# Promoting innovations in fisheries value chain for improving human nutrition in South Asia-Pakistan's Perspective

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**By**

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**Abstract:**

Pakistan has about 79200 sq km water cover area of natural resources in the shape of river, lakes, dams', barrages, wetland areas, coastal areas and about 290,270 sq km EEZ. Pakistan's total fish production is about 0.807 million metric tons, of which 62 % was from Marine fisheries, and 38 % from inland fisheries and aquaculture. Pakistan is the 5th most populated country in the world having around 222 million people. Fish consumption in the country is currently very low, about 2 kg per year per capita, compared to a global average of 17 kg. Greater fish production can increase fish consumption directly if smallholders who produce or catch fish eat it, or indirectly if the greater production stabilizes prices and creates wider availability in local markets. in the marine sector most of the fish process only in the frozen form which fetch low prices in the international market. In the inland aquaculture mainly, carp is being produced which consume locally, Tilapia spp. is a recent entry into aquaculture in Pakistan. Value chains are incomplete and require investment in infrastructure development and regulatory framework.

**Keywords:** value chain, poverty, seafood, aquaculture, fisheries.

# 1. Introduction

Pakistan has plenty of natural water resources as fresh, marine waters and brackish waters. Pakistan has inland water covered area about 79,200km2. The length of coastline is about 990 km with Economical Exclusive Zone of 350 nautical miles, that covers an about 290,270km2. Fisheries sector provides employment to about 400,000 fisher or fish farmers and about 600,000 people in allied industries. Pakistan has 193 freshwater fish species and about 800 marine fish species. Only 31 freshwater fish species are considered as commercially important while, 120 marine species are commercially important. The consumption of fish is about 1.9 kg per capita per year. Currently fisheries sector contributes about 0.4% to the national GDP.

As per estimate, the total area covered by fishponds across all provinces is about 80,000 ha, mainly in Sindh and Punjab and few in other provinces (Balochistan, Khyber Pakhtunkhwa, Azad Kashmir, and Northern Area). 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 a best estimate, nearly 50 000 persons are either directly or indirectly employed in the sector.

# 2. Role of fisheries and aquaculture in improving human nutrition:

Fish is a good source of proteins, healthy fats, and essential nutrients such as long-chain Omega-3 fatty acids, iodine, vitamin D, and calcium. Small, micronutrient-rich fish (suitable for polyculture in homestead ponds) are particularly beneficial. In Pakistan despite the marine capture fisheries have the major share of fish production, the inland fisheries and aquaculture are equally important. Inland fishery is critical for achieving sustainable development goals and can substantially contribute in alleviating and preventing poverty (Lynch et al., 2017). Pakistan’s total fish production is about 0.807 million metric tons, of which 62 % was from Marine fisheries, and 38 % from inland fisheries and aquaculture. Fish consumption in the country is currently very low, about 2 kg per year per capita, compared to a global average of 17 kg.

Greater fish production can increase fish consumption directly if smallholders who produce or catch fish eat it, or indirectly if the greater production stabilizes prices and creates wider availability in local markets. Growth in the fisheries sector may also provide jobs and boost incomes, allowing for improved consumption of nutritious food in general. The present low rates of consumption indicate the minor role that fish play in Pakistan's food culture; acceptance of or a preference for fish may not occur rapidly or at all. Carp is the main fish consumed in inland areas with small consumption of tilapia and trout while in coastal area sea fish and shrimp are consumed on wider scale.

Pakistan is the 5th most populated country in the world having around 222 million people. Pakistan is an agricultural country, but people of Pakistan are facing shortages of protein. Fish and its products are important source of essential fatty acids, vitamin D & E. Globally, fish provide nearly 16% of the animal protein consumed by humans and are a valuable source of minerals and essential fatty acids. Fish is the primary source of omega-3 fatty acids in the human diet.

# 3. Resource Potential & Fish Production, Consumption in Pakistan

## I. Marine

Pakistan's Fisheries sector is comprising of two parts, the fisheries resources along Balochistan coast and fisheries resources along Sindh coast. Under declaration of an exclusive economic zone (EEZ), 1976, the fishing limits were extended to 200 nautical miles from the coastline, providing the country with a fishing area of approximately 240,000 square kilometers, additional 50,000 square km area (total 290,000 square km) is available to Pakistan to explore and utilize for economic activities after decision of the UN Commission on Limits of the Continental Shelf (UN CLCS) in 2018 (Sarfraz, 2019).

Continental shelf differs in size distinctly along the Sindh and the Balochistan coasts. The marine coastal zone up-to 12 nautical miles (NM) from the coastline is within the jurisdiction of the two provinces (Sindh & Balochistan). The coastal zone beyond the 12 NM up to 20 NM is the contiguous or buffer zone and beyond the 12 NM up to 250 NM is under the jurisdiction of the federal government.

The Sindh coastal region is located in the South-Eastern side of Pakistan between the Indian border along Sir Creek on the east to Hub River along the Balochistan coast on the west. Sindh Coast can be sub-divided into two parts, the Indus Delta Creek system and the Karachi Coast.

The Indus Delta starts from Korangi Creek and extends up-to Sir Creek. The area covered by the Indus Delta is more than 600,000 hectares of tidal land and mud flats, most of which are inundated during flood tides. There are 17 main creeks in the Indus Delta covered by one of the largest arid mangrove forests in the world. The mangrove forests can be divided into two main blocks, the Keti Bundar and Shah Bundar blocks.

The Balochistan coast starts from the Hub River in the east to the middle of the Gwatar Bay (bordering Iran) in the west and extends over a distance of about 770 km. The Balochistan coast could be sub-divided into the Lasbela coast and the Gwadar coast (districts of Balochistan province). Along the Balochistan Coast are many bays like Gwatar Bay, Gwadar Bay, Pasni Bay and Sonmiani Bay. (MFF Pakistan, 2016).

The continental shelf along the Makran coast (Balochistan) is steep, rough and narrow, i.e., between 12-32 km wide. The Sindh coast has extended 40-120 km shelf area. Mostly flat, it forms good trawlable ground. The coast protrudes into the sea in the form of capes and peninsulas and is, at a few sites, cut off into several small and large bays. There are only a few islands along the coast. The large estuarine delta of the river Indus provides good nurseries for finfish, shrimp and other marine life.

Along the coast of Pakistan there are more than 65 population centers and villages where fish is landed on beaches having no facilities for fish landing. Recently floating landing facilities have been established in some creek areas like Keti Bundar, Kharo Chan and Darya Pir, which are being used by the local fishing boats.

- **Karachi Fish Harbor**

The largest fish harbor of Pakistan is the Karachi Fish Harbor which catering to more than 7,000 fishing boats. It was established in 1958 and upgraded and expanded in 1990. There are five auction halls and 10 pontoons and a long quay wall and all other ancillary facilities at the port. The harbor also has 25 seafood processing plants. The control of the harbor is with Sindh government.

- **Korangi Fish Harbor**

Korangi Fish Harbor was established in 1993 by the federal government mainly to cater to deep sea fishing vessels. It was also envisaged to handle about 500 fishing boats. The harbor has a large auction hall, and all other allied facilities and has a quay wall of about 2 km.

- **Pasni Fish Harbour**

The Pasni Fish Harbor is located along the Balochistan coast near Pasni Town. Because of excessive siltation and inadequate dredging, the entrance is partially blocked, efforts are underway to clear it. The harbor is being used by the small artisanal boats and large gillnetters. Balochistan Government is managing this harbor.

- **Gwadar Fish Harbour and Miniport**

The Gwadar Fish Harbor is usually used by large fishing boats especially gillnetters. For small artisanal boats, a floating pontoon has been constructed along the harbor which relates to the main platform through bridges.

- **Fish Landing Jetties**

Apart from harbors, Pakistan have five major landing jetties along the Balochistan coast located at Gaddani, Damb, Jiwani, Sur and Pishukan respectively.

On Sindh coast Ibrahim Hayderi Landing Jetty is the second largest fish landing center in Pakistan. Though this jetty is not properly designed and lacks basic facilities, a large number of artisanal fishing boats still use this landing center. This landing center is the main base of fishing boats that are engaged in one day fishing trips for shrimp using bottom set gillnetting (locally known as “thukri”). There are about 15 private jetties in the area where fishing boats are berthed, after landing their catch at Ibrahim Hayderi.

# II. Inland

Pakistan have an extensive lake, river and canal system. Natural lakes cover an area of 109,780 hectares. Some lakes are at high- altitude suitable for cold water fishery e.g., Saif-ulMulook lake in the Khyber Pakhtunkhwa, Satpara lake in the Gilgit Biltistan

and Hanna lake in Balochistan. Warm water lakes are mostly located in Sindh and Punjab, and two such lakes are Manchar and Keenjhar. There are small lakes also, mostly in the Thatta and Sanghar districts of Sindh. The Indus and its tributaries are the major freshwater fisheries of the country. The Indus flows from the Gilgit Biltistan through the KP and the Punjab, where it is joined by five large rivers; Kabul, Jhelum, Chenab, Ravi, and Sutlaj before passing through Sindh and finally draining into the Arabian Sea. Along the course of the Indus there are a number of dams and reservoirs which store water for an extensive irrigation network in the Punjab and upper Sindh provinces, representing one of the world's largest canal systems. Apart from the large canal network still waters cover only about 4.57 million hectares, while waterlogging covers about 2.225 million hectares. Besides these, more than a hundred small and minidams (in the baran (rain-fed) tract of the country, particularly in the Potwar Plateau) built for the storage of water, hold an immense potential for aquaculture. At present only a few of these water resources are being used to raise fish. Although aquaculture is a fairly new activity in the country, dug-out ponds for fish farming have been constructed in the private sector. There are approximately 80,000-hectare fish farming in the country. However, the Pakistani aquaculture is characterized by low production per unit area, mainly because of low inputs.

# 4. Challenges faced in the fisheries value chain system of the country

A value chain is the variety of activities that are required to bring a product or service from its conception to the final consumers. This includes activities such as design, production, marketing, distribution and support services. Value chains include local, regional and global markets. Key activities in a fisheries value chain usually include fishing, aquaculture production, processing, transport, wholesale and retail marketing. The value chain player includes fish farmers, fisherman, fish processors, marketing companies and input suppliers including seed, feed, medicine, equipment, ice and other supplies.

## I. Marine Sector

In Balochistan province, a large number of fishing vessels are Karachi based with minor and other coastal towns, including Gaddani, Ormara, Pasni, Gwader and Jiwani,

are engaged in commercial fishing. These vessels operate in coastal and offshore waters and catch large quantities of fish, shrimp and other shellfish. The fish is marketed and processed in fish factories located mainly in Karachi and Gwadar Districts. A major portion of the fish caught by commercial fishing boats is exported to other countries.

- **Fish Marketing**

The marine captured fish is marketed usually through traditional channels in coastal areas. As per common practice the fish is auctioned at the landing centers through auctioneers or middlemen who charge a commission of 6.25. The auctioneers also called mole holders and middlemen provide loans to the fishermen for the fishing operations which are paid back by Fisherman from the value of their catch. Fish from the landing centers is transported to mainly Karachi through a series of middlemen. A major portion of fish is procured by fish processing plants; whereas that for domestic consumption is routed through middlemen to fish mongers or fish shop owners. Although marketing channels are adequately organized, but at several instances, the fish quality is not properly maintained mainly because of lack of basic facilities.

- **Fish Processing**
    - **Curing/Salted-Drying**

Salt drying is the oldest form of fish processing done in Pakistan. Historically curing yards were established along the coastline like Sonmiani (Damb), Ormara, Pasni, Gwader and Jiwani where low quality salted dried fish was preserved for export mainly to Sri Lanka. In these processing facilities, salt was being used to dry the fish. Till 1970, almost all export consisted of salted dried product but presently salted dried products have been declined to a great extent mainly because of establishment of fish processing plants along the coast.

    - **Freezing**

Most of the seafood processing in Pakistan is based on freezing method consuming about 80 % of raw material and the product is being used for export. It is estimated that about 150,000 m. tons of seafood is processed annually in frozen form. Most of the seafood freezing plants are based in Karachi; however, during the last few years a number of seafood freezing plants have been established along the Balochistan

coast. Shrimp, crab, lobster, cuttlefish, squid, ribbonfish, croakers, threadfin breams and Indian mackerels are the main products which are exported to about 60 countries of the world.

- **Canning**

Canning used to be a large industry in Pakistan during 1960 but it declined in 1980s due to increase in the price of raw material. Presently there are two canning plants operating in Pakistan. One is producing pasteurized crab meat and other canning sardines and Indian mackerel in tomato sauce/paste.

- **Fish Meal Processing**

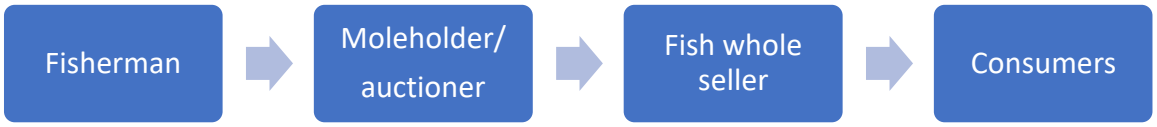
Fish meal industry uses small pelagic fishes (such as sardinellas, anchovies, etc.), by-catch of shrimp trawling and fish offal for production of fish meal in Pakistan. Most of the Fish meal processing plants use sun-dried fish and other raw materials, which are steamed (cooked under pressure), again sub-dried and pulverized. Protein content of fish meal produced by using this method is usually very low (between 40 to 55 %). Only a few fish meal processing plants have wet processing facilities. Major part of the fish meal is produced and consumed locally in the poultry industry; only small quantities are exported.

**a. Marine Fish marketing channels**

The existing fish marketing channels are as below;

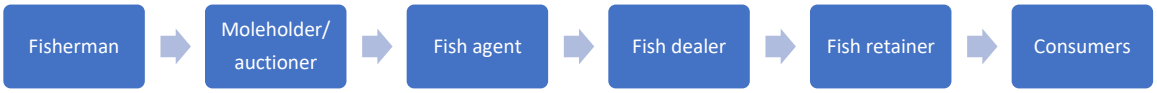
1. Ordinary channel for local consumption


2. Ordinary channel for local consumption when consumer visits landing sites

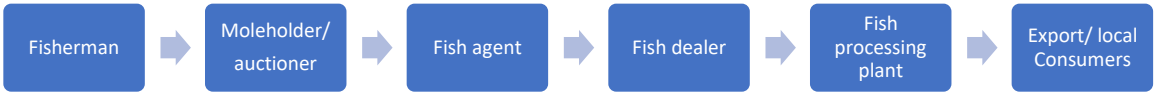



3. Ordinary channel for local consumption when consumer buy processed fish


4. Ordinary channel for local consumption when site is far away.




5. Ordinary channel for local consumption when site is far away.




6. Ordinary channel for fish meal.


7. Ordinary channel for fish meal export.


### b. Value Chain loss and cost analysis (Shrimp fishery)

#### i. Lost of value

Shrimp fishing is very important economic activity for fishermen. As per existing handling practices the following loss has been recorded while handling and processing.

Icing at boat (loss=5%) ……fish handling at boat (loss due to bad handling=10%) ……. weigh & wash before auction hall transportation (loss=1.2%)……..transfer to auction hall (loss=1.7%)…….auction (loss=5.8%) ……..transfer to factory (loss=1.7%)……De-heading & peeling (loss=19.6%) …… Grading and sorting (loss=1.7%) ……..freezing (loss=1.5%)

Net raw material available for export on every 100kg caught is 52 kg for export purposes.

### ii. Cost of fishery and processing

Catch & Haul cost of an ordinary fishing trip and processing of raw material is as under:

Labor cost 5.7%, Food cost 5.3%, Ice cost 7.6%, Fees cost 0.4%, Fuel cost 61.7%, Repair & Maintenance cost 19.3%. while adding into it the cost of processing, as Transportation, peeling, grading and packing cost 2.5%, storage cost 0.6% and overhead cost is 1%.

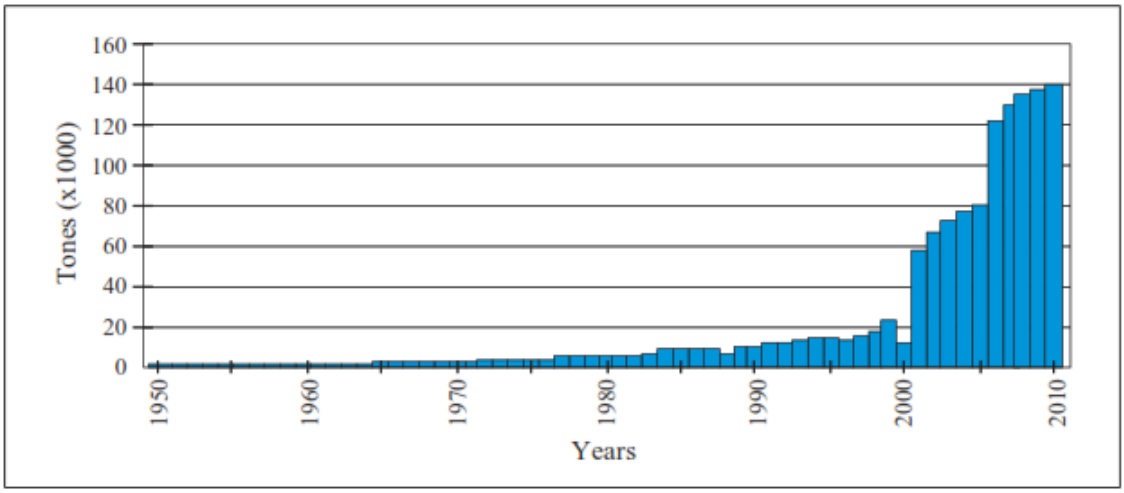
## II. Freshwater Sector (Inland fisheries and aquaculture)

In Pakistan the riverine fishery management system is managed by Provincial Fisheries Departments through enforcement of regulatory laws by restricting catch by size of fish and implementing closed seasons (FAO (2009).

Carp farming is the mainstay of aquaculture activity in Punjab, Sindh, KP and Balochistan. Despite diversified water resources (fresh, brackish, lakes and dams) only carp culture has been promoted. Recently tilapia spp. has been introduced by Fisheries Development Board which is successfully adopted by private fish farmers. The shrimp aquaculture has been tried on experimental basis but due to absence of input supply chain, it was not commercially viable. In Khyber Pakhtunkhwa (KP) and the Gilgit Biltistan areas have trout culture has been promoted, the industry has been hard hit by recent floods.

According to National Aquaculture Sector Review as presented in figure 1, aquaculture production in Pakistan had a quantum jump during last decade

**Figure 1 :** Trends in Aquaculture Growth in Pakistan




Source: National Aquaculture Sector Review

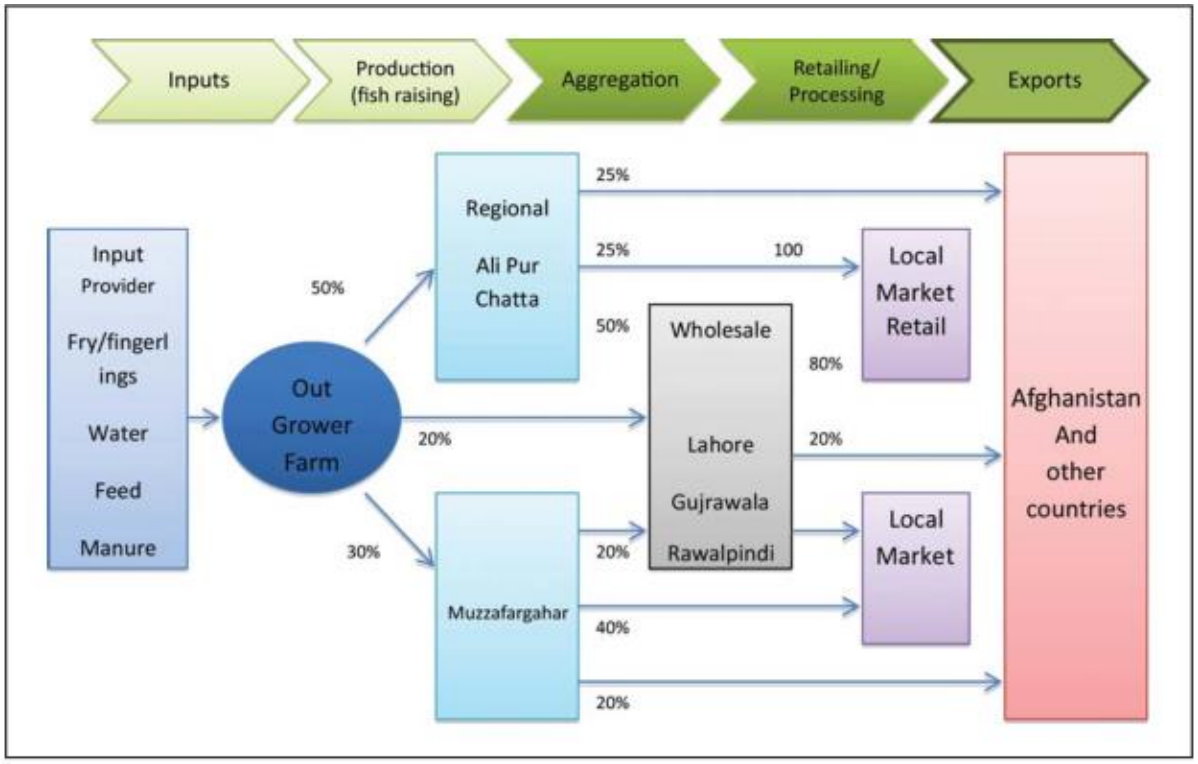
### a. Inland Fisheries Sector Value Chains

This value chain analysis is based on regional clusters in Punjab, Sindh and KP. The Punjab fish markets predominantly are established 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.

### i. Punjab Aquaculture Value Chain

In Punjab, some aquaculture has been established mainly in the areas where lands were not suitable for agriculture purposes and plenty of water was available. Such as Sheikhpura, Gujranwala, Multan, Muzzafargarh, Khanawal, DG Khan, Rajanpur and Attock districts as they carry larger number of farms and constitute around 80% of the total number of farms in Punjab. Then there are small fish farms scattered over the province. One of the fish farming cluster has developed private fish markets on small level while in other clusters, the farmers bring fish in the large urban fish markets like in Lahore, Gujranwala and Islamabad. The average size of these farms is around 15 acres with a range from 2 to 25 acres, mainly growing carp species with a few progressive farmers producing Tilapia spp.

**Typical value chain in Punjab**



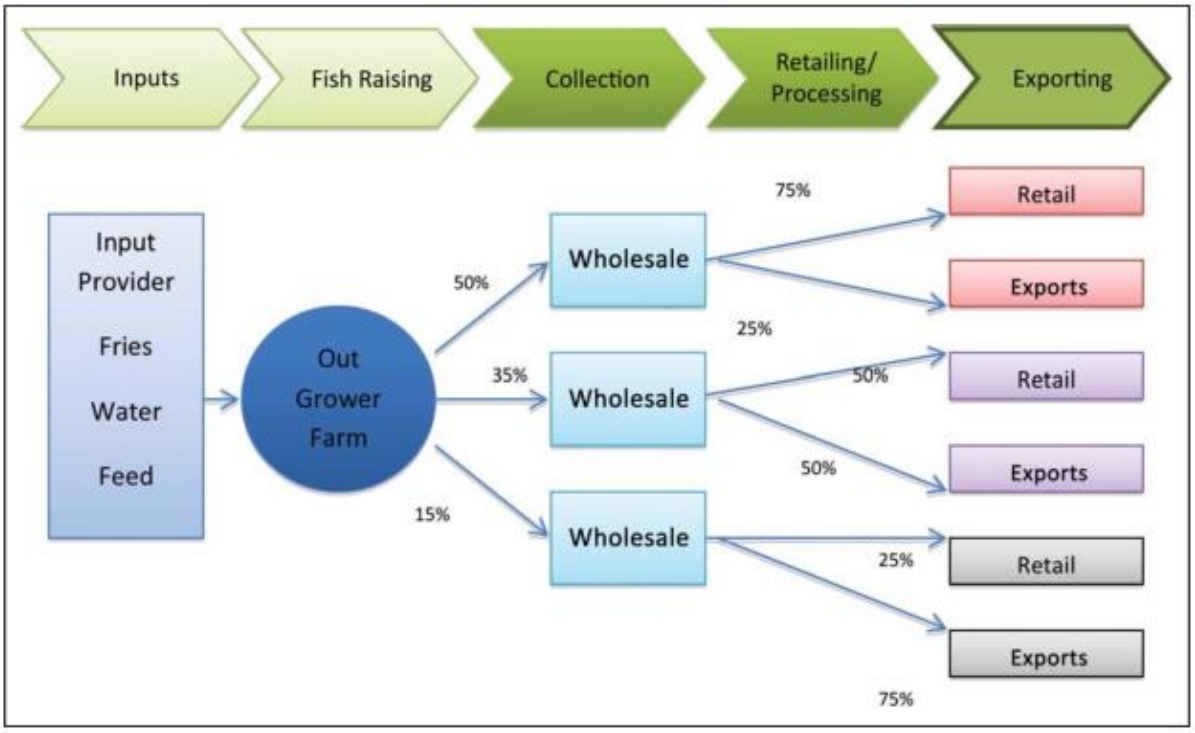

### ii. Sindh Aquaculture Value Chain

The above figure shows a typical value chain in Sindh, fish from 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 public and private Hatcheries provides providing fish seed to fish farmers. Fish seed also brought from Punjab by farmers or commission agents in Sindh. 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.

**Typical value chain in Sindh**

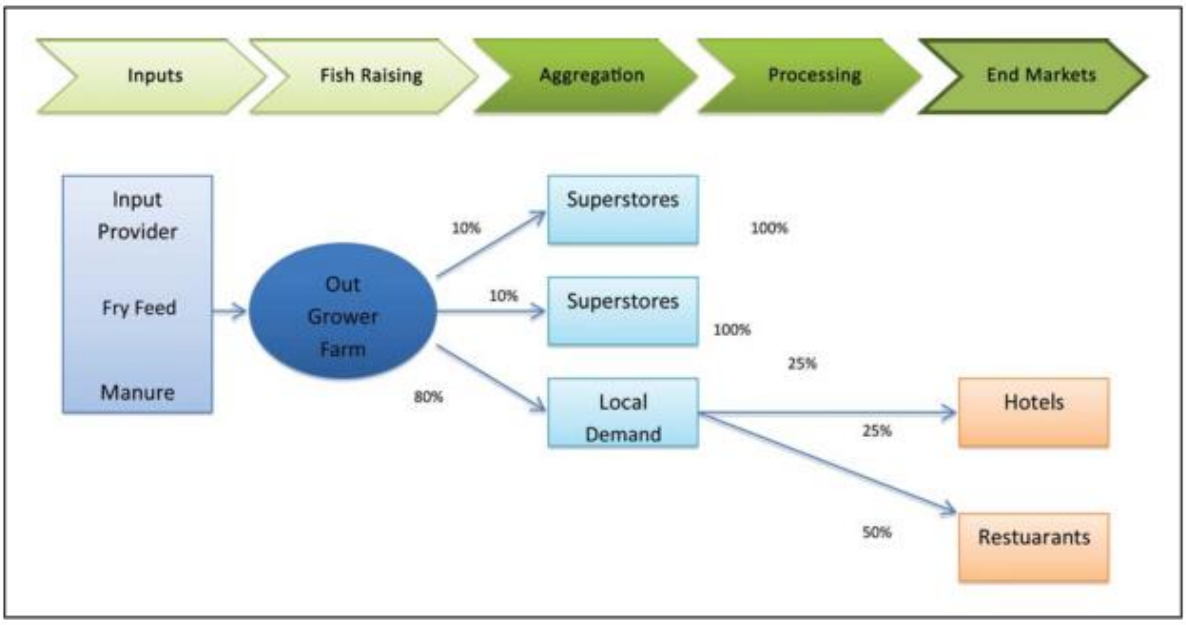



From inland fish markets the fish is sold to the venders, retail shops, restaurants and super-markets or goes for processing plant for export markets. The processing for export market entails two actions, one to process it by cleaning, scaling, packing and other mode is to pack fish as such with ice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

### iii. Trout Value Chain in KP, AK and GB

Trout is very popular and tasty fish, mostly considered as a delicacy with very high willingness to pay especially by the tourists. 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 KP, AK and GB. Trout farms are also located in Chitral, Swat, Dir, Malakand, Mansehra and other parts of this region.

**Typical trout value chain**




Trout business model is very simple 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 as fresh fish

### b. Market Price Analysis

The per capita fish consumption in Pakistan 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 traditionally 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 demand river to farm or marine fish and are ready to pay more, the price difference between river and farm fish is about Rs. 100 per Kg, the price of fish ranges from Rs 150 to 450 per kg, depending upon the size and type. The price of Rahu is Rs. 250-400 per Kg at retail stores. 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

When comparing prices of trout with traditional carp varieties, it shows that trout prices are more than double some time three times compared to carp species.

### c. Value Chain Analysis

In Punjab the pond sizes range from 2.5 acres to 10 acres. In Sind the average size of fishpond is 5 to 15 acres. The economic analysis reveals that returns on fish farms are quite good and as the size of farm increase, the profitability increases.

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. The fish prices increases with decreasing temperate and about Rs. 100 per kg difference is noted during the extreme cold weather every year.

As per common channel of fish distribution a fish farmer producing Rahu in traditional business mode (Producer-trader- consumer) usually get 56 percent of the consumer price, his revenues per kg stand at Rs 188 and the cost of cost of production was estimated at Rs. 110 per kg, yielding a net profit of Rs. 78/kg.

*Arthi* (trader) trading Rahu in a typical fish wholesale market, is charging 4.49 percent of the consumer price this may look small but given his volume of turnover, income is substantial.

*Retailer*, trading Rahu in a typical retail market, is charging 39.39 percent of the consumer price which is quite sizable but less than the what farmers receiving, again his volume are large and so is his yearly income.

*Processor* selling fried Rahu fish in medium and large cities, is charging a 31.88 percent of the consumer price, which is considerably larger than the farmer, again his volume can be sizable and so his yearly income

# 5. Developing markets for fisheries and aquafarming: utilizing the value chain approach.

There is direct linkage between production and marketing. Production will fail if marketing fails and vice versa. Fish demand increases due to many factors, like growing population, increase in income status of people, changing food habits when people are moving toward healthier and foods. Fish demand is more in urban areas than the rural areas due to the all above reasons. Demand in developed countries is increasing and new markets are emerging on the same reasons. However, to promote trade, new markets needs to be identified by producing countries to supply the fisheries and aquafarming products. The main concerns for promotion of trade are proper handling and hygiene, traceability and safety of foods. Processing technologies that can produce cheap consistent quality products needs to be promoted.

A proper regulatory framework and its enforcement by exporting countries needs to be established to promote international seafood trade to develop trust in the target markets.

The specific challenges regarding utilizing the value chain include:

I. Necessary infrastructure for fish harvesting, landing, marketing, transport and processing is not at par with international standards. Government support is required to establish and maintain such system for which incentives system needs to be established and regulatory function needs to be strengthened.
II. The fisheries sector needs to be declared an industry, so it can attract low cost financing from commercial banks. Special government policies needs to be formulated to provide targeted financing to fisheries and aquaculture sector along with its value chain.
III. Research and Development in the seafood processing sector is missing or not present in the formal form. There is a need to established a dedicated organization to develop new products and services along with technology for production of new exportable products to enter into new markets.
IV. A complete new framework needs to be established to make contracts between producer and buyers so the price stability is established in the market. It will help get financing from banks against such formal contracts.
V. Use of new technologies like IT Plate forms and E-commerce needs to be promoted to reach out to new customers within country and abroad and for that electronic funds transfer is required to be formalized and international players in electronic fund transfer like Paypal, Skrill, TransferWise, Payoneer or Google Pay needs to be invited to Pakistan to promote international seafood and other trade.

# 6. Poverty reduction as a means to enhance social justice for workforce in the fisheries value chain.

The UN Global Goal No. 1 states that there will be no poverty by Poverty by 2030, therefore, the eradication of poverty must be the biggest challenge for each country. The challenge of poverty and its consequences malnutrition and hunger are aggravated by global challenges such as fast population growth and climate change, which exacerbate the vulnerability of poor people and hinder rural development.

Fisheries and aquaculture both contribute toward meeting the Sustainable Development Goals especially the poverty reduction. Small scale fisheries was an important source of employment and income. But the rise of industrial fishing has come at the expense of small-scale fisheries, as small-scale catches from some south Asian countries (Thailand, Vietnam and Cambodia) have declined from comprising 80% of total reconstructed catch in the mid-1960s to 35% in 2013. Reports of

decreased catches in small-scale fisheries are common throughout Southeast Asia (Butcher, 2004; Morgan and Staples, 2006; Teh et al., 2007). Main difficulties faced by small-scale fisheries which declining their contribution to food security and poverty reduction includes pollution, Urban development, destruction of estuaries, mangroves and coral reefs, destructive fishing methods. Fish stocks are Overexploited by large industrial fishing boats leading to further deplete lowers income small-scale fisherman. Further, the small-scale fisherman capture fish and poorly handle it onboard as the methods/ infrastructure is not proper. They suffer high losses due to low quality fish which yields low prices. Small scale fishermen mostly live in low standard lives with problem of sanitation, health, education, etc. They also face the problem of displacement and deprivation of land use and access to resources.

The climate change also has a great impact on small-scale fisheries and has great relevance to poverty reduction. Majority of the world's 250 million fisherfolk lives in areas that are highly exposed to climate change. A combination of climate-related stresses and widespread overexploitation of fisheries resources reduces the scope for adaptation and increases risks of stock collapse (Allison et al. 2005).

For inland waters, projected changes in surface water availability are the most obvious threat to fisheries production. There are close relationships between floodplain area, river flow and lake surface area and total fish production (Welcomme, 2001).

The farming of aquatic organisms that feed low in the food web, converting plant-based foodstuffs and agricultural by-products into high quality animal protein, is an inherently efficient means of producing increasingly scarce and nutritionally important foodstuffs. Aquaculture can utilize aquatic resources of marginal economic value, e.g. salinized ground waters, and its integration into smallholder agriculture can increase aquatic productivity ('more crop per drop'), thereby reducing pressure on increasingly scarce freshwaters. Farming of fish and shellfish can relieve pressure on overexploited wild stocks, as well as provide a means of livelihoods diversification for poor fishers. Fish are a high value crop and integrating aquaculture into smallholder farming systems can yield an additional high value cash crop which, in the context of the 2008 World Development Report (World Bank 2008).

The FAO's Advisory Committee on Fishery Research (ACFR) Working Group on Small-Scale Fisheries recently provided a vision statement for small-scale fisheries that should be supported by all States which put emphasis on all states to not marginalize them, involve them in decision making, reduce their poverty and mange the resources in sustainable manner (FAO, 2004).

# 7. Institutional framework

Pakistan's fisheries governance structure has changed substantially over the last decade. For many years it was led by a Federal Ministry of Food, Agriculture and

Livestock (MINFAL). In 2008, fisheries were transferred to the newly established Ministry of Livestock and Dairy Development. After amendment to Pakistan's Constitution in 2010 under 18th Amendment, the federal fisheries related organizations scattered among various ministries and still that anomaly exists.

Pakistan currently has no specific strategy or policy for capture fisheries or aquaculture. In 2007, a National Policy and Strategy for Fisheries and Aquaculture Development in Pakistan was developed for the then MINFAL with the support of FAO. This comprehensive document underwent considerable stakeholder review, and, while MINFAL signed off on it, it was never formally adopted due to a Federal political transition. At the Provincial level, Sindh developed its own fisheries plan, the Sindh Fisheries and Aquaculture Strategy 2010-2013 (Patil, et al, 2018).

The provinces have roughly similar distributions of responsibilities among their departments and other institutions, including:

1. Departments of Fisheries (DoF) are responsible for licensing coastal fishing vessels and regulating fisheries under their jurisdiction (less than 12 nautical miles from the coast). They are also the permitting authority for aquaculture development and for leasing out government land or water bodies to private investors or communities. They own and operate fisheries training facilities. The Balochistan DoF also has the remit for monitoring, control, and surveillance (MCS) in the Province's marine waters, unlike Sindh where this function is mandated to the Pakistan Maritime Security Agency (PMSA).

2. Fishing Harbor Authorities operate the major fishing harbors of Karachi (Sindh) and Pasni (Balochistan) under the DoFs, while Korangi Harbor in Sindh is part of the Federal Ministry of Ports and Shipping. All of these ports are run on a corporate basis, with a board of directors and a managing director.

3. Coastal Development Authorities coordinate development in the coastal zone (from the coast to 30 km inland) in Sindh and Balochistan, including projects related to fisheries and aquaculture.

4. Irrigation Departments are responsible for supplying water to irrigation areas, and thus have an influence on inland aquaculture and fisheries development in Punjab and Sindh.

5. Departments of Planning and Development/Investment scrutinize the development plans of sectoral departments, such as fisheries, at the provincial level. They have strong links with provincial boards of investment.

Core functions are distributed throughout these institutions and their Federal counterparts. These include:

1. Fisheries Control: This includes monitoring and, where deemed necessary, limiting fishing capacity, imposing technical standards on fishing techniques and gear, and controlling operations at sea, such as movements in and out of harbors. In Sindh, vessel registration is a Provincial matter for vessels under 30 t and a Federal matter for larger vessels. In Balochistan, this is a Federal matter, but a lack of monitoring capacity on the ground means that it is undertaken by the Balochistan DoF. Fishing licenses in the EEZ beyond 20 nautical miles (Zone III) are issued by the Federal Government, and by the Provincial Governments in coastal waters (Zone I) and the buffer zone (Zone II).

2. Fisheries Research: MFD has the recognized mandate for fisheries research, with the Karachi-based National Institute of Oceanography (NIO) working on wider marine biology, oceanography, and geology issues. A lack of national level marine research planning results in potential overlaps between the two organizations, and thus competition for funding. However, the two institutions work together on some fisheries research. Pakistan does not own any fisheries research vessels, and therefore must depend upon foreign vessels, which are not always available.

3. Statistics and Data Collection: At the Federal level, the Pakistan Bureau of Statistics (PBS), under the Ministry of Economic Affairs and Statistics, is responsible for setting a national framework for statistics, including for the fisheries sector. At the Provincial level, each government has its own Bureau of Statistics. The responsibility for collecting fisheries statistics (for example, landings by location and species) lies with the fisheries department, which provides Provincial authorities with data, while MFD works with PBS to provide marine capture fisheries landings and exports. The Provinces also supply MFD with fisheries-related data (catches, employment, processing, commodities, exports, and prices).

4. Maritime Surveillance: The limit of territorial waters is twelve nautical miles beyond land. The internal waters of Pakistan are measured from the baseline. Fisheries outside of territorial waters are managed by the MFD, although responsibility for MCS is provided by the Pakistan Maritime Security Agency (PMSA). MCS functions within the territorial waters are more variable, with Sindh Province mandating the PMSA to undertake this function in coastal waters, while Balochistan—which does not allow trawling has a Technical Wing in its Coastal Development and Fisheries Department (CDFD) that is responsible for MCS activities in territorial waters. Of the two provinces, Sindh faces the most challenges, with a convoluted coastline (especially the Indus Delta area to the southeast of Karachi) and a large, motorized bottom trawl fleet that operates throughout Pakistan’s marine and coastal waters. The PMSA is better suited for monitoring and control in open waters.

At present, there is no formal Fisheries Monitoring Centre at either the Federal or Provincial levels, nor are vessels fitted with satellite-based Vessel Monitoring Systems (VMS). That said, the Balochistan government recently directed that vessels greater

than 15 meters in length must carry and operate VMS equipment, with data provided every four hours to the CDFD (Patil, et al, 2018). It is likely the Sindh Government will follow suit, and it appears that the private sector is also encouraging the uptake of VMS monitoring.

While there is no officially adopted national fisheries policy or strategy, other policies partially define the Federal Government's vision for the sector. The current supreme policy document in Pakistan is Pakistan 2025: One Nation, One Vision (Patil, et al, 2018). This affirms the Sustainable Development Goals (SDGs) and has pillars covering elements such as institutional reform, food security, the private sector, and entrepreneurship led to growth and value addition. An important part of Pakistan Vision 2025 is a structural transformation towards production of high value-added products. The Ministry of National Food Security and Research, under which the Fisheries Development Board (FDB) operates, recently released a draft National Food Security Policy (MNFS&R, 2017) in which fisheries and aquaculture are considered “high value activities.”

The Deep-Sea Fishing Policy, which guides access to the 20-200 nautical mile zone (Zone III) of the EEZ, was first developed in 1995, last updated in 2009, and is currently under revision (Ministry of Ports and Shipping 2016). The policy intends to ban all bottom trawling and purse seining in this zone, limiting the number of other gear-equipped vessels, and requiring use of VMS and Pakistani-only crews. A limited number of foreign joint ventures will be permitted for tuna, squid, and mesopelagic fishing, but their vessels must have a minimum of 25 % Pakistani crew.

**Federal Government Institutes**

- Ministry of National Food Security and Research
- Ministry of Ports and Shipping
- Fisheries Development Board (FDB)
- Pakistan Agricultural Research Council
- Marine Fisheries Department (MFD)
- Korangi Fisheries Harbour Authority
- Water and Power Development Authority (WAPDA)
- Trade Development Authority of Pakistan (TDAP)
- Environmental Protection Agency (EPA)
- Mercantile Marine Department (MMD)
- Maritime Security Agency (MSA)
- National Institute of Oceanography (NIO)

**Provincial Fisheries Departments**

- Karachi Fisheries Harbour Authority (KFHA)
- Fishermen Cooperative Society (FCS)
- Pasni Fish Harbour
- Gawadar Fish Harbour
- Fisheries Department Government of Punjab
- Fisheries Department Government of Sindh
- Fisheries Department Government of Balochistan
- Fisheries Department Government of KPK
- Fisheries Department Government of GB
- Fisheries Department Government of AJK
- Coastal Development Authorities in Sindh and in Balochistan

**Fisheries Education Departments (Universities having department of Fisheries)**

- University of Agriculture, Faisalabad
- Arid Agriculture University, Rawalpindi
- Quaid Azam University, Islamabad
- Punjab University, Lahore
- Bahuddin Zakariya University, Multan
- University of Veterinary and Animal Sciences, Lahore
- University of Karachi
- Sindh University, Jamshoro
- University of Balochistan, Quetta
- University of Peshawar, Peshawar
- Centre of Excellence in Marine Biology, Karachi.

**Others Fisheries Organizations/Association**

- Pakistan Sea Food Industries Association
- Sindh Trawlers Owners & Fishermen Association
- Karachi Fishing Boat and Trawler Owners Group
- Mole Holder Association

- Pakistan Seafood Exporter’s Association
- Karachi Fishing Boat and Trawler Owners Group

# 8. Conclusion

Fisheries is an important economic activity along the coast of Pakistan, and aquaculture is growing rapidly in inland areas. Fish and fish products are common food in the two coastal provinces, but it is mostly consumed only in winter in the other provinces like Punjab and KP. Seafood is a best food for human nutrition as it contains protein, vitamin, mineral and low-fat contents.

The value chain of most of the fish species is not complete and many draw backs exists in the input supply chain, production system, pond management, harvesting and post harvesting, transportation and marketing. There is a need of government intervention in development of cool chain infrastructure and regulate the sector as per best practices.

# 9. Recommendation

For the fisheries side there is need to work for improvement of the sector governance and enforcement of laws and rules, on aquaculture side there is a lot to do including but not limited to:

- Establishment of local supply of inputs, value chain and cold chain across supply line.
- Foster local entrepreneurship and invite foreign investment in aquaculture sector.
- Legal framework, spatial planning and one window licensing facility.
- Establishment of local industry for supply of equipment, machinery and ready to use cage nets.
- Development of value chain like fish hatcheries, commercial fish feed and live fish transport vehicles.
- Training for Aquaculture operation, and for related value chain activities through technical and vocational education system.
- Hiring of experts in fisheries departments with special education and training like Aquaculture engineering etc.
- Development of special funds for financing to private sector Aquaculture projects offering low markup loans.

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