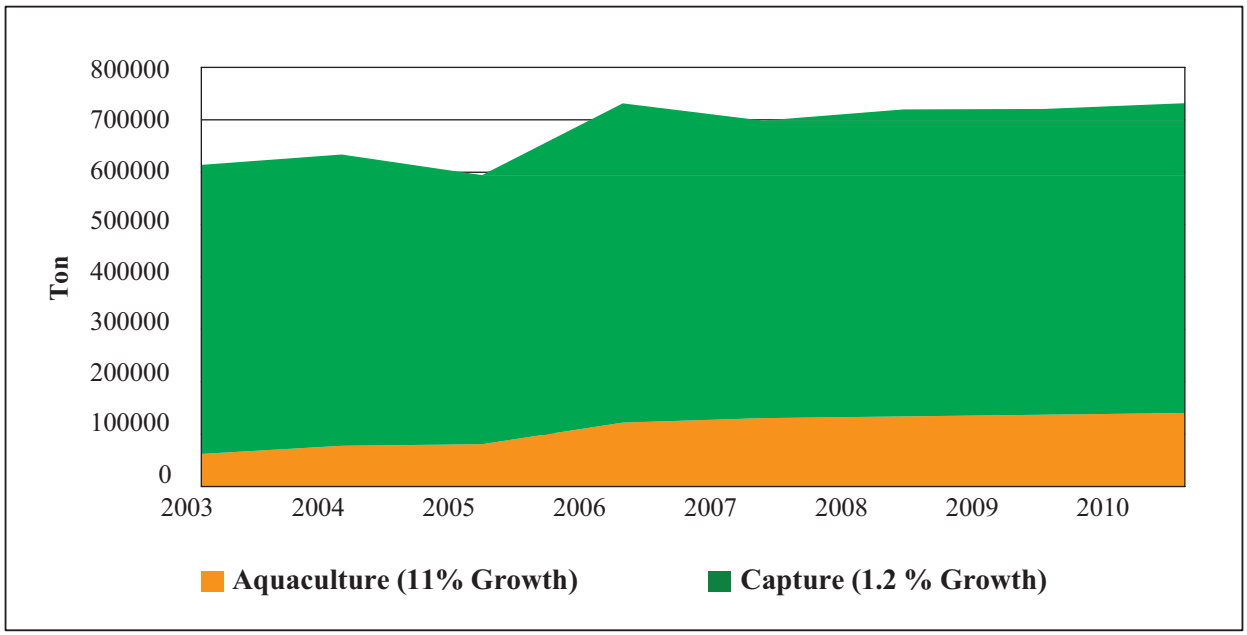
Figure 1 : Trends in Aquaculture Growth in Pakistan



Source: National Aquaculture Sector Review

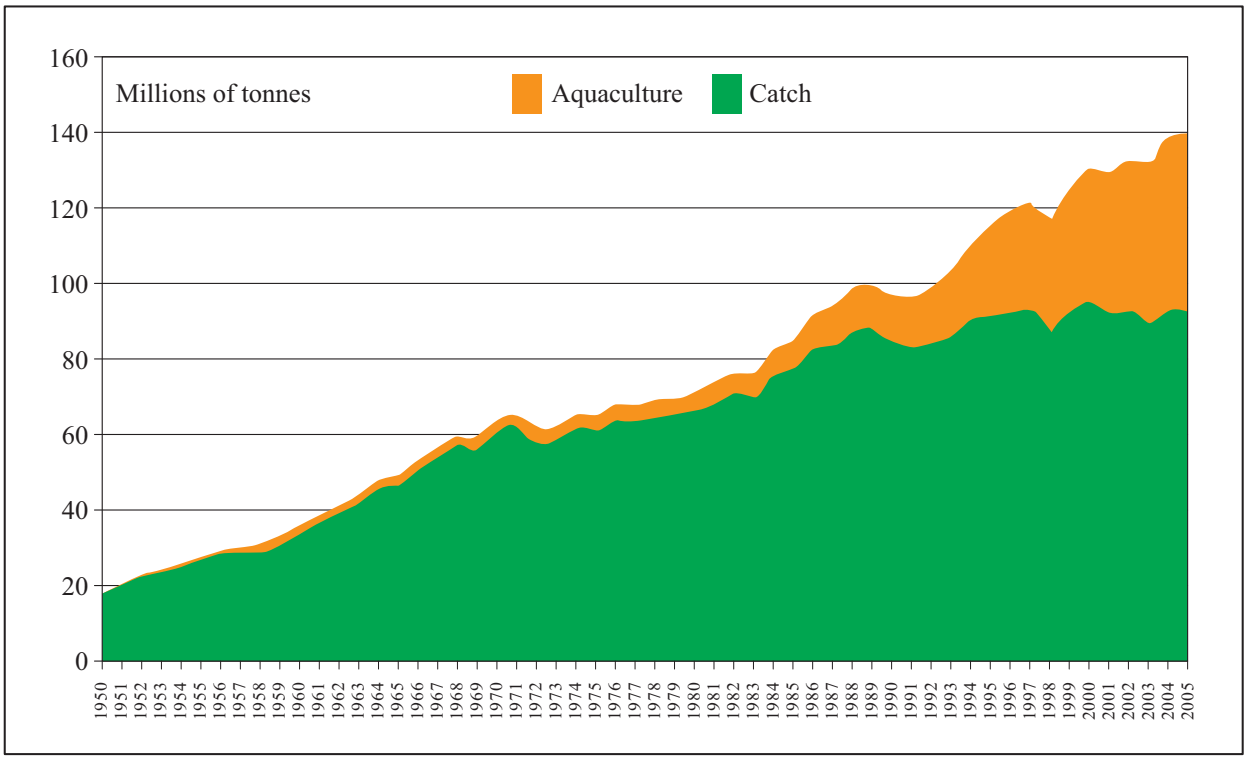
The phenomenal growth in aquaculture in Pakistan has kept pace with the global trends of being growing faster than the traditional capture fishery (Figure 2 & 3). According to FAO statistics share of aquaculture in total production increased from 11% in 2003 to 24 % in 2010, accordingly it fell for the capture fishery (figure 2)

Figure 2 : Trends in Production of Aquaculture & Capture Fishery



Source: FAO Fishery Data Base, 2013

Figure 3: World Trends in growth of Aquaculture



Source: FAO Fishery Data Base, 2013

Fishery Value Chains

The fishery value chain analysis has been based on regional clusters in Punjab, Sindh and KPK. The Punjab fishery markets predominantly are geared for domestic markets or low end markets in the region. In Sindh and Baluchistan fish production, both marine and inland are relatively directed at export markets and for processing industry in Karachi. The trout value chain is marketed to high end domestic markets.

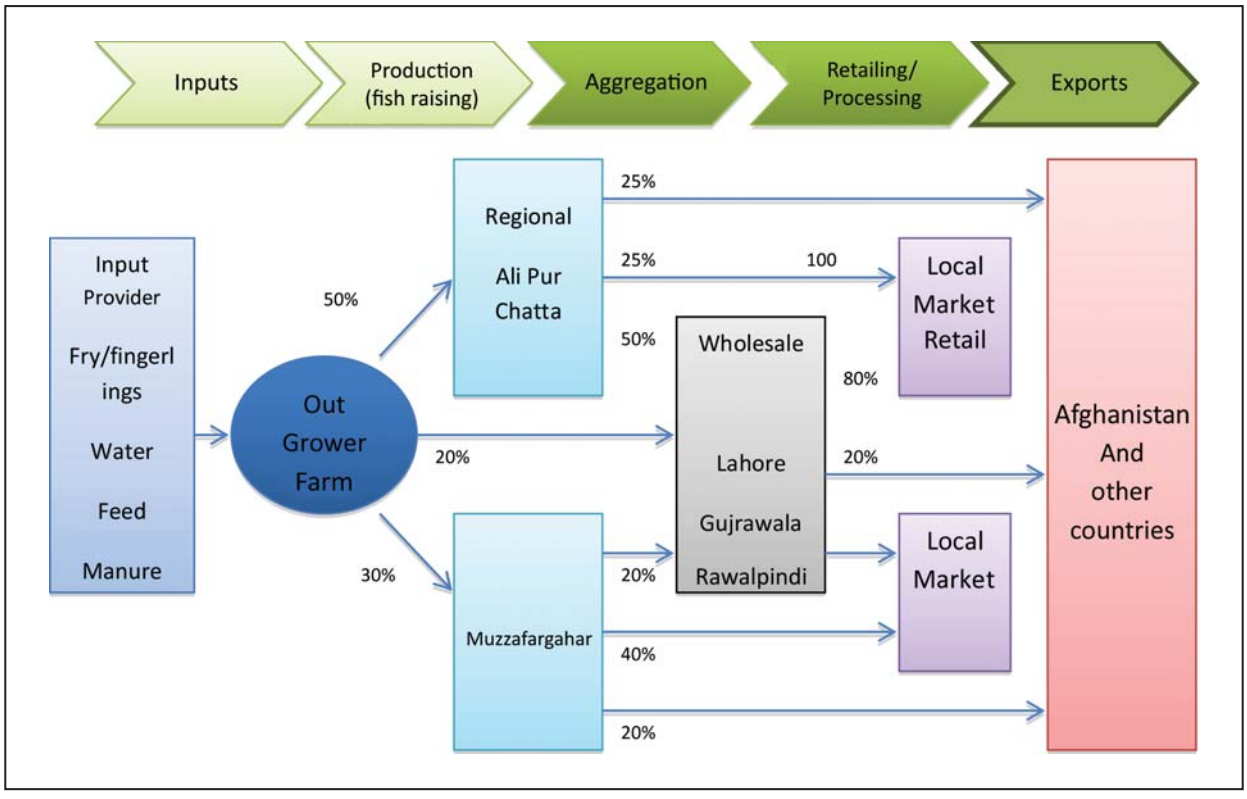
1. Punjab Aquaculture Value Chain

In Punjab, aquaculture is dominated in two such a clusters, one in Sheikhpura, Gujranwala, and Attock districts as they carry larger number of farms and constitute around three quarters of the total number of farms in Punjab. Then there are small fish farms scattered over the province. The fish farms are being developed along rivers or canal banks, one such a cluster we visited is in Alli Pur Chatta where farmers sell their fish to four well organized fish markets. The average size of these farms is around 10 ha with a range from 2 to 25 acres, mainly growing carp species with a few progressive farmers piloting Tilapia.

The second cluster is located in Muzzafghar/Der Ghazi Khan, carrying relatively larger fish farms and marketing to regional markets like Lahore and Peshawar. For example Metro store in Lahore has contracted progressive farmers from this region to supply fish in quality and quantities as demanded; fish is being transported in ice packed boxes with better hygienic conditions.

Figure 4 below represents a typical value chain in Punjab, fish from out growers farm that goes to the regional markets in Ali Pur Chatta and Muzzafghar, indicating directions of commodity flow and its share going to different agents within the chain. The Ali Pur cluster has four wholesale markets where farmer brings their produce in pickups on wards from noon time, unloading take place and sorting begins according to species and sizes. On demand side, traders from regional markets bring their transport (pickups) to buy from these four markets through an auction which is organized in such a way to have these traders to participate in all four auctions within the cluster. We attended two marketing transactions and auctions (see picture below). The fish from these markets are sold partly in larger fish markets of Lahore, Gujrawala, Rawalpindi and Peshawer, partly is exported to low end markets like Afghanistan, Middle East and Africa, this a group of countries that do not require strict rules of SPS and traceability. But if we want to compete in fish exports to countries like Canada, USA Denmark, Japan, Holland, Norway, Iceland, Korea, Hong Kong, Taiwan, Singapore Malaysia, Gulf, we need major investments at the farm and post harvest levels to measure up to the tough food standards and safety rules.

Figure 4: Value chain mapping Punjab



Two Mandis Visited in Ali Pur Chatta

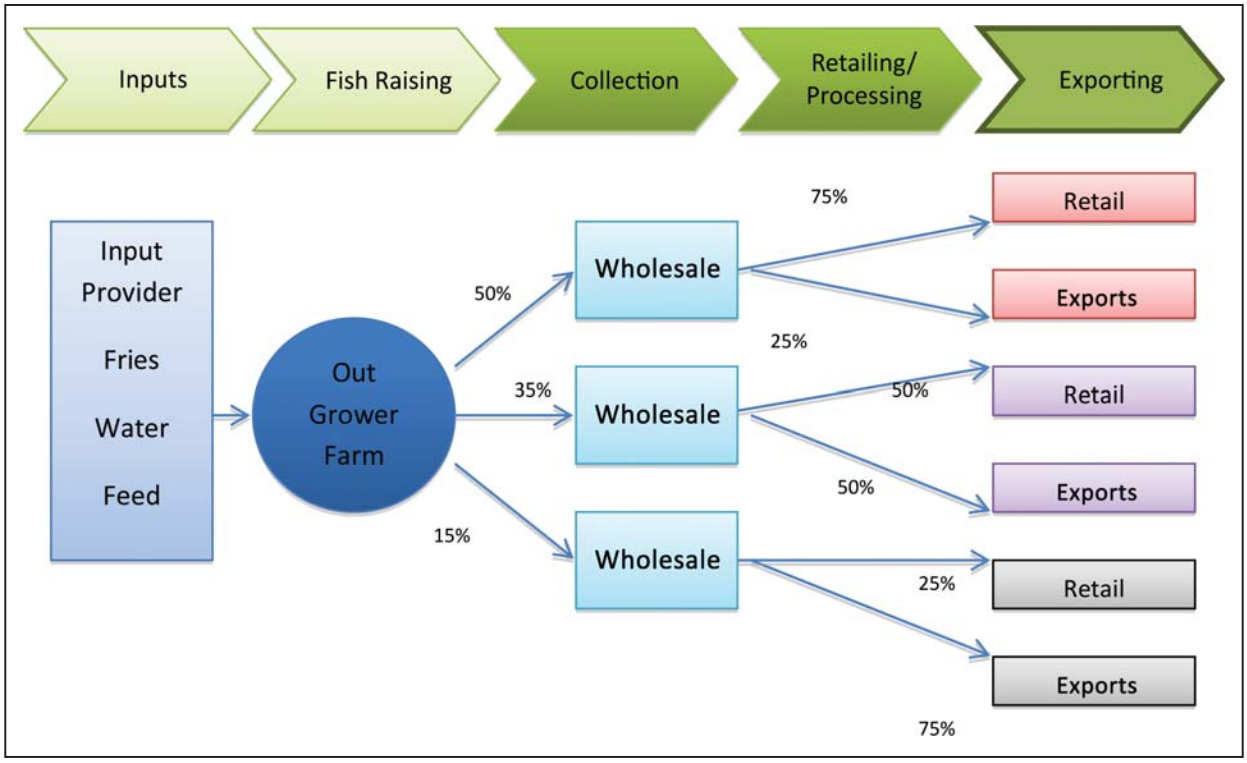
2. Sindh Aquaculture Value Chain

Figure 5 represents a typical value chain in Sindh, fish from out growers farm goes to regional markets in Thatta, Hyderabad and Karachi, providing the direction of flow commodity and its share going to different agents within the chain. The fish farms from this cluster carry Thala, Rahu, and Mori as the main carp species, exotic fish include Grass, Silver, Gulfam and Big Head The majority of these farms are located in Thatta, Badin and Dadu, the three districts through which the River Indus passes. Badin and Thatta have water logged floodplain areas which are suitable for fishery and potential has not been fully realised.

The Fish Hatchery Chilya, Thatta provides strain breeding (both traditional and exotic) and providing fishery seed at a subsidized rate which helped the province in producing volumes and values for the market. When hatchery was started in 1983, only 20 acres were under farm fishery, imparting constant improvement know how, training and capacity building the farm numbers have increased to 49765 ha with total of 3213 fish farms. A phenomenal success story. The institute was instrumental in transforming fish farming from side business to farms with orientation for running on commercial lines. The institute is now meeting not training needs of farmers but also support research programmes involving academic institutions, Master and Ph.D. programmes.

In Sindh volume of available marketable fish determines the commodity flow. If the volume or truck load is less 5 to 10 maunds the produce is marketed to Thatta and if the volumes are between 10 to 40 maunds, the fish farmer prefer to sell their produce in Hyderabad or Karachi markets . The primary processing takes place at retail levels, the fish buyers have it cleaned , sliced and packed , or at fried fish shops where it is sold with spices and chickpea flour used before frying and selling.

Figure 5: Value Chain Mapping Sindh



From these regional markets the fish is sold to the retail shops, restaurants and super markets or goes for processing to the export markets. The processing for export market entails two actions, one to process it by cleaning, scaling , packing and other mode is to pack fish as such with ice layers and box it to export markets.

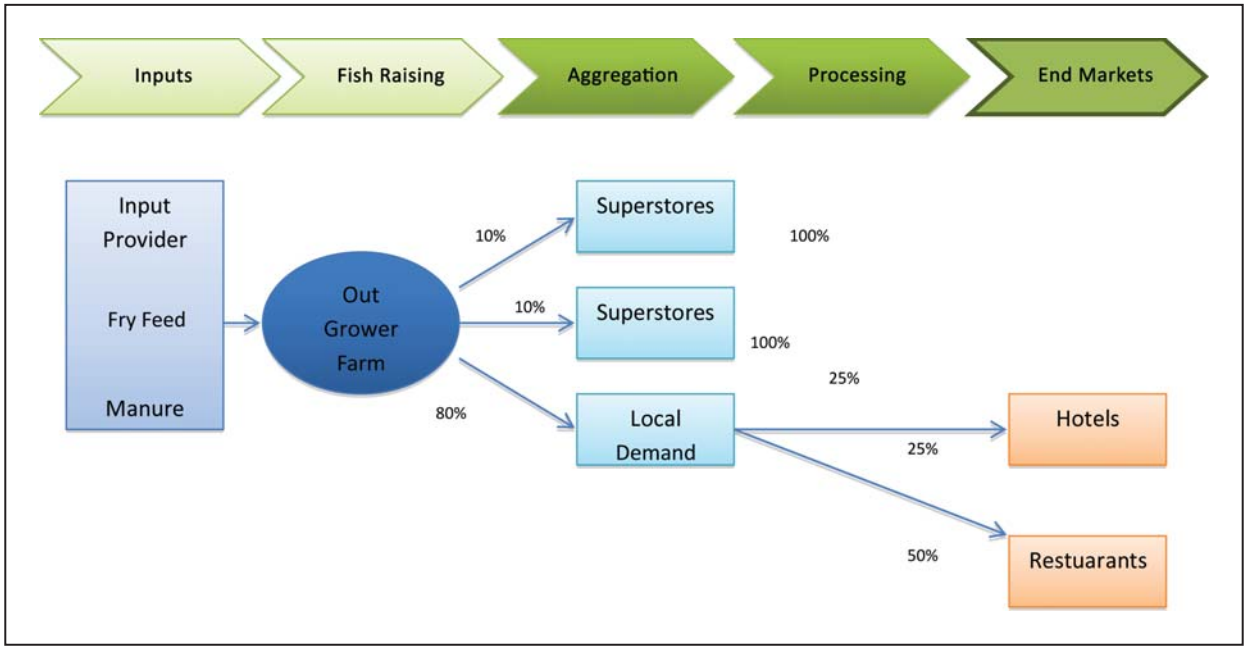
Fish and shrimp processing includes plants for freezing, canning and fishmeal. There are 29 fish processing units in Pakistan with storage capacity of 10,000 tons, out of these 25 units, one is for canning, and eight are for fishmeal processing, all these plants are located in Karachi. Almost 100 per cent of the frozen and canned fishery products are exported, while the bulk of the processed fishmeal is used in the country in the manufacture of poultry feed. It is very difficult to get data on what percentage these processing plant use fresh water fishery.

The fish without scales/bones is targeted for export markets as they do not accept fish with scales. The export demand for fish is growing in low end markets like Afghanistan, Middle East and Africa where SPS measure and food safety rules are not a binding constraint for export.

Case of Trout Value Chain

Trout is considered a tasty fish, mostly considered as a delicacy with very high willingness to pay. Demand for trout has been on the rise with people getting more health conscious and also due to rising income. Two species of trout namely brown trout (Salmo trutta) and rainbow trout (Oncorhynchus mykiss) are cultured in NWFP, AJK and NA. Trout farms are also located in Chitral, Swat, Dir, Malakand, Mansehra, Federally Administered Tribal Area (FATA) and other parts of NA.

Figure 6: value chain mapping trout



Swat is a major producer of trout fish as the region being ideal for its rearing. Its production and marketing is closely linked with tourism industry and rise of upper income class in the country. The fishing industry has been hard hit by conflict in the region, further the floods of 2010 also badly affected its onging revival efforts, production dropping from its peak levels of 162 metric tons to almost zero. USAID/Firms Project has developed a business recovery plans to rehabilitate farms with a target to attain potential productions levels of 100 metric tons. According to USAID FIRM report[13], recapturing this market depends on return of tourism and overall economic development in the country.

The business model for trout is simple as depicted in figure 6, requiring minimal post harvest processing, as the fish is purchased on the site or transported live from grow out farms to onward sale points to hotels and restaurants in each of the main tourist areas or is transported to regional markets. The trout from Swat has recently reached marketable size and is currently offered in few hotels/restaurants in Swat and one superstore each at Islamabad and Lahore (see picture below).

Trout attractive for its looks and being sold with premium price of Rs 1009 per Kg at Metro Store in Lahore

[13] Chemonics/USAID, 2012, Market Demand Analysis of Trout Fish, Islamabad, Pakistan

Value Chain Actors: Their Roles And Relationships

i. Input suppliers

Seeds the most important input is available through large number of hatcheries in small or large towns. The fishery seed industry is quite competitive, both private and public sectors are competing in the market. The farmers buys his seed where he can access with ease or within close proxity, does not matter weather sourced from private or public. A 10 to 20 % is accessed through Arthi, these are small fish farms, lacking access to working capital

ii. Contractors

The contractors perform a key role in the marketing of fish. They take the contracts or lease of fishing rights of public water areas from the Fisheries Departments. They manage catching of fish and supply to the markets.

iii. Fish Farmers

A typical fish farmer produces the fish in their farms and supplies the same to the market. As mentioned above, there are two large fish farm clusters in Gujrawala and Muzzafar Ghar Districts. The rest of fish farms are scattered all over the country with major concentration in Punjab. The average farm size range from 2 to 10 acres.

iv. Aggregators – Marketing Intermediaries

Marketing intermediaries (wholesalers/ CA, processors and retailer) are the main aggregators; they include all individuals or firms who handle the fish after it leaves the producer until it reaches the consumers. The aggregation of fish takes place at local fish markets, where farmer bring produce to Mandi and displays his produce in small or large lots made according to the size (Figure 9) . After auction the buyer takes the produce to either to the regional markets where again these quantities are aggregated into larger size and another round of auction takes place.

Aggregation at Wholesale levels (Lahore Mandi)

Aggregations at Retail Levels (Metro Lahore)

From regional markets the fish is sold in the retail markets (Figure 10). He buys the fish in small lots and sell to ultimate consumers. Fish retailing is mostly done through shopkeepers , and lately through modern supermarkets (Metro and Hyper store) and some specialty stores like Zienth operating in Lahore. However, the bulk of fish is sold at shops and by hawkers selling the fish sitting at foot path or in pickups moving from one spot to the other.

v. Processors

For our study we are considering two types of processors, first shops selling fried fish with value addition, second type of fish processing include cleaning, packing and boxing for export markets. Fish and shrimp processing is usually divided into mechanical and non-mechanical processing. There are 65 fish processing plants with average capacity to process 800 metric tons of fish and shrimps daily (FAO 2009). Most of the fishery units are obsolete with very old machinery and poor cold store insulation. The equipment used for essential fast freezing to preserve export products and to extend their shelf life is in poor shape and their function is not uniform.

vi. End Markets

Pakistan produced about 937,000 tons of fish in 2010-11, from which about 50 percent of the total fish production is consumed locally, 22 percent of the total fish production was exported, whereas 28 percent of total catch was converted into feed for poultry industry. The exports mainly comprise frozen of fish, frozen shrimps, lobsters and crabs, dried fish and mollaces . (FAO 2009)

Supporting Institutions

Aquaculture in Pakistan is basically a provincial responsibility; at the central level fisheries is the responsibility of the office of the Fisheries Development Commissioner (FDC) working under the Ministry of Food, Agriculture and Livestock (MINFAL). The office of the FDC is responsible for policy, planning and coordination with provincial fisheries departments and other national and international agencies. The Pakistan Agricultural Research Council (PARC) is the country's largest research organisation and is responsible to MINFAL. Some universities in the country are also involved in basic fisheries research.

The Punjab DOF has a Fisheries Research and Training Institute located at Manawan in Lahore, which offers training programmes in warm water fish farming for private sector fish farmers, in-service personnel of DOF and staff from other provinces. The NWFP DOF also has a training institute at Sherabad in Peshawar, while the Sindh DOF has a training institute at Thatta. The NWFP DOF also has a pilot commercial trout farming and training center located in Madyan in Swat. This facility is the largest commercial trout production unit in the country and is also used as a demonstration and training facility.

The various departments provide training to the participants both from within Pakistan and from neighbouring Afghanistan. The PARC has established the Aquaculture and Fisheries Research Institute (AFRI) which conducts production technology-oriented research in aquaculture and reservoir fisheries. The center has also established a trout breeding and production unit near Gilgit in the NA of Pakistan.

Several universities engaged in academic aquaculture research include the Bahuddin Zakariya University at Multan, the Agriculture University at Faisalabad, the Sindh University at Jamshoro and Karachi University.

MFD is also mandated to provide support to and liaise with the Provincial governments of Sindh and Baluchistan, in particular the departments of fisheries in those governments. Further, MFD cooperates

with various research institutions located in Karachi, such as the National Institute of Oceanography and the Centre of Excellence in Marine Biology.

At federal levels, newly created at National level is Ministry of National Food Security and Research (MNFS&R). The Fisheries Development Board which established under MNF&R. It is mandated to work towards a blue revolution with a focus on increasing the fish production of the country It is envisaged that FDB should also be a platform for public-private partnerships for fisheries and a mechanism for an end-end approach for ensuring efficiency in the process of fish production to consumption in the count.

Input Supply

Hatcheries

The large number of fish hatcheries is operating under a competitive market in Pakistan selling fish seed with a price ranging from PKR 0.50-2 per piece depending on its size and species. The imported seed is selling in the range of Rs 7 to 10 per unit. The farmer has the option to buy fingerlings with a size from 10 to 500 grams, normally the most demanded size is 200 gram, the price is much lower for smaller size but mortality rate for small is high. It will further depend if the farmer owns a nursery, he will prefer to buy a smaller lot with less cost but he has to take production risk during their growth.

Fish hatcheries are operating both in the private and public sector, Table 2 provides a detail account of number and distribution of fresh water hatcheries in Pakistan.

Table 2: Number And Distribution of Fresh Water Hatcheries in Pakistan

Types of hatcher	Punjab	Sindh	KPK	Baluchistan	AJK and others
Public	14	5	6	1	2
Private	76	21	10		
Trout	1		8	1	7
	91	26	-	2	9

Source : Ayub. M 2007, Freshwater Fish seed resources in Pakistan, FAO Technical Paper No 502

In all the provinces private hatcheries dominate the market as shown in Table 1. These hatcheries are catering to the needs of the farms at a competitive price and well maintained quality. There are 107 hatcheries in private sector and only 27 in Public sector. Punjab dominates in meeting not only its needs but also supplying seed to other provinces; even some of it is being exported to Afghanistan and Iran.

There are 5 public hatcheries in Sindh, located at Chilya (Thatta), Mirpur Sacro and Sukkar, in addition there are 72 private hatcheries that are providing fish seeds. Shrimp hatchery complex at Hawks Bay is supporting in seed supply and basic research in developing a competitive shrimp industry.

In Baluchistan, there are few hatcheries. In KPK, 8 warm water fish hatcheries and about 30 trout farms cum hatcheries are operating. The DOFs provide technical guidance, juveniles at subsidised rates to farmers as well as other extension services which have resulted in the establishment of a number of trout hatcheries/farms under private ownership. The government has also successfully transferred the technology gained by the Provincial Fisheries Departments to the private sector and as a result the number of farms is increasing.

Feed

Unlike poultry, there is no supply for feed in Pakistan, very limited imported feed is available and is channeled through private and public sector. The major inputs for Carp/farmed fish are feeds, medicines, fertilizers and other materials used in constructing and maintaining the ponds like water, labor, nets, etc. Feed accounts for larger share of 35 % of the total cost of production for fish in a cultured environment. A typical farm use the following ingredients to prepare the feed mix

- Rice Polish
- Soya Cake
- Cotton seed cake
- Maiz Bluton
- Vitamins and mineral Molasses
- Organic and in organic fertilizer
- Poultry waste
- Binders

The above ingredients are mixed with proportion of 15 % proteins, 45 %, carbohydrates and 40 % other ingredients (Punjab Aquaculture Department).

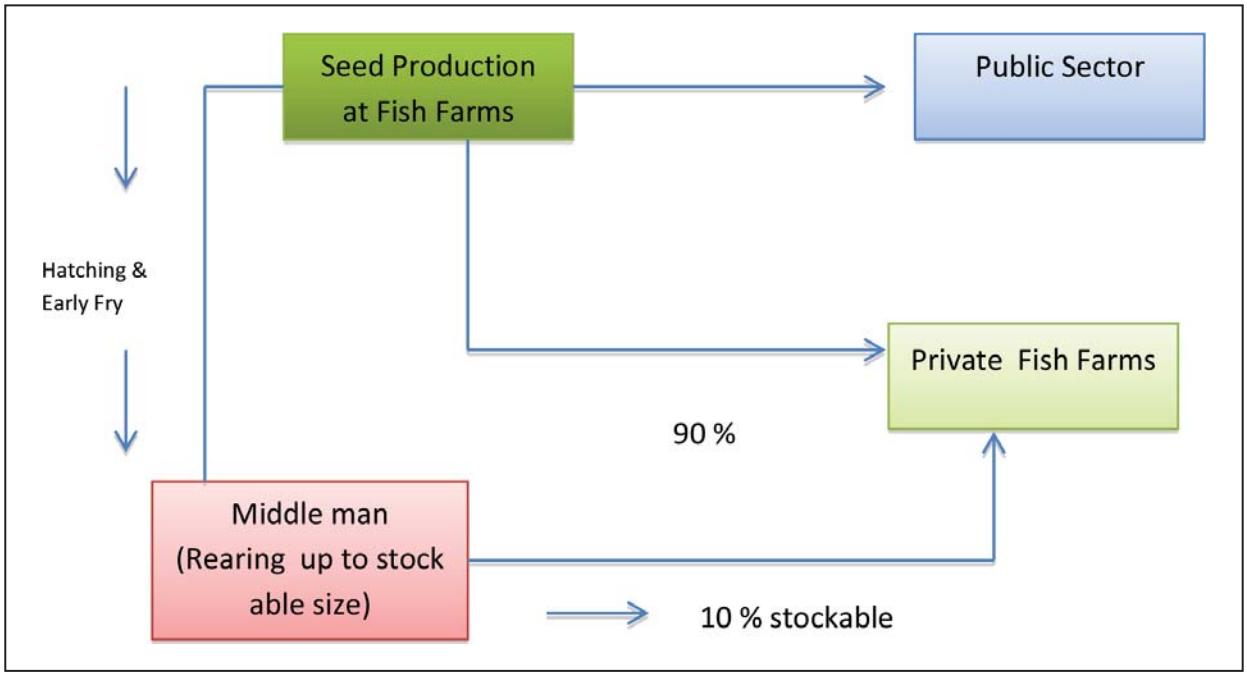
It may be noted that insignificant amount of feed is imported, but may be indirectly as list provided above may have traded and non traded items, for example inorganic fertilizers such as NPK mixtures that might have import components.

Contractual Arrangements in Input Supply

The markets for input supply in fishery sector are not as organized as for other industries. Punjab dominates the fish seed market and supplies large quantities to other provinces, especially Sindh. The fish seed production and marketing structure is such that there few but large scale Government hatcheries that source supply to the private sector as well as to natural water bodies for stock replenishment (Ayub, 2007). The marketing system of fish seed is presented in figure 7. In public sector, the delivery of fishery seeds from hatcheries is based on cash payment. The private sector operates though hatchery facilities that provide input both in cash or kind. Middle men also provide fish seeds to farmers who are in contract to sell produce.

During our survey, it was also revealed that some large fish farms also maintain their own hatcheries and sell the excess supply to other farms.

Figure 7: Fishery Seed Supply Chain



Source: Ayub. M 2007, Freshwater Fish seed resources in Pakistan, FAO Technical Paper No 502

Production System

Producers – Fishers and Fish Farmers

In Punjab, the concentration of aquaculture development is in two clusters, first one is located in Muzaffar Ghar, specially in DG Khan. Polyculture is the common practice with Rahu as a dominant species. The second is Ali Pur Chatta in Gujranwala districts. In Sindh, the number of fish farms in the private sector has increased from 59 in 1980 to 3213 in 2012, producing 47099 tons from an area of 49765 hectors. In Sindh, average fish yield is 550 kg per acre which is almost half that of Punjab.

Carp Farming

Pakistan aquaculture is dominated by indigenous species such as catla (Catla catla), rohu (Labeo rohita) , mrigal (Cirrhinus mrigala) and common carp (Cyprinus carpio). Two fast growing species, the grass carp (Ctenopharyngodon idellus) and silver carp (Hypophthalmichthys molitrix), are being produced under polyculture fishing regime with a view to enhance productivity and competitiveness of the fishery industry and in the process have gained good market acceptance.

More recently, Tilapia is being introduced as a high value fishery that carries a huge potential for fish revolution in Pakistan (see section 5.14). Other species being increasingly introduced is Gulfam (used on in open ponds as it multiply very fast and compete for feed resources) (National Fishery Review 2007)

Shrimp Farming

As reported in National Aquaculture Sector Overview, establishment of shrimp began with the establishment of a pilot scale farming at Garho in Mirpur Sakro District in Sindh The intervention also included creating 80 prospective shrimp farms on 1700 Government allocated land These pilot farms stopped functioning in 1990 primarily due to higher dependence on imported seeds and lack of needed technical skills.

However, the potential of shrimp farming was recognized and Government again initiated efforts to establish a shrimp hatchery complex at Hawks Bay and have it operational in 2001. Our recent visit to the hatchery revealed that it is fully operational, providing research and transfer of technology in shrimp farming. Specifically provision of live food culture, and breeding successfully a number species that are being transferred to the growers. Most of these species are being developed, using indigenous species. The facility is also acting as model for the private sector to invest in shrimp farming.

Trout Farming

Trout is one of the most popular fish, famous for its taste and value. Trout farms are located in Chitral, Swat, Dir, Malakand, Mansehra, Federally Administered Tribal Area (FATA) and other parts of NA. Two species of trout namely brown trout (Salmo trutta) and rainbow trout (Oncorhynchus mykiss) are cultured in NWFP, AJK and NA. are widely fished.

Swat trout industry was well developed but due to conflict in region and recent floods most of trout farms have been damaged and needs rehabilitation. According to a USAID sponsored study out of 24 trout fish farms, five were operational while the rest were dormant due to lack of financing and would need a revival. Firms Project procured and delivered construction material worth USD 127,108 needed to complete facility-level repairs and renovations. As of January 2012, cash grants equalling USD 179,997 have been disbursed to 22 trout fish farms. The fish farms were provided construction materials, operating equipment, pre-formulated imported fish feed and fish eyed eggs worth USD 239,817. (USAID/FIRMS 2012). Revival of this industry on priority basis is needed stimulate tourism based economy.

New Opportunities in Production

Tilapia farming has witnessed vast expansion in developed and developing countries, because of its robust growth rate and hardy characteristics. It can be commercially farmed in ponds, cages, lakes or rivers, or in water tanks or raceways. Fisheries Development Board is promoting Tilapia (GiFT) fish farming in Pakistan to enhance per acre production of fish from 1.5 ton to 5.0 ton per acre. There efforts in Punjab included demonstration of Tilapia production for large number of farmers showing that as much as 4 ton / acre production can be obtained. Its economics also works out very well, with other costs remaining the same, imported cost of seed is Rs 7 per unit compared to Rs 1 for other carp varieties. His gross revenues would jump to Rs 800000 per acre as compared to Rs 200000 from traditional Carp varieties.

One progressive farms in Ali Pur Chatta also reported similar results, the only down side being that feed is imported, with a success rate is only 50 %, and fish stock has to be feed with good quality feed, unlike carp species they need to be fed with certified feed, they cannot live on local indigenous food. Further respondents from Sindh reported hat price of Talapia was high in Punjab due to its demand, this was not the case in Sindh where prices simply collapsed.

In our view it is a success story that can open ways to produce large quantities of fish for domestic and export markets provided we develop a competitive marketing strategy for the fisher sector.

Technical and Quality Requirements

The intensive culture of these species has not yet been adopted so far, the major impediment to this development being the non-availability of low cost feed and to some extent the non-availability of intensive fish farming technology. The productivity of carp farms show marked differences across provinces with Punjab having the highest per unit production followed by Sindh and KPK.

Technology and farm practices include a hatchery, nursery, fry, and fingerling and grow out ponds. Pond area varies from a few hundred square ft. to manmade lakes over 500 acres. The parameters that define food fish farming include: proper site selection, suitability of soils; appropriate water quality, proper farm design; timely manuring and fertilizing.

The farm system is predominantly using extensive culture, bringing more ponds under cultivation, intensive culture has not yet been developed to its potential because of non- availability of low-cost feed and limited production expertise. Fish farm management calendar presently followed for carp is presented in table 3.

Table 3: Fish Farm Management Calendar for Carp

Months	Grow Out Pond	Nursery Pond
January	Dry pond	Maintain water at required rate
February	Dry pond to cracking	Maintain water at required rate
March	Plough the pond bottom until smooth Spread of organic manure evenly	Maintain water at required rate Pre for harvest of advance on fingerling Add inorganic fertilizer
April	Transfer advanced fingerlings for nursery pond to grow out pond	
May	Maintain water at the required level Apply fertilizers Monitor growth on month by month basis	
June	Maintain water at the required level Apply fertilizers at the required rate Monitor growth	Plough pond until smooth Spread Organic Manure evenly on bottom Fill pond with water Add inorganic fertilizer Maintain water at required rate Stock with fingerlings of silver grass carp
July	Maintain water at required levels Apply fertilizers at the required rate Monitor growth	Maintain water at required rate Apply Fertilizers at the required level Monitor growth Stock with fry of Rohu, Mori and Catla
August	Maintain water at required levels Apply fertilizers at the required rate Monitor growth	Maintain water at required rate Apply Fertilizers at the required level Monitor growth
September	Maintain water at required levels Apply fertilizers at the required rate Monitor growth	Maintain water at required rate Apply Fertilizers at the required level Monitor growth
October	Maintain water at required levels Apply fertilizers at the required rate Monitor growth	Maintain water at required rate Apply Fertilizers at the required level Monitor growth
November	Maintain water at required levels Apply fertilizers at the required rate Monitor growth	Maintain water at required rate
December	Harvesting by draining entire pond for marketing Drain, dry the pond	Maintain water at required rate

Source: Fishery Manual (2006), Punjab Fishery

Risks in Production

At production levels water scarcity has been highlighted as a major risk, than stealing of fish stock is very common, especially prevailing on large farms. Farmers also complained that adhoc policy shift for fishery export regime is resulting in distorted incentive structure; recent ban on export to Afghanistan is resulting in significant price drop which is difficult to absorb given rising cost of energy. Than there are number of risk s due to water related diseases and quality, that requires special skills on part of fish farmer to address. Finally, defaulting on loans is often cited by Arthi as the main, production and marketing risk.

SWOT Analysis

SWOT Analysis for Carp Fishery in Pakistan

Table 4: SWOT Analysis for Carp Fishery

Strengths	**Treats**
• Profitable business with good management practices and enjoys economies of scale • Less labour intensive than mainstream agriculture • Improved food security- ready protein source • Make use of waste land • Make use of water logged lands	• Floods • Crime & theft • Highly perishable • Prone to diseases
Constraints	**Opportunities**
• Insufficient supply of fingerlings • Unsuitable weather conditions • Lack of technical assistance from government. • Low productivity • Low margin and limited amount of free cash flow available owing to low fishing yields • Fish farming costs (fuel/energy) have risen, while fishery prices have either remained steady or declined in real terms, imposing financing shortfalls and indebtedness to fish farms. • No accredited aquaculture input suppliers • Considerable untapped commercial aquaculture in coastal areas • Post-harvest losses are high due to poor handling practices, • Poor quality raw material for processing and consumption. • Poor physical infrastructure in fish markets • Lack of preservation facilities • Lack of proper fish handling and processing.	• Fish is a major source of nutrition and contributes to the food security and poverty alleviation • Relative prices of competing meat products have risen. • Consumer willingness to pay high price for trout • Fish farms when converted to main stream farming often provide higher productivity better returns • To diversify production base

• Lack of equipment for chilling • Few processing units available in Punjab • Lack of cold chain facilities • Poor adherence to food safety protocols and farm to market traceability • Lack of legislation and rules regulating aquaculture production, processing, transportation and marketing. • Dominant role of Arthi • Lack of access to affordable financing • Lack of support structure and institutional organization	

Recommended Actions for Carp Fishery Value Chain Development

- Need to increase per unit production from fish ponds on a sustainable basis
- Strengthening of inland aquaculture production.
- Develop high potential zones for inland aquaculture.
- Attract private sector investment in inland aquaculture production.
- Development of aquaculture in coastal areas
- Develop high potential zones for coastal aquaculture.
- Attract private sector investment in coastal aquaculture production.
- Facilitate the establishment of the culture of shrimp, finfish and mud crab in coastal areas of Sindh and Baluchistan.
- Ensure that environmental concerns are fully taken into account in coastal aquaculture development.
- Introduction of licencing system based on sustainable use of fishery resources
- Institutional improvements and development within the fisheries and aquaculture sectors
- Strengthen current fisheries institutions through a better demarcation of roles and responsibilities, establishment of fishery institute is on the table and be supported.
- Address current fisheries and aquaculture legislation and regulations shortcomings
- Recognize and promote the role of communities in fisheries management in coastal and inland areas
- Developing shrimp hatcheries to meet increasing demand
- Further develop the Aquaculture Training Centre at Chilya in Thatta and other brackish and fresh water centers
- Promote shrimp aquaculture with private –public initiatives
- Support FDB to undertake water quality survey in existing and new areas expected to be used for aquaculture.
- Promote FDB initiative to promote high value fishery, especially Tilapia
- Capitalize on Hawks Bay hatchery in developing a competitive fish industry.

SWOT Analysis for Trout Fishery

Table 5 : SWOT Analysis for Trout Fishery

Strengths	**Treats**
• Main and profitable economic sectors in Swat • Lowest price premium is mostly preferred by the customers • Swati trout fish, with comparatively higher prices • Demand is high in summer which is not the case for other fisheries	• On-going Conflict • Recurring Floods • Raised in cold water, highly perishable
Constraints	**Opportunities**
• High prices compared to other available fish • Non-availability of trout egg hatching equipment and its accessories such as fish graders • Poor management of trout fish farmers • Inconsistent supply • Low fish demand • Lack of proper fish handling and processing • Lack of equipment for chilling • No processing units available in Swat • Poor flow of market information between local, national and global markets • Lacks of cold chain facilities • Strict adherence to food safety protocols and farm to market traceability are increasingly sought by consumers • Lack of proper certifications and branding/labelling • High cost of compliance • Lack of legislation and rules regarding production, processing, transportation and marketing	• Developing a competitive trout industry • Promote tout fish marketing • Logo that can promote trout fishery in Swat • Potential to increase fish catch from 35 MT to 100 metric tons • Consumer willingness to pay high price for trout

Recommended Actions for Trout Fish Value Chain Development

The study recommends the following to address some of the gaps identified in trout production, processing and handling techniques. They are largely drawn from FIRMS/USAID study on Trout demand analysis.

- Strengthen the capacity of various public and private sector departments through on-going training programs in best management practices, upgraded equipment and laboratories
- Provision of high quality inputs such as fish feed and seed to enhance trout production.
- Technical and material support to trout fish farmers in establishment and construction of fish processing units set up on the farms.
- Technical and material support to the Trout Fish Farmers Association on a cost-sharing basis.
- Investment in the development of cold chains from trout farms to the market
- Development of marketing linkages in high value market cities of Lahore, Islamabad, Karachi, Peshawar and other cities, where there are opportunities for the product to fetch a higher profit for local fish farmers.
- Continuous market price surveillance and flow of information from the market to the farmers.
- Promote collective action or contract farming in developing a competitive trout industry for KPK.

Economics

Market Price Analysis

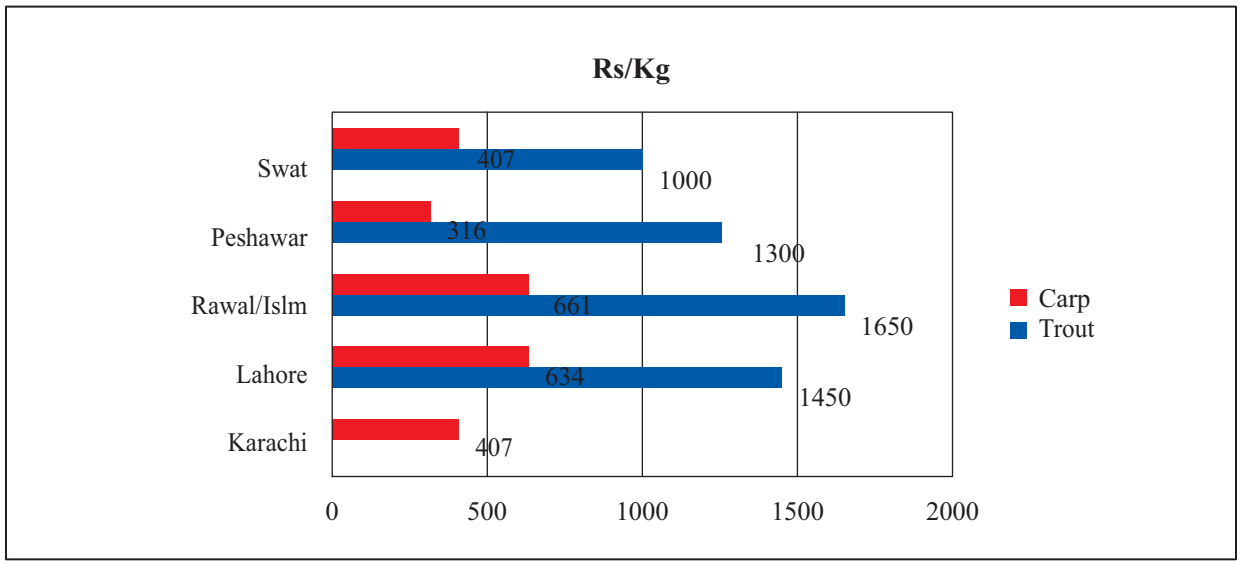
In Pakistan, the per capita fish consumption is about 2.0 kg/yr., which is extremely low compared to world average of 18.4 kg per person. The demand for fish is seasonal but is on the rise due high prices of alternative meat like, beef, mutton and chicken. Fish is also perceived as healthy food compared to other meats.

Consumers prefer river to farm or marine fish and are ready to pay more, the price difference between river and farm fish is about Rest. 100 per Kg. Based on our field work, the price of fish ranges between Rs 150 to 450 per kg, depending upon the size and type (table 4). The price of Rahu in year 2002 in Lahore fish market was selling at 69 per Kg, ten years later it is selling as high as Rest 300 per Kg, depending on the size. This increase is partly explained by phenomenal rise in all other forms of meat prices. Further supply has not kept pace with the demand.

Rohm (Label rohita) has a substantial local market, table below shows relationship of fish size and price, and a good market size is usually 2 kg+ up to a maximum of 3 kg. Prices tend to decline when the fish is more than 3 kg in weight; factors include freshness of the fish and the supply/demand situation in the market. The fish market works by a simple logic: fish of larger size is sold more expensively while fish of smaller size is sold cheaper

Table 6: Fish price of Rahu per kg according to size recorded in Lahore Fish market	
Size of Fish	**Price Rs Per Kg**
Less than 1 Kg	240
One Kg	260
1.25 Kg	280
1.50 Kg	300
2.00 Kg	320
2.50 Kg	340
3.00 Kg	360
3 and above	Same

Figure 8. Fishery Prices : Trout and Carp



Source: USAID/FIRM study on Fish Demand analysis for Trout

A comparative price analysis of trout and traditional carp varieties indicates (figure 8) trout prices in all cases are more than double compared to carp fish commonly used in all major cities. The prices for both carp and trout are highest in Rawalpindi and Islamabad markets. The USAID/FIRMS study further reveals that traders from Karachi and Rawalpindi/Islamabad prefer produce be marketed at Mandi or Super Markets with transport cost to be incurred by producers.

Profitability Analysis

Carp Farming

Based on 2006-07 data, a farm fish analysis for mix of carp species was undertaken by Punjab Aquaculture Department, with farm sizes of 2.5 acres (one ha) considered small farm and 10 acre relatively large. In Sind the average size of farm is 5 acre. The analysis reveals (Table 7) that returns on fish farms are quite high and as the size of farm increase, the profitability jumps from R 81100 per ha for 2.5 acre farm to Rest 455000 for 10 acre farm. For this reason the number of fish farms both in Punjab and Sindh are on the rise.

Table 7: Economic Analysis of Fish Farming, 2006

Items	**2.5 Acres**	**10 Acres**
Production (Kg)	2500	10200
Income (Rs)	187,500	765,000
Costs (Rs)	105,400	310,000
Net Benefits (Rs)	81100	455000
Source: Punjab Department of Fishery, Lahore		

Based on the consultant's field visits a rapid market and economic analysis was undertaken for Rahu. Similar analysis was completed for Trout based on secondary data and recent USAID/FIRM report. Both these fish species are highly demanded, Rahu in the low end markets and Trout in the high end markets.

Rahu value chain analysis is presented with two variations, one with minimal processing taking place according to consumer specification like removing scales, cutting, cleaning, salting and packing. The second, where a large number of fish shops/ restaurants are selling fried fish with value addition at the retail levels, these shops are very popular during winter. Only within a span on one month the price for fried fish increased by PKR 100 per kg due to very cold weather this year.

Table 8. Rahu Traditional Business Model (SMEs)			
		Rs Per Kg	**% of Consumer Price**
Retailer	Selling Price	335	
	Buying Price	203	
	Difference	132	**39.39**
Wholesaler	Selling Price	203	
	Buying Price	188	
	Difference	15	**4.49**
Producers	Selling Price	188	
	Buying Price	-	
	Difference	188	**56.12**

The second business model is a case where direct contract takes place between large and modern market likes Metro and progressive fish farms in Muzzafar Ghar or trout farms in Swat. These farms supply the produce on a regular basis transported in packed iceboxes; a picture of this model is also provided below. A variation of this model is selling trout to high end markets in Punjab is also presented below.

For fish farmer producing Rahu in traditional business mode (Producer-trader- consumer) is obtaining 56 percent of the consumer price (table 6), his revenues per kg stand at Rs 188 and the cost of cost of production was estimated at Rs. 54.49 per kg, yielding a net profit of 131.51.

Fish from Muzzaffar Ghar shipped to metro store in Lahore

Table 9: Rohu Processing Business Model (SMEs)			
		Rs Per ton	**% of Consumer Price**
Processor	Selling Price	590	
	Buying Price	335	
	Difference	255	43.18
Retailers/Wholesale	Selling Price	335	
	Buying Price	203	
	Difference	132	22.38
Farmer	Selling Price	188	
	Buying Price	-	
	Difference	188	31.88

Arthi trading Rahu in a typical wholesale market, is charging 4.49 percent of the consumer price (table 8) this may look small but given his volume of turnover, income can be substantial. His revenues per kg stand at Rs 207.29 and the cost of production was estimated at Rs. 195 per kg, yielding a net profit of 12.49 per Kg.

Retailer, trading Rahu in a typical retail market, is charging 39.39 percent of the consumer price (table 8), quite sizable but less than the what farmers receiving, again his volume are large and so is his yearly income. His revenue per kg stands at Rs 335 and the cost of production was estimated to be Rs. 213 per kg, yielding a net profit of 122 per Kg.

Finally, processor selling fried Rahu fish in medium and large cities, is charging a 31.88 percent of the consumer price (table 9), sizable and considerable larger than the farmer, again his volume can be sizable and so his yearly income (see picture below). His revenue per kg stand at Rs 590 and cost of production was estimated at Rs. 410 per kg, yielding a net profit of 179 per Kg.

Tilapia: The Prices and Profitability Analysis

Tilapia production systems appear to be well-suited for adoption by small scale producers because the initial capital investment, especially for cage culture, is not high. Because of the industry's potential for providing income to small-scale producers and protein to consumers, a more detailed economic analysis is perhaps needed; here we have done a rapid economic analysis providing comparison of traditional Carp species with tilapia for its productivity, prices and profitability.

Tilapia yield in the range of 3 to 5 tons per acre was reported in comparison to 1 ton achieved for traditional carp species in Punjab and .550 tons achieved in Sindh. (see figure below 9 &10)

Figure 9: Tilapia Versus Carp Fishery

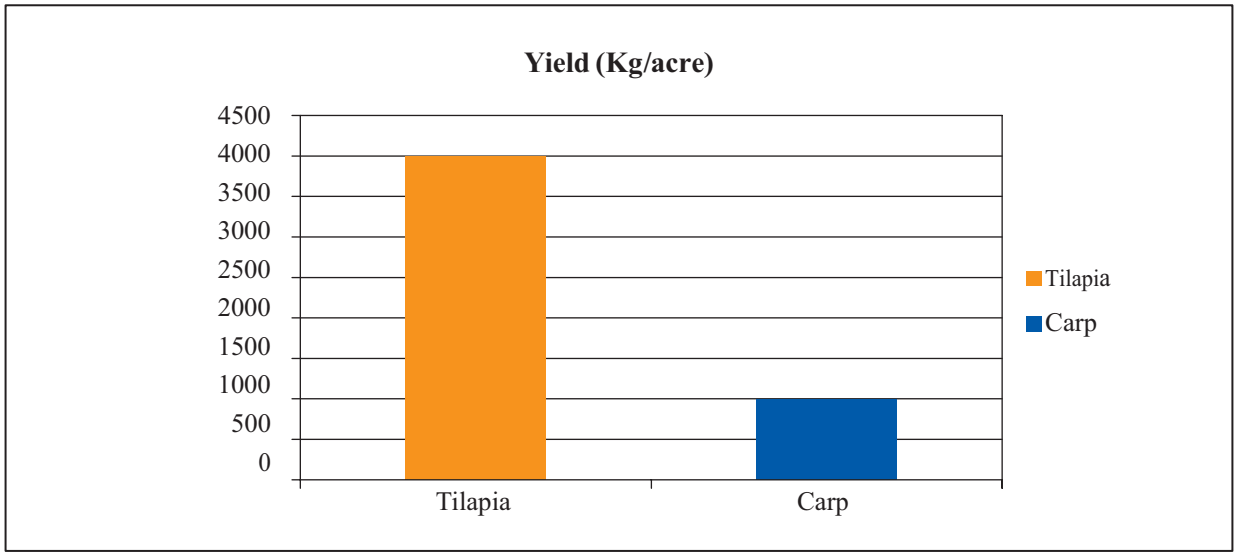
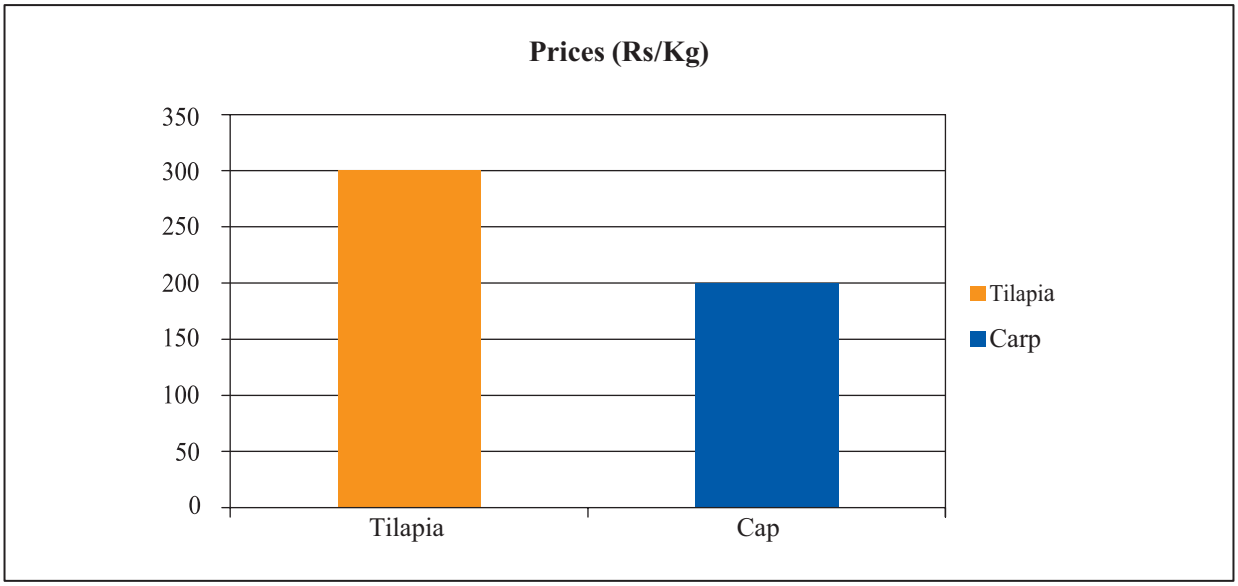


Figure 10: Tilapia Versus Carp Fishery

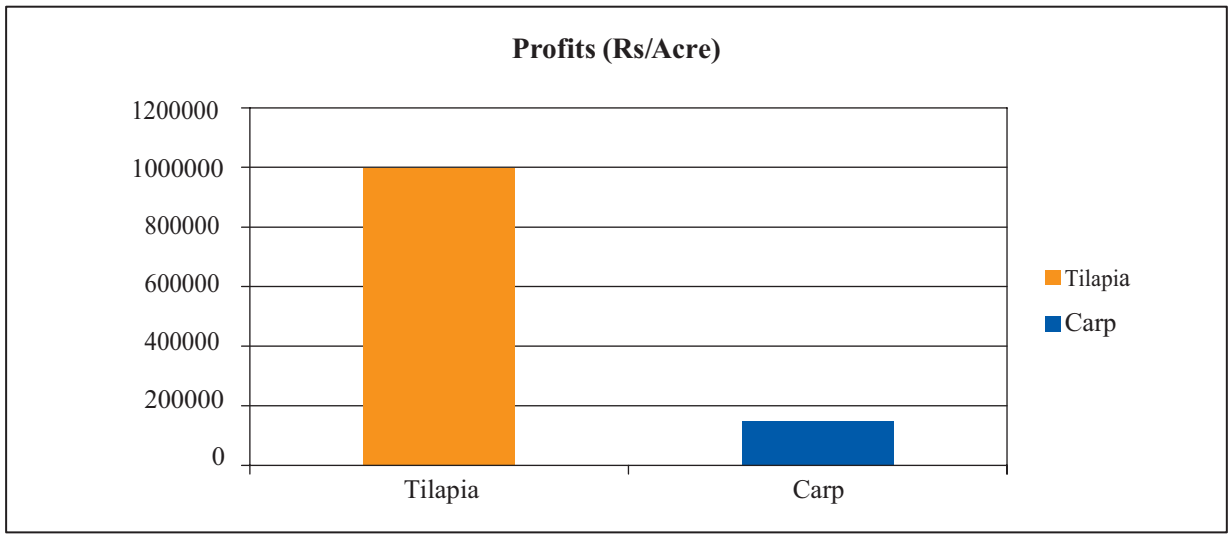


The prices received by Tilapia producers have been in the range of Rs 200 to 300 per kg, with averaged at Rs 250/kg. Price primarily varied according to the size of tilapia sold, with larger fish fetching higher prices. The costs of production for Tilapia produced on one acre farm is estimated at Rs 200,000 per acre, in comparison cultivating carp fishery costs Rs 50,000 per acre (figure 12). The average revenue is estimated at Rs 1200000, with net profit of Rs 1000000. In comparison for Carp, the revenue was estimated at Rs 200,000 with net profit of Rs 150,000 (data from FDB) . Since most of the tilapia farms were operated as secondary sources of income, this total return is quite attractive given low return in alternative farming activity. It is pointed out that these abnormal profits are due to first movers in the chain, as other potential investors join, normal profits would prevail.

The above analysis is based on ideal condition obtained at a pilot work on progressive farms, some farmers complain that Tilapia management is lot labour intensive and the success rate of imported seeds is only 50 % that makes it profitability questionable, further research is needed to look at most binding constraints to promote its culture. Considering that seed costs can range from 35-70% of total variable costs for tilapia production in cages or fishponds, the ability of hatcheries to produce low cost, high quality fingerlings is an important element for continued success and in developing a sustainable and competitive industry.

Tilapia industry well developed in some countries, trend is to establish large-scale centralized hatcheries which, in addition to providing potential advantages of economies of scale, appear to be designed primarily to allow for the maintenance of high quality brood stock.

Figure 11: Tilapia Versus Carp Fishery



Future actions are needed to establish Tilapia fish hatcheries in partnership with private fish farmers in Sindh and Punjab for easy availability of tilapia seed in Pakistan. Than feed is also imported for the time being, support to establish a fish feed plant would be investment in right direction. It is essential to identify an appropriate market and develop a strong marketing strategy before embarking on an activity of this nature.

Three major areas of concern are critical for the further development of the tilapia farming industry in Pakistan, (1) the need for improvement of tilapia broodstock for the production of high quality fingerlings, (2) the commercial production of economical feeds for intensive culture and (3) development of market strategies.

In order to address meaningfully the above issues, credit assistance and adequate extension service should be provided to encourage the tilapia producers to adopt improved management practices.

Trout Profitability

Trout producer in swat is obtaining 62 percent of the consumer price. The product is marketed directly by the producer or in few cases through middleman. The reported selling price ranges between Rs 1200 to 1600 in superstores in Islamabad and Lahore. The retailer/processor is making 32.43 percent of consumer price and farmer a healthy 62% of retail price . The revival of trout farming would benefit fish farms and bring back economic welfare to the region. The SOWT analysis brings out key issues and options for reviving and developing trout industry.

Table 10. Trout Semi Integrated Business Model (SMEs)

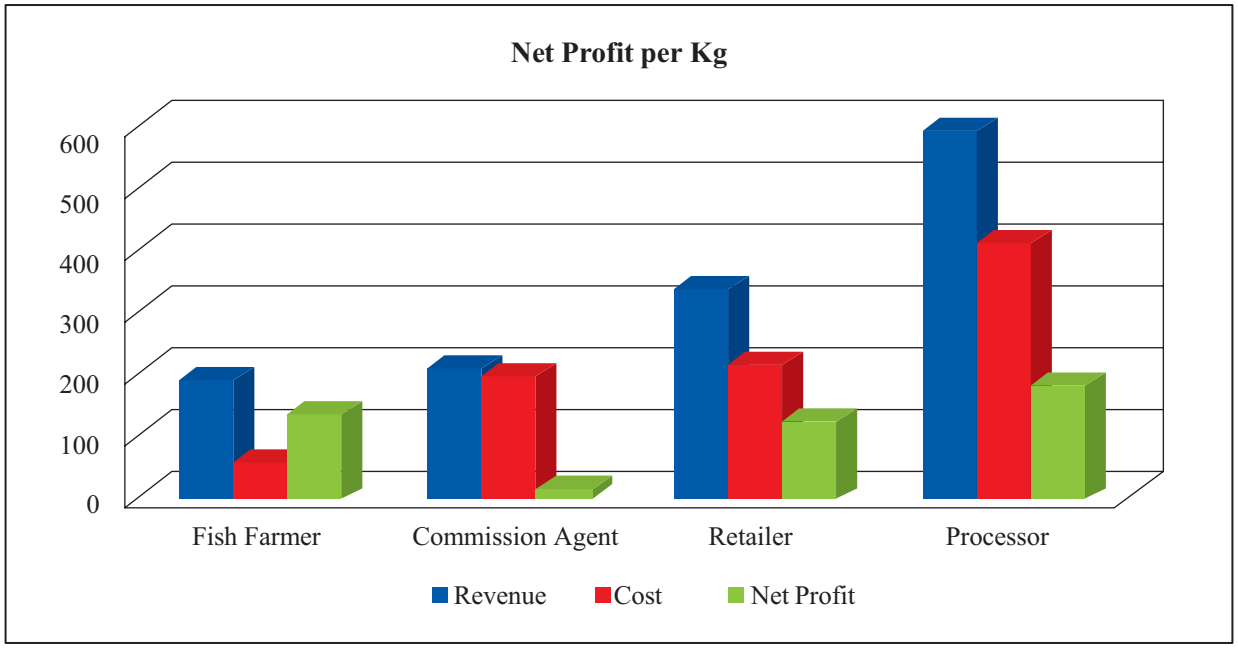
		Rs Per ton	% of Consumer Price
Processor	Selling Price	1598	
	Buying Price	1080	
	Difference	518	**32.43**
Wholesaler	Selling Price	1080	
	Buying Price	1000	
	Difference	80	**5.01**
Producers	Selling Price	1000	
	Buying Price	-	
	Difference	1000	**62.56**

Comparative Analysis of Costs, Revenues and Profits

Figure 12 below provides a summary of the analysis with revenues, costs and profits per kg for each agent within the chain. Clearly all agents make reasonable normal profits with processor making highest profits as he adds value to the produce. This indicates the fact that a small investments in value addition can result in larger benefits, the analysis further reveals that farmers per unit costs are lower than all other agents in the chain but if we consider returns per unit of labor his returns would be quite low. This profitability also depends on source of water, farmer with tube wells as source of water supply are incurring high costs than by those with canal water access.

A thorough research is needed to work out the fish profitability with different ecological, technology in use and species, an exercise useful for both policy makers and potential investors.

Figure 12: Rahu Fishery Value Chain in Lahore Market



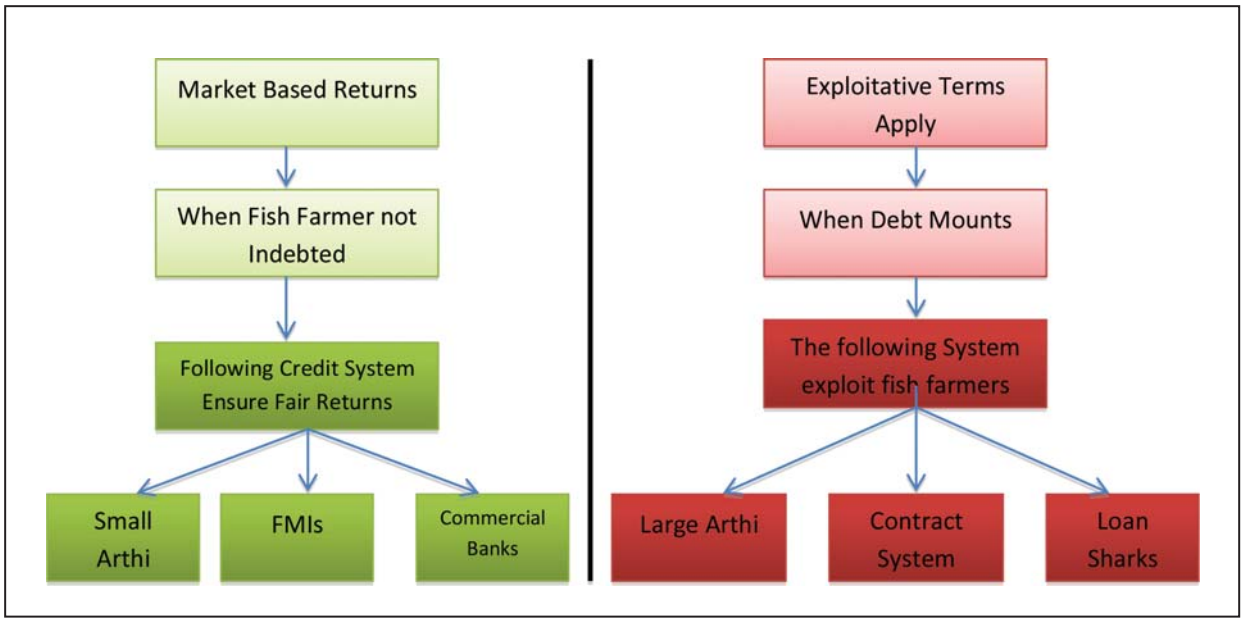
Access to Finance

Financing in the Fishery Value Chain

There are two broad types of financing mechanisms exist in the value chain: Institutional through banks (Formal) and Non Institutional (Informal), Friends, relatives, Arthi, Wholesalers, Storage Operators, Processors, Input Suppliers. A good 90 per cent of financing comes from informal sector dominated by Arthi.

Figure 13 highlights the importance of credit in fishery industry, a typical poor farmers/fisherman's are caught vicious cycle of poverty and are locked them into a debt cycle due to low appetite for risk, investment, productivity, market orientation, value addition and economic wellbeing. The Arthi dominated system extends loans to meet fish farm operating costs. Under prevalent system, fair returns to fish farmer in the value chain are only possible to those who are debt free or if they are able to repay their loans within a season. These are farmer who take loan but are caught debt cycle, are fully exploited by the middle man, a case prevalent not only in fishery but so common in Mandis for grains, fruits and vegetable.

Figure 13: Characterization Credit, Market Based or Exploitive



Source: Shaheen Rafi Khan, Fahd Ali, Azka Tanveer, "Compliance with International Standards in the Marine Fisheries Sector, A Supply Chain Analysis from Pakistan Sustainable Development Policy Institute (SDPI)December 2005.

In Punjab, like in other agriculture value chains, a majority of small fish farmers main source of financing is Arthi or commission agent who operate through input supply dealer. The financing system varies from one province to the other and even within Mandis in a province. A typical small fish producer who owns his pond, net and few other assets borrows from the Arthi (middleman) for his working capital. He is not compelled to sell to the same Arthi but must pay him a commission (varying from five to 10 per cent of the value of the catch) as repayment for the loan. When an Arthi lends money for both product development and for working capital he is obligated to auction his catch through him and pay him a higher commission (seven per cent production trading cycle). The Arthi also makes profits as he tends to under-weigh the catch.

In Sind and Baluchistan, the fisher farms or fisherman need financing for developing a fishery farm, which include loans to purchase land and other equipment to set up a fishery farm. They also need financing for working capital for purchase of fish seedling, feeds and other running expenses. In Sind, alternative system is also operational that bypass the traditional auction system being followed at Karachi fish harbors. It operates through category of small beopari named vichaatey purchasing fish directly from fishermen. The vichaatey work for large beoparis, who are agents for the processing plants which export fish and shrimp, or convert trash fish into chicken feed.[14] The vichaatey charge the large beoparis a commission between five and 10 per cent. Similar arrangements are reported for Baluchistan.

Medium to large farmers are in a position to obtain limits from the bank for working capital. Again the dividing line is not so clear, even some large fish farms do go to Arthi but they are exceptions. At the retail levels again commercial banks do provide a line of credit to traders.

For financing the trout value chain, USAID/FIRM study reveals that more than half of the agents in chain purchase fish on credit basis with payments made within 2-4 weeks to the suppliers, whereas one-thirds of respondents purchasing fish on cash payment. The mode of payment to fish suppliers includes payments in cash, on credit basis and in some cases a combination of both. Further it highlights that agents in Karachi, Peshawar and Swat are willing to buy fish on credit, while in from Lahore were interested to pay fish on cash payment.

Not many agents within the fishery value chain are aware of availability of formal credit. According to State Bank policy of financing the fishery sector,[15] financing to fishermen is available to meet daily expenses i.e. working capital and long term investment for purchase of boats & equipments, construction of cold storage, ponds, tanks etc. Regarding eligibility of finance for fisheries, loan can be extended to individuals, fishermen, fish farmer, and corporate firms. Cooperative societies/self help groups, fish catching/processing/packing companies and fish exporters having sufficient knowledge and relevant experience provided the ACO/ Branch Manager is satisfied with the capacity of the borrower and subject to fulfilling requisite conditions. (State Bank Manual).

[14] Good overview on marketing fishery, one of few studies done on fishery in Pakistan on "Compliance with International Standards in the Marine Fisheries Sector, A Supply Chain Analysis from Pakistan by Shaheen Rafi Khan, Fahd Ali, Azka Tanveer Sustainable Development Policy Institute (SDPI)December 2005.

[15] 1.Competitive Support Fund 2006, Sindh Fisheries and Aquaculture Strategy 2010 – 2013
2.Credit policy of State Bank of Pakistan for fishery sector.

The acceptable collateral to banks for fisheries financing are personal surety, hypothecation/mortgage of assets e.g. motor boats / fishing trawlers, mortgage of rural, urban or commercial property and/or Pledge of SSC/DSC, lien on bank deposit, bank guarantee and/or Pledge of gold and gold jeweler and /or; Individual/Group Guarantee (maximum per person exposure as mentioned in PRs for agriculture regarding personal guarantee).

Role of Arthi

Arthi has much larger role in fishery value chain than other players, much more evident than some of commodity markets where processing is important part of the chain, they have also market leverage as most of them have storage facilities. They grade the fish in according with size and accordingly lots are made, auction takes place with floor price set by Arthi according to market, but in our view this does not have any transparent procedure, this is where some parties can collide to create rents.

The market committee prescribed the commission agents to receive 10 percent commission fees from the buyers of fish. This rate varies a bit, at time giving discount to most regular and reliable clients. Commission agent also gave the credit to producers and contractors with some conditions such as the producer or contractors will sell their produce through the commission agent and commission agent will charge a 7 percent commission fee from producer or contractors. Most of time, the commission agent disposed off all the fish catches preferably on the same day or within next day the most.

A brief regional perspective is presented. In Punjab, the consultant interviewed a number of commission agents in Lahore and Gujranwala districts, operating out of wholesale markets. The auction in Lahore Mandi takes place early in the morning, from 6 to 10 am, but in regional markets like in Ali Pur Chatta it takes place in the afternoon at 4 pm. The commission agents have shop owned or rented with one or two employed laborers to undertake loading, unloading, grading, weighing cleaning and storing the fish. After price is settled in the auction, the seller's gets some part of deal; rest is paid within two or three days. The buyers have more time (two weeks) to pay pack the Arthi.

Since the Arthi advances the cost of the inputs and is repaid from the harvest sale, the return to the Artie can be high. They emphasized the point that he faces considerable risks in their business, in addition to the carry cost of providing the inputs. There is the risk of fishery production failure or disease and more importantly, the risk of fish farmer defaulting or selling to another agent.

Relationships between the fish farmer and Arthi are often more temporary and price-driven than in the case of contract farming and out-grower schemes. The major contribution of such institutional set up is that he is providing a market access to poor fish farmer otherwise difficult to obtain. Arthi credit is also vulnerable to "side-selling" arrangements, in which the farmer sells his or her product to competing buyers rather than making good on their purchasing agreement with the "lender."

The matrix in table 11 below provides insight on two things, the financing nodes and each agent needs for working and fixed capital.

Table 11: Working and Fixed Capital Needs with Fishery Value Chain

Participant in the Chain	**Financial Needs**	**Financing within the Chain**	**Financing from Outside the chain**	**Awareness on Available Financial Products**
Input Distributor	Working Capital (WC) Fixed Capital (FC)	Factory Purchased Capital	MFIs, Commercial Banks	None
Farmers	Working Capital (WC) Fixed Capital (FC) Household Budget (HB)	Self Financing Friends and relatives, commodity based per-finance and credit providers, Arthi, and input stockist	Informal Money Lenders, FMIs and ZTB	None
Processors	Working Capital (WC) Fixed Capital (FC)	Pre-financing from Exporter	Commercial Banks	Low
Whole sellers/Exporters	Working Capital (WC) Fixed Capital (FC)	Pre-financing from Exporter	Commercial Banks, MFIs	Very Low

Enabling Environment

Regulatory Environment

As documented in National Aquaculture Sector overview, the governing fisheries ordinances and supporting legislation and regulation are promulgated by the provincial DOFs. It provide rules and regulations for the marketing, handling, transportation, processing and storage of fish and shrimp for commercial purposes and the sale of fish used for domestic and inter-provincial trade. Non compliance with ordinance is punishable by imprisonment of up to six months or fines of up 10 000 rupees or both. The rules further calls for a total ban on the use of destructive fishing gears as well as a closed season for the catching of shrimp during June and July. Further MINFAL (now MNFR) polices granted concessions and incentives pertaining to credit and financing facilities, import and export policies and the provision of fishing gears and equipment such as navigational and electronic fishing aids.

Pakistan used to exports its major catch of shrimp to the European market. Because of its inability to comply with EU health safety standards (technical regulations), it has faced embargoes on its exports, first in 1998 and again in February 2005. The embargo still stands and its removal depends upon complying with European processing standards. For this reason our exports are directed towards low-end markets where compliance with standards and safety rules are not strict.

Increasingly the tough standards are now even not only for meeting health and sanitation practices in the processing plant but also backward links to good fish farming practices, in the auction at the Mandi and in the transportation of catch to the processing units. Right now the problem is being addressed at processing levels, to make fishery and aquaculture competitive in export markets, but very little to done for problems at the pre-processing stage. It needs sizable investment in developing farmer capacity and in building necessary infrastructure at marketing levels. We need to start to create policy and regulatory framework at pre-processing and harvesting levels of the supply chain.

Provincial Laws

The Sindh Fisheries Ordinance, 1980, includes rules and regulations for marketing, handling, transportation, processing and storage of fish and shrimp for commercial purpose and sale of fish used for domestic and inter-provincial trade

- Sindh Fisheries Rules 1983, 1995.
- Karachi Fisheries Harbour Authority Ordinance, 1984. Coastal Development Authority Act of Sindh, 1994. The Baluchistan Sea Fisheries Act No. IX 1971.
- Baluchistan Sea Fisheries Ordinance Amendment, 1994. Baluchistan Sea Fisheries Rules, 1971. Federal laws Exclusive Fishery Zone Act, 1975.
- Exclusive Fishery Zone Rules, 1990.
- Territorial Waters and Maritime Zones Act, 1976. Pakistan Environmental Protection Ordinance, 1983. Pakistan Environmental Protection Act, 1997.
- The Agricultural Produce (Grading and Marketing) Act, 1937. Dry fish, shell fish and fishmeal are graded according to this act.
- The Pakistan Animal Quarantine (Import and Export for Animal and Animal Products)
- Ordinance 1979: The “health certificates” are issued to regulate trade and to check the introduction of or spread of diseases.
- The Karachi Fisheries Harbor Authority Ordinance 1984:
- The Coastal Development Authority Act Sindh Act No. XXVIII 1994
- Pakistan Fish Inspection and Quality Control Act, 1997: Deals with the registration and inspection of fish processing plants.

The MINFAL has formulated policies from time to time according to prevailing requirements. They include:

- The Agriculture Produce (Grading and Marketing) Act, 1937, provides authority and control for the grading and marketing of agricultural produce. Dry fish, shellfish and fishmeal are graded under the provision of this act.
- The Pakistan Animal Quarantine (Import and Export of Animal and Animal Products) Ordinance, 1979 law provides for control of the import and export of animals and animal products, and the issue of health certificates to regulate the trade and to prevent the introduction or spread of diseases.
- The Federal Government, vide Notification No.F.272/FDC/99 dated 6 April 1999, in exercise of the power conferred by Section 12 of the Pakistan Animal Quarantine Ordinance, exempts the export of fish and fishery products from all the provisions. The Sindh Fisheries Ordinance, 1980, provides rules and regulations for marketing, handling, transportation, processing and storage of fish and shrimp for commercial purposes and sale of fish used for domestic and inter-provincial trade in the Province of Sindh. Contravention of this Ordinance is punishable by imprisonment up to six months or by a fine of PRs 10 000, or both. A provision has also been included for a total ban on the use of destructive fishing gear, and for a closed season for shrimp during June and July.
- The Pakistan Environmental Protection Ordinance No. XXVII, deals with protection, conservation and improvement of the environment for the prevention and control of pollution, including biodiversity, ecosystems, effluent, hazardous substance emission and water pollution. It also provides for rules for implementing international environmental agreements.
- The Pakistan Fish Inspection and Quality Control Act, 1997, deals with the registration of fish processing plants and fish exporters, and constitutions and functions of the inspection committee.
- A first attempt would entail harmonizing federal and provincial fishing policies through a consultative process involving all the important stakeholders; in particular, the representatives of the fishing communities who have first-hand knowledge of the problems and issues which affect their livelihoods.

Conclusions and Recommendations

Identified Issues

1. ***Production*:** Insufficient supply of quality fingerlings; Poor on farm fishery practices; lack of intensive culture; lack of access to affordable financing, very high cost of water.

2. ***Harvesting:*** Post harvest losses; Poor or lack of business management skills; market access.

3. ***Marketing & Competitiveness; Fish***
Unstable prices; adhoc policy shift; Farmer caught in vicious cycle low appetite for risk leading low investment in productivity, market orientation, value addition and profitabity along the chain.

4. ***Enabling Environments:*** Outdated legal and regulatory framework ; Poor Institutional set set up to support the sector; Very little processing in Punjab, Mandis need complete upgradation with greater role of private sector.

Proposed Actions

1. ***Production*:** Developing local feed Industry; Effective Extension services; Provide training on fishery management; Diversify production; Promote Talapia fishing: Increase Access to Finance.

2. **Harvesting:** Provide Training on harvesting and post-harvesting practices; improve transport/hauling material (add value); promote cold chain.

3. **Marketing & Competitiveness:** Business managemnt skills; Market access; improve market orientation; create producer groups or promote contract farms.

4. **Enabling Environments:** Reforming the Mandis; Develop high potential zones ; Strengthen fisheries institutions & establishment of fishery institute; IT based information data creation and sharing.

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