



SINDH IRRIGATION AND DRAINAGE AUTHORITY
WATER SECTOR IMPROVEMENT PROJECT PHASE – I (WSIP-I)

Preparation of Regional Plan for Left Bank of Indus

Proposed Project on

**Shrimp and Mud Crab Farming
In Coastal Areas of Left Bank**



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In Association with
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Executive Summary

Background and Rationale

With the passage of time the terrestrial resources are depleting due to several socio-economic and environmental problems. The focus is on aquatic resources which are cheapest source of nutrients and fish is one of the main resources. In Sindh fisheries is categorized as coastal fisheries and inland fisheries. Coastal fisheries are the backbone of economy of the country/province and coastal communities. This provides livelihood and a major food item to the local fishermen community. Due to sea intrusion, release of contaminated drainage effluents in the wetlands and sea, overfishing and use of illegal nets the fish resource is declining resulting in poverty, livelihood sources and change in fish diversity. The coastal districts of Badin and Thatta are worst affected due to above described problems since last two decades.

Description of the Project

The proposed project type is non –structural, to be implemented in the coastal areas of Thatta and Badin districts. Under this project mud crab fattening and shrimp farms will be established in four talukas, namely Shah bander, Jati, Kharo Chan and SF Raho (Golarchi).

Project location and boundaries:

The project will be located in the coastal areas of Badin and left side of Thatta districts comprising of Shaheed Fazil Rahu Taluka of Badin district and Jati, Shahbander and Kharo Chan Talukas of Thatta district.

Project scope and objective:

The overall scope of the proposed project is to strengthen the fish resource in the coastal area of Badin and Thatta through shrimp farming and fattening of crabs which have an extensive market potential within and outside the country. This will also improve the economy of the country/province and provide substantial livelihood opportunities to the local communities.

Specific objectives of the project are as under:

- To popularize shrimp farming and crab fattening interventions.
- To establish and demonstrate the shrimp farming and crab fattening technologies.
- To create awareness and build capacity of local coastal communities.
- To help provide and improve livelihood opportunities to the fishermen communities and local land-owners.
- To utilize the brackish sea and drainage water for aquaculture development in the coastal districts.
- 10 number of mud crab farms and 10 of shrimp farms will be established in Badin and Thatta districts as under:

Each farm will be of 10 acres; hence 200 acres of shrimp and mud crab farms will be established.

Approach and Methodology

Following approach and methodology will be adopted for the proposed project;

- The ponds will be built in inter tidal low lying areas.
- The tidal water into pond by gravity will flow during high tide and shutdown the inlet at receding tide to retain water into pond
- Flush water in low tide
- Cyclic change of water
- Low stocking (4 pls per square meter)

- No artificial aeration shall be needed.
- The post larvae will be kept on natural/low cost feed.
- The seed will be obtained from Sindh Government Shrimp hatchery Hawks bay Karachi.

Outcome/targets and scope

The outcome of the proposed project will be as follows;

- | | |
|---------------------------------|---------------|
| • Survey of target areas | |
| • Establishment of Crab Farms | 10 |
| • Establishment of Shrimp Farms | 10 |
| • Community trainings | 60 man months |

Description of Technical aspects of Project

The project will have two components, viz. Shrimp Farming and fattening of mud crabs.

Shrimp Farming: Due to recent floods and damage to LBOD (Tidal link) the intrusion of sea has change the topography of area near Zero point Badin as a result the side has become more suitable for shrimp and fin fish culture including crabs and lobster. Immense potentials exist to start commercial scale fish / shrimp farming.

Fattening of Mud Crabs: Mud crab (*Scylla serrata*) named Koko is very famous in taste in south East Asian countries. At present so many parties are exporting crabs to European and Fareast Asian countries which are on rise. The following species of crabs are exported in shape of crab meat, canned and alive.

1. *Scylla serrata* commonly known as mud crab, green crab or mangrove crab.
2. *Portunus pelagicus* commonly known as blue crab.
3. *Portunus sanguinolentus* commonly known as red spot swimming crab.
4. *Charybdis cruciata* commonly known as coral crab.

Mud crab likes to live in mud therefore named as Mud crab can be culture in following ways:

1. Fattening
2. Grow out

Water Quality: Water quality required for its growth is 0-50 ppt TDS. Temperature 12-35 degree C however if less than 20 degree C it stops taking food.

Food: Mud crab is a carnivore. Likes and eats fresh fish and other animal like mollusk barbells and small fries. Looking at export market and its depleting trade in the nature *Scylla serrata* can be reared easily but it is economically not viable as the production of natural resources is adequate to meet the existing demand.

Fattening: Crab fattening is practiced as under

- Small size crabs can be collected from sea mostly purchased from fishermen engaged in this trade.
- Reared in earthen ponds for 3 - 4 weeks (till skeleton become hard).
- The small mud crabs are fed trash fish.
- 15 small crabs can be reared in 1 square meter.
- Due to short fattening period no diseases therefore survival rate is 90%.

Grow Out: Small crab 10-100 grams are kept in earthen ponds for 3 to 8 months to get market able size 200-500 grams. One crab is kept in 1 square meter area. Survival rate is 40%.

Project Cost

Total estimated cost of the proposed project is Rs. 108.30 million. The year-wise details of physical targets and financial allocation are given in table-1.

Implementation Arrangements

The farms / ponds will be managed by land owners. Sindh Fisheries Department will provide extension and advisory services.

Monitoring and Evaluation Mechanism

Monitoring and Evaluation is an important activity in project cycle. Since the proposed project is based on collaboration and participation of stakeholders, the monitoring will also be the same. A monitoring committee will be established constituting of members from each stakeholder with a clear mandate and monitoring mechanism. During the project execution and afterwards this committee will frequently monitor and evaluate the project outcomes, identify bottlenecks and address such bottlenecks through an interactive way. During the process of monitoring indicators and sub-indicators will be established and monitored.

Project Benefits

Social benefits

Employment generation and livelihood

The proposed project will create ample direct and indirect employment. The shrimp farming and fattening interventions are directly related to the livelihood of the local population. The poor people will be engaged for employment, increase their earnings, benefit from the sale proceeds of shrimp and mud crabs and will also get nutrient food. All above benefits will improve the livelihood sources for the local poor people of the coastal area.

Poverty, Distribution of Benefits

The project area is a poverty ridden area where the poverty line is above 70% and the income distribution is not equitable. Due to execution of the proposed project the poverty level of the poor people, mostly fishermen, will improve significantly because they get employment and also the crabs and shrimps will be sold in enhanced price than the previous condition.

Environmental Benefits

This is an environmental friendly project as it will not create any adverse impacts on flora and fauna, soil, water, land use, climate etc. The proposed project will be executed in the mangrove areas the care shall be taken to protect the mangroves as due to increase in human activity there is apprehension that mangrove resource will be deteriorated on the cost of shrimp farming.

Financial Benefits

The estimated IFRR for shrimp farming has been computed at 59.6%, hence the project is financially viable. The NPV at 12% is Rs.15,864 million. The sensitivity analysis presented in the table below shows that with 10% decrease in the benefits the IFRR is 49.6% while with 10% increase in the cost the IFRR is about 50.8%. Both of these are above 12%. The simultaneous 10% decrease in benefits and increase in cost suggests the IFRR is still above 12%, hence is robust. The switching values divulge that if the benefits decrease by 46.7%, and costs increase by 87.7%, even though if both may change by 30.5% the project will still be viable.

Moreover the estimated IFRR for mud crab farming has been computed at 36.2%, hence the project is financially viable. The NPV at 12% is Rs.7,730 million. The sensitivity analysis presented in the table below shows that with 10% decrease in the benefits the IFRR is 29.7% while with 10% increase in the cost the IFRR is about 30.3%. Both of these are above 12%. The simultaneous 10% decrease in benefits and increase in cost suggests the IFRR is still above 12%,



hence is robust. The switching values divulge that if the benefits decrease by 34.8%, and costs increase by 53.6%, even though if both may change by 21.1% the project will still be viable.

ICID evaluation

The project has also been evaluated as per requirements of International Commission for Irrigation and Drainage (ICID). The evaluation reveals that there is no negative impact of this project on the components of the environment.

The above evaluations reveal that the proposed project is environment friendly and also feasible both economically and financially.

Resettlement Issues

Resettlement is no issue as evacuation does not take place.

Shrimp & Mud Crab Farming in Coastal Areas of Left Bank

1 Introduction

With the passage of time the terrestrial resources are depleting due to several socio-economic and environmental problems. The focus is on aquatic resources which are cheapest source of nutrients and fish is one of the main resources. In Sindh fisheries is categorized as coastal fisheries and inland fisheries. Coastal fisheries are the backbone of economy of the country/province and coastal communities. This provides livelihood and a major food item to the local fishermen community. Due to sea intrusion, release of contaminated drainage effluents in the wetlands and sea, overfishing and use of illegal nets the fish resource is declining resulting in poverty, livelihood sources and change in fish diversity. The coastal districts of Badin and Thatta are worst affected due to above described problems since last two decades.

1.1 Background/Rationale

Fisheries are an important activity in coastal districts of Badin and Thatta. Majority of the overall marine fish exports originate from these districts. The districts are also considered to be among the most productive in Sindh for fresh water fisheries. Sindh inland fisheries statistics for 2002 revealed that out of the total fish production of 80,659 tons, some 14,152 tons or 17.5 percent was produced in Badin, which was second only to Thatta District in inland fish production.

Most development activities have a direct impact on biodiversity. Demographic trends and socio-economic conditions in the district have far-reaching consequences on ecosystems. Population growth and poverty exert a heavy pressure on natural resources. Isolated interventions do not address the root causes of biodiversity loss. This understanding needs to be incorporated into all planned interventions.

1.2 Status

As a coastal district, Badin relies on fisheries as an important component of economy. The current situation suggests that habitat protection has not been addressed, enrichment is not a priority and general indifference to the fisheries sector is pervasive. As such, it is not surprised that little has been done to check the discharge of dangerous effluents and untreated waste into water sources, which not only seriously undermines water quality but also threatens the existence of fish species. Similarly, the absence of land-use planning, accelerated urbanization and population growth has transformed some streams into virtual municipal drains.

About 10 percent of the overall marine fish exports originate from Badin. Promoting fish production will not only raise the income of fish farmers, but will also benefit other businesses including processors and exporters.

During 2000-2001, total fish production in Pakistan was recorded at 665 000 tons; the contribution from marine fisheries along Sindh and Balochistan coast lines was 480,000 tons, while the contribution of inland fisheries was 185 000 tons. Of all the coastal fisheries the contribution from the Sindh coast and Indus delta is higher than Balochistan despite Sindh's coast line being smaller (only 350 km). During 1999, out of a total of 474,665 tons of marine fish catches in Pakistan, the Sindh coast contributed 333,047 tons; the exclusive economic zone (EEZ) under the control of the federal government produced an additional 184,545 tons. Badin, being part of the Sindh coastal area, contributes significantly to marine fish production, especially shrimp. It is estimated that out of the marine fish exports worth US \$ 100 million, about 10 percent comes from the Badin coast.

Badin is considered to have some of the most productive fresh water fisheries in Sindh. Inland fisheries statistics for Sindh in 2002 revealed that out of the total fish production of 80,659 tons, some 14,152 tons or 17.5 percent were produced in Badin which was second only to Thatta district in inland fish production.

In Badin taluka, there are 100 fish farms covering 1,619 hectares. In Tando Bago taluka, there are 150 fish farms encompassing 3 540 hectares. Fish farms are also found in Golarchi, Matli and Talhar.

The vast majority of these fish ponds have been established in former lakes and natural depressions. Only a dozen or so fish farms are reported to be managed on scientific lines and profitable in financial terms. Most of the farms are facing problems related to technology, maintenance of proper soil and water balance and feeding practices. There is a need for appropriate training as well as the establishment of hatcheries to supply fry from successful species.

Badin has many other fresh water fisheries including natural depressions and water bodies such as the Dhoru Puran, surface drains, inland lakes, tidal lakes and canals and distributaries. The development of fresh water fisheries at selected locations in these vast areas could yield significant gains in terms of fish production as well as income generation for the local communities.

1.3 Problem Statement

Sindh province holds the premier position in the fisheries sector of the country. It commands almost 100 percent of the brackish, 65 percent of the fresh water and 71 percent of the marine water resources of the total fisheries area of the Pakistan. These resources comprise 400 commercially important species of the marine fish, 200 species of fresh water fish and 13 species of shrimp. The coastal areas of Thatta and Badin districts are considered major fishing areas. Fisheries in these districts were doing very well until 1996. Since then, however, drought and destruction of breeding grounds and estuaries has reportedly caused 70-80 percent reduction in fishing. Marine fisheries in Badin district, which replaced the fresh water fisheries, have also experienced a significant reduction after the destruction of the tidal link and cholri weir. The brackish water fishing resources were quite significant in the coastal areas as it has many surface drains as well as natural depressions and water bodies but due to problems of disposal of untreated industrial and domestic effluents and sea intrusion the wetlands have been converted to extremely saline which are detrimental to fish resource

During the process of consultations with the stakeholders in phase I and II it was revealed that apart from other fish varieties, shrimps and mud crabs are very important natural resource in the coastal area. The fishermen living in the vicinity of coast line catch these fish species from the coastal waters daily and sale to the contractors in meager amount. The contractors then transport the shrimps and mud crabs to Karachi market and earn substantial amount as a profit. The exporters and local market sellers also earn significant prices by grading the purchased fish from the field. Both the species of fish are export items to middle east and European countries.

There are no grading and fattening facilities in the field to fetch more prices to the actual fishermen. There are very few mud crab processing and fattening facilities at Karachi but they are not working on scientific lines. Thus, it has been emphasized by the stakeholders at local level that constructed shrimp farms and mud crab fattening facilities at the site so that the local stakeholders be benefitted and improve their livelihood sources. This will not only be beneficial

for the local beneficiaries but also will also improve the economy of the province and the country.

2 Description of project area

2.1 Climate

The overall climate of the area is maritime; characterized by mild temperatures, high velocity south-western winds, low rainfall and high humidity. The general climate of the project area is moderate. However, the summer months-April, May and June- are very hot during the day. The maximum recorded humidity at Badin is 76 percent. Rainfall is highly erratic with an average of about 170 mm. the monsoon dominates from July to September. Rainfall is highly unpredictable and years without rainfall are quite common.

The climate comprises of following ranges of low and high parameters:

Air temp range	5-41 Celsius
Water temp range	8-34 Celsius
Salinity range	0-47 ppt
Highest tide	3.83 meters
Mean high tide	3.20 meters
Mean sea level	2.06 meters

2.2 Physiography and topography

The project area is part of the lower Indus plain formed by the alluvial deposits of the Indus River through the ancient Hakra, Nullah and Gungra water courses. Being a vast alluvial plain, its land is highly uniform in character. The southern part of the project area is close to the delta of the river Indus and the land surface is therefore relatively low in comparison with the northern part of the project areas.

2.2.1 Current situation/Resource base

During the last decade great amount of interest has been created regarding shrimp farming. The Indus river farms a wide delta at its tail wit network of creeks and arteries which along with adjoining no land and mud flats occupies an area of more than 385,000 hectares.

The delta waters because of flow of wash holds of lands brought by the river in the form of salt and organic matters and intermixing of salts and mineral water are rich in fish food and can be utilized for intensive fish and shrimp culture and serve as a large breeding, grazing and growing grounds for young and adult fish and shrimp.

The shrimp catch in the project area of Badin and Thatta is variously claimed to be affected by or affect the offshore from fishery depending on which authority on listen to the trawler operators claimed that the over fishing of the small juvenile in the delta region particularly by fisher men using small mesh net has a detrimental effect on recruitment to the mutual stock offshore this is refuted by deltaic fishermen and some officials who complained that the offshore fishery is destroying the adult stocks. So there are inadequate shrimp to breed any way and the shrimp caught by the small arsenal fisher men n the delta is of species that do not grow to any great size. The destruction of mangrove has probably a negative effect in that, mangroves provide a nursery

area for shrimp post larvae and juvenile Shrimp form a seafood delicacy and are in great demand around the world and can be successfully farmed in brackish region of Badin and Thatta districts.

It is therefore high time to produce declining commercial species such as shrimp and crab to meet the demand of the local as well as international market.

3 Description of the Project

Project Name: Shrimp and Mud Crab Farming in Coastal Areas of Left Bank

Project type: Non –structural.

3.1 Project location and boundaries

The project will be located in the coastal areas of Badin and left side of Thatta districts comprising of Badin, Shaheed Fazil Rahu Talukas of Badin district and Jati, Shahbander and Kharochan Talukas of Thatta district. The project area is bounded by Arabian Sea in the south, Indus River in the west, Talukas of Tando Bago, Talhar, and Sujawal in the north and Taluka Diplo and Runn of Kutch in the east. Within the project Talukas only areas located near the coast preferably creek system will be covered by this intervention.

3.2 Project scope and objective – general and specific objectives

The overall scope of the proposed project is to strengthen the fish resource in the coastal area of Badin and Thatta through shrimp farming and fattening of crabs which have an extensive market potential within and outside the country. This will also improve the economy of the country/province and provide substantial livelihood opportunities to the local communities.

Specific objectives of the project are as under:

- To popularize shrimp farming and crab fattening interventions.
- To establish and demonstrate the shrimp farming and crab fattening technologies.
- To create awareness and build capacity of local coastal communities.
- To help provide and improve livelihood opportunities to the fishermen communities and local land-owners.
- To utilize the brackish sea and drainage water for aquaculture development in the coastal districts.
- 10 number of mud crab fattening farms and 10 of shrimp farms will be established in Badin and Thatta districts as under:

Taluka	Mud crab farms	Shrimp farms
Shahbander	2	2
Jati	2	2
Badin	3	3
S.F. Rahu	3	3
Total	10	10

Each farm will require 10 acres; hence 200 acres land in the coastal areas (100 acres for shrimp farms and 100 acres for shrimp farms) will be required for this project.

4 Approach and Methodology

In order to accomplish this project successfully the approach and methodology is an essential step in the project cycle. Following steps are proposed to be taken to accomplish the proposed project:

- The ponds will be built in inter tidal low lying areas.
- Low tidal water into pond by gravity flow during high tide and shut down the inlet at falling tide to return water into pond.
- Flush water in low tide.
- Cyclic change of water
- Low stocking (4 pls per square meter).
- No artificial aeration shall be needed.
- The post larvae will be kept on natural/low cost feed.
- The seed will be obtained from Sindh Government Shrimp hatchery Hawksbay, Karachi

The mud crab fattening farms will require required food/feed so that the crabs may grow and acquire required size as per requirement of the of the international and national markets. These farms will be constructed closer to the coastal area in Badin and Thatta districts.

5 Due Diligence

5.1 Description of proposed project

There is tremendous potential for shrimp farming in areas adjacent to “inland sea” in Badin and Thatta districts and the part of the Indus delta particularly on the mud flats and agriculture land that is now salt water intruded. There are about 70,000 hectares of suitable area in the coastal area where shrimp farming could be introduced on scientific lines for the benefit of local fishermen as livelihood and economy of the province and Pakistan. Likewise, the area is having lot of crabs in the area but there is no facility and expertise for fattening of this species with the result that the local fishermen community whose dependence is on crab catch get meager prices by the contractors on site. There is also no facility in the coastal area for fattening process of the mud crabs and organized shrimp farming. Keeping in view these problems it is proposed to establish shrimp farms and mud crab fattening farms in the coastal areas of left bank so as to transfer technology at local level and facilitate the local fishermen to improve their livelihood sources and socio-economic position.

The proposed project has two main components i.e. i) Establishment of Shrimp Farms and ii) establishment of Fattening of Mud Crab farms in the coastal areas of left bank of Indus.

5.1.1 Outcome/targets and scope

- Survey of target areas
- Establishment of Crab Farms 10
- Establishment of Shrimp Farms 10
- Community trainings 60 man months

5.2 Description of Technical aspects of proposed project

Survey of target area

In order to establish the proposed farms it is essential to conduct survey of the area through suitability process. This activity will be carried out jointly by the project management team and local stakeholders of each Taluka. Consideration will be given to technical aspects of the proposed outputs and available infrastructure such approach roads, adjacent to coastal village and other facilities required for the proposed activity.

Capacity building/Trainings for stakeholders

It is essential to transfer technology to the grass root level so as to ensure sustainability of the targeted activities. Stakeholders lack capabilities to scientifically manage the projects in the coastal areas. It is proposed to provide trainings to the stakeholders on the technical, management, marketing and socio-economic aspects of the project. Financial provision has been made in the project to impart such trainings to the stakeholders.

Construction of Shrimp and Mud Crab Farms

The project will have two components.

1. Shrimp Farming.
2. Fattening of mud crabs.

6 Shrimp Farming

Due to recent floods and damage to LBOD (Tidal link) the intrusion of sea has changed the topography of area near Zero point Badin as a result the area has become more suitable for shrimp and fin fish culture including crabs and lobster. Immense potentials exist to start commercial scale fish / shrimp farming.

Following sites are suitable for this purpose in LBOD project area.

Districts	Taluka	Deh	Area Available
Badin	S.Fazil Rahu	Girhari and Ahmed Rajo 4-6	8000 Acres
Thatta	Jati	Oranga	4000 Acres

6.1 Site Conditions

During site selection following parameters of climate, water and oceanography will be considered:

Air temp range	5-41 Celsius
Water temp range	8-34 Celsius
Salinity range	0-47 ppt
Highest tide	3.83 meters
Mean high tide	3.20 meters
Mean sea level	2.06 meters

All these conditions are suitable for shrimp and mud crab culture.

6.2 Site Selection

Selection of site plays a major role in shrimp farming. The determination of site for shrimp farming is made only after thorough analysis of information on topography, ecosystem, metrological and socio economic condition in relating to farm design, species compatibility and economic viability criteria are therein presented that could serve as guide line in judging the following parameters are important:

- Water quality
- Tidal fluctuation
- Soil
- Topography
- Vegetation
- Source of seed
- Accessibility

6.2.1 Species for Culture

In Sindh coast there are more than 15 species of *Penaeus* and *Meta Penaeus*, but the variety recommended in this culture method in *Penaeus monodom* for production of which Government of Sindh has established hatchery at Hawks Bay Karachi where from seed can be purchased easily.

6.2.2 Pond design and construction

There is no standard design for shrimp rearing. Pond farming practices still heavily rely on the experience of individual farmers, financial capability and the environmental conditions prevailing at the site.

6.2.3 Land

Thousands of hectares of low lying coastal land consist of inter tidal mud flats and mangrove farms along the said coast. These areas can be utilized for brackish water shrimp farms on extensive and intensive basis.

6.2.4 Size of Farm

Size of farm depends on maintenance and operational experiences and financial position. However, farms less than 10 acres are uneconomical and non profitable.

6.2.5 Water Quality

Temperature: Water temperature suitable for prawn farming should be around 25-30 C higher or lower temperature are not suitable whenever the temperature is above 30 C the shrimps can temporarily hide in the holes or cavities but not for a long time . Temperature usually gets very low during the months of November to January.

Salinity: Salts contents of the water should be around 28-33 % specific gravity 1.005 to 1.020 at the temperature at 25 C over and less than normal quantity of salt content hinders growth of shrimps & if the situation is still worse the shrimps will die. Salinities rise to very high levels in the dry months for which fresh water supply be arranged.

Oxygen content: Oxygen content of water must also be continuously monitored; oxygen and such measurements are important tools in pond management. If oxygen levels are below 3ppm

by 7.00 a.m. or sechi disc readings are less than 20 cm at 2.00 pm then water exchange is required until these parameters are under control. Oxygen level becomes quite low in the months of June – August and adequate steps are required for checking this shortage on a regular basis, such as use of paddle wheel aerator etc.

Water Color: Desired water color is light brown and light green, if the color is too dark it means too many plants under water and it is not suitable for shrimps and this be monitored properly because this can suddenly deplete all oxygen in pond at night and can kill all the shrimps in a single night.

6.2.5.1 Food

Prior to stocking of the seedlings the pond should be fertilized with organic and inorganic manure. The is maintained well and kept clean natural food will become available in the ponds and this type of natural food is considered ideal for shrimps.

6.2.5.2 Supplement Feeds

Suitable feed is now being made available by some manufacturers who are preparing from good quality fish meal, rice or the pressed cotton or mustard cake in the form of fine powder or pellets which are commonly available as moist feed based on 30% trash fish minced mixed with the any carbohydrates base, such as wheat bran / rice bran powder can be used.

6.2.5.3 Water source

Water must be clear sea water. As such the pumps must be located on the sea shore, and if inter tidal zone is used it should free of pollution etc. In order to select proper area it is necessary to check before hand, clean sea water, water temperature throughout the year, rain fall, and salt content and tidal information.

6.2.5.4 Seed supply

Shrimps fries are generally collected from the wild. It is recommended that fries should be obtained from Sindh Government Shrimp Hatchery at Hawks Bay Karachi.

6.2.5.5 Pond preparation

In any earthen pond culture system, the pond soil plays major role in pond yield. High organic matter content in natural soil often promotes higher primary productivity and hence can yield higher shrimps. Culture operation can be grouped in to three major categories

1. Those that can depend entirely on natural food (extensive culture)
2. Those that depend on both on natural and supplementary feeds (improved extensive and semi intensive culture)
3. Those that depend entirely on artificial diet (intensive culture).

Irrespective of the culture operation used it is always advise able prepare the pond in sustaining higher natural productivity throughout the culture period.

6.2.5.6 Culture techniques

In the proposed feasibility extensive culture technique should be adopted with four animals per square meter density will be kept.

6.2.5.7 Security

One of the greatest threat is under taking fro farming is un account of security reasons. The farmer will be required to setup his own security system.

7 Fattening of Mud Crabs

Mud crab (*Scylla serrata*) named Koko is very famous in taste in south East Asian countries. At present so many parties are exporting crabs to European and Fareast Asian countries which are on rise. The following species of crabs are exported in shape of crab meat, canned and alive.

1. *Scylla serrata* commonly known as mud crab, green crab or mangrove crab.
2. *Portunus pelagicus* commonly known as blue crab.
3. *Portunus sanguinolentus* commonly known as red spot swimming crab.
4. *Charybdis cruciata* commonly known as coral crab.

In Pakistan crab farming is not in practice. Local fishermen catch the same from sea and sell to exporters this trade has taken tempo during last five years. *Scylla serrata* species is liked more which is available in mangroves areas of the Sindh coast. Mud crab likes to live in mud therefore named as Mud crab can be culture in following ways:

1. Fattening
2. Grow out

7.1 Water Quality

Water quality required for its growth is 0-50 ppt TDS. Temperature 12-35 degree C however if less than 20 degree C it stops taking food.

7.2 Food

Mud crab is a carnivore. Likes and eats fresh fish and other animal like mollusk barbells and small fries. Looking at export market and its depleting trade in the nature *Scylla serrata* can be reared easily but it is economically not viable as the production of natural resources is adequate to meet the existing demand.

7.3 Fattening

Crab fattening is practiced as under

- Small size crabs can be collected from sea mostly purchased from fishermen engaged in this trade.
- Reared in earthen ponds for 3 - 4 weeks (till skeleton become hard).
- The small mud crabs are fed trash fish.
- 15 small crabs can be reared in 1 square meter.
- Due to short fattening period no diseases therefore survival rate is 90%.

7.4 Grow out

- Small crab 10-100 grams are kept in earthen ponds for 3 to 8 months to get market able size 200-500 grams.

- One crab is kept in 1 square meter area.
- Survival rate is 40%.

Apart from above, nowadays few prospective exporters out of total 17 exporters have started a very extensive type of crab farming in a way that they collect the adult crabs from the wild with the help of local fishermen and stock them in three half acre crab ponds which are earthen with 400 to 500 kg of crabs in each pond with stocking densities of 4000 to 5000 crabs per ponds and they feed them with trash fish 5% to 10% of body weight (male and female respectively) daily for a month or so. The harvesting is done by setting of tapes according to a marketing strategy to sell them alive in the market of Far East Asia countries and China at an approximate weight of 100 to 200 gms during the culture period of 1-2 months the farmer sometimes experiences 10-15 % mortality.

7.5 Seed collection

Since there are no crab breeding hatcheries in Sindh therefore crab seed (soft shell crab) is collected from wild are purchased from fishermen engaged in this business.

7.5.1 Project cost

Total estimated cost of the proposed project is Rs. 108.30 million. The details are given in Table-1.

Component –wise details are as under:

Shrimp Farming

No. of farms	Construction Cost (Rs.)
10	63.80 million

Mud crab Fattening

Number of Farms	
10	44.50 million

Source of funding

Source of funding will be identified by the stakeholders to implement the scheme.

7.6 Project justification

8 Financial Analysis

The estimated IFRR for mud crab farming has been computed at 36.2%, hence the project is financially viable. The NPV at 12% is Rs.7,730 million. The sensitivity analysis presented in the table below shows that with 10% decrease in the benefits the IFRR is 29.7% while with 10% increase in the cost the IFRR is about 30.3%. Both of these are above 12%. The simultaneous 10% decrease in benefits and increase in cost suggests the IFRR is still above 12%, hence is robust.

The switching values divulge that if the benefits decrease by 34.8%, and costs increase by 53.6%, even though if both may change by 21.1% the project will still be viable.

#	Scenario	NPV @12%	IERR	Switching Value
1	Base Case	7,730	36.2%	
2	Decrease in Benefits (10%)		29.7%	34.8%
3	Increase in Costs (10%)		30.3%	53.6%
4	Simultaneous Change by 10%		24.2%	21.1%

The estimated IFRR for shrimp farming has been computed at 59.6%, hence the project is financially viable. The NPV at 12% is Rs.15,864 million. The sensitivity analysis presented in the table below shows that with 10% decrease in the benefits the IFRR is 49.6% while with 10% increase in the cost the IFRR is about 50.8%. Both of these are above 12%. The simultaneous 10% decrease in benefits and increase in cost suggests the IFRR is still above 12%, hence is robust.

The switching values divulge that if the benefits decrease by 46.7%, and costs increase by 87.7%, even though if both may change by 30.5% the project will still be viable.

#	Scenario	NPV @12%	IERR	Switching Value
1	Base Case	15,864	59.6%	
2	Decrease in Benefits (10%)		49.9%	46.7%
3	Increase in Costs (10%)		50.8%	87.7%
4	Simultaneous Change by 10%		41.9%	30.5%

8.2 ICID evaluation

The project has also been evaluated as per requirements of International Commission for Irrigation and Drainage (ICID). The evaluation reveals that there is no negative impact of this project on the components of the environment.

The above evaluations reveal that the proposed project is environment friendly and also feasible both economically and financially.

8.3 Project benefits

8.3.1 Employment generation and livelihood

The proposed project will create ample direct and indirect employment. The shrimp farming and fattening interventions are directly related to the livelihood of the local population. The poor people will be engaged for employment, increase their earnings, benefit from the sale proceeds of

shrimp and mud crabs and will also get nutrient food. All above benefits will improve the livelihood sources for the local poor people of the coastal area.

8.3.2 Social benefits (poverty, distribution of benefits)

The project area is a poverty ridden area where the poverty line is above 70% and the income distribution is not equitable. Due to execution of the proposed project the poverty level of the poor people, mostly fishermen, will improve significantly because they get employment and also the crabs and shrimps will be sold in enhanced price than the previous condition.

9 Implementation Arrangements

The farms / ponds will be managed by land owners. Sindh Fisheries Department will provide extension and advisory services.

10 Monitoring and evolution mechanism

Monitoring and Evaluation is an important activity in project cycle. Since the proposed project is based on collaboration and participation of stakeholders, the monitoring will also be the same. A monitoring committee will be established constituting of members from each stakeholder with a clear mandate and monitoring mechanism. During the project execution and afterwards this committee will frequently monitor and evaluate the project outcomes, identify bottlenecks and address such bottlenecks through an interactive way. During the process of monitoring indicators and sub-indicators will be established and monitored.

10.1 Environmental Issues

This is an environmental friendly project as it will not create any adverse impacts on flora and fauna, soil, water, land use, climate etc. The proposed project will be executed in the mangrove areas the care shall be taken to protect the mangroves as due to increase in human activity there is apprehension that mangrove resource will be deteriorated on the cost of shrimp farming.

10.2 Resettlement Issues

Resettlement is no issue as establishment of fish farms will be on the government lands.



TABLES

Table 1: Detailed physical targets and investment cost

		Quantities						
	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
I. Investment Costs								
A. Mud Crab Farming /a								
Survey & Investigation	Is							
Pond Construction	Farm	2	3	3	1	1	-	10
Nets for Enclosures	Farm	2	3	3	1	1	-	10
Farmer Training	Farm	2	2	2	2	2	-	10
Operation & Maintenance (Extension)	Is							
Subtotal								
B. Shrimp farming /b								
Survey & Investigation	Is							
Pond Construction	Farm	2	3	3	1	1	-	10
Screen and Planks	Farm	2	3	3	1	1	-	10
Farmer Training	Farm	10	10	10	10	10	-	50
Operation & Maintenance (Extension)	Farm							
Subtotal								
Total Investment Costs								
II. Recurrent Costs								

/a 10 Acre Farm

/b 10 Acre Farm



	Unit Cost (PRs)	Base Cost (PRs Million)						
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
I. Investment Costs								
A. Mud Crab Farming /a								
Survey & Investigation		0.3	0.3	0.3	0.3	0.3	-	1.5
Pond Construction	3,000,000	6.0	9.0	9.0	3.0	3.0	-	30.0
Nets for Enclosures	800,000	1.6	2.4	2.4	0.8	0.8	-	8.0
Farmer Training	300,000	0.6	0.6	0.6	0.6	0.6	-	3.0
Operation & Maintenance (Extension)		0.4	0.4	0.4	0.4	0.4	-	2.0
Subtotal		8.9	12.7	12.7	5.1	5.1	-	44.5
B. Shrimp farming /b								
Survey & Investigation		0.3	-	-	-	-	-	0.3
Pond Construction	3,000,000	6.0	9.0	9.0	3.0	3.0	-	30.0
Screen and Planks	100,000	0.2	0.3	0.3	0.1	0.1	-	1.0
Farmer Training	600,000	6.0	6.0	6.0	6.0	6.0	-	30.0
Operation & Maintenance (Extension)		0.5	0.5	0.5	0.5	0.5	-	2.5
Subtotal		13.0	15.8	15.8	9.6	9.6	-	63.8
Total Investment Costs		21.9	28.5	28.5	14.7	14.7	-	108.3
II. Recurrent Costs								
		21.9	28.5	28.5	14.7	14.7	-	108.3



Totals Including Contingencies (PRs Million)						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total
I. Investment Costs						
A. Mud Crab Farming /a						
Survey & Investigation	0.4	0.4	0.4	0.4	0.4	1.9
Pond Construction	7.0	11.1	11.6	4.1	4.3	38.0
Nets for Enclosures	1.9	2.9	3.1	1.1	1.1	10.1
Farmer Training	0.7	0.7	0.8	0.8	0.9	3.9
Operation & Maintenance (Extension)	0.5	0.5	0.5	0.5	0.6	2.6
Subtotal	10.4	15.6	16.4	6.9	7.3	56.5
B. Shrimp farming /b						
Survey & Investigation	0.4	-	-	-	-	0.4
Pond Construction	7.0	11.1	11.6	4.1	4.3	38.0
Screen and Planks	0.2	0.4	0.4	0.1	0.1	1.3
Farmer Training	7.0	7.4	7.7	8.1	8.5	38.8
Operation & Maintenance (Extension)	0.6	0.6	0.6	0.7	0.7	3.2
Subtotal	15.2	19.4	20.4	13.0	13.6	81.6
Total Investment Costs	25.6	35.0	36.8	19.9	20.9	138.2
II. Recurrent Costs	25.6	35.0	36.8	19.9	20.9	138.2



Table 2: Enterprise Budget for 10 Acre Shrimp Farm

N ^o	Detail	Unit	Rate (PRs)	Quantity	Years										
					1	2	3	4	5	6	7	8	9	10	15
A	Revenue (PRs 000)														
	Shrimp production	kg			0	10,940	11,049	11,160	11,271	11,384	11,498	11,613	11,729	11,846	12,451
	Rate	Rs/kg	500		500	500	500	500	500	500	500	500	500	500	500
	Gross value of Output	Rs 000			0	5,470	5,525	5,580	5,636	5,692	5,749	5,807	5,865	5,923	6,225
B	Investment Cost														
1	Survey	ls	300,000	1	300										
2	Cost of land	ac	10	5,000	50	50	50	50	50	50	50	50	50	50	50
3	Earthwork	hour	300,000	10	3,000										
4	Screen & wooden planks	ls	100,000	1	100	0	0	0	0	0	0	0	0	0	0
C	Subtotal	Rs 000			3,450	50	50	50	50	50	50	50	50	50	50
	Production Cost (000)														
1	Shrimp larvae	per month	5.0	120,000	600	600	600	600	600	600	600	600	600	600	600
2	Imported feed	mt	600,000	1	600	600	600	600	600	600	600	600	600	600	600
3	Local feed	mt	200	1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
4	Fertilizer	mt	300	1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
5	Lime	mt	200	1	0	0	0	0	0	0	0	0	0	0	0
5	Labor cost 8)	month	10,000	96	960	960	960	960	960	960	960	960	960	960	960
	Subtotal				2,161	2,161	2,161	2,161	2,161	2,161	2,161	2,161	2,161	2,161	2,161
D															
	Total Cost	Rs 000			5,611	2,211	2,211	2,211	2,211	2,211	2,211	2,211	2,211	2,211	2,211
F	Net Cash Flow	Rs 000			-5,611	3,259	3,314	3,369	3,425	3,481	3,538	3,596	3,654	3,713	4,015
	IFRR	59.65%													



Table 3: Enterprise Budget for 10 Acre Mud Crab Farm

N ^o	Detail	Unit	Rate (PRs)	Quantity	Years										
					1	2	3	4	5	6	7	8	9	10	15
A	Revenue (PRs 000)														
	Crab production	kg			0	5,850	5,909	5,968	6,027	6,088	6,148	6,210	6,272	6,335	6,658
	Rate	Rs/kg	610		610	610	610	610	610	610	610	610	610	610	610
	Gross value of Output	Rs 000			0	3,569	3,604	3,640	3,677	3,713	3,751	3,788	3,826	3,864	4,061
B	Investment Cost														
1	Survey	ls	300,000	1	300										
2	Cost of land	ac	10	5,000	50	50	50	50	50	50	50	50	50	50	50
3	Earthwork	hour	10,000	300	3,000										
4	Nets for enclosure	ls	800,000	1	800	0	0	0	0	0	0	0	0	0	0
	Subtotal	Rs 000			4,150	50	50	50	50	50	50	50	50	50	50
C	Production Cost (000)														
1	Cost of juveniles	No.	30	5,000	150	150	150	150	150	150	150	150	150	150	150
2	Feed for juvenile	ls/year	500,000	1	500	500	500	500	500	500	500	500	500	500	500
3	Transport	ls/year	150,000	1	150	150	150	150	150	150	150	150	150	150	150
4	harvesting cost	ls/year	250,000	1	250	250	250	250	250	250	250	250	250	250	250
5	Labor cost (4)	month	10,000	48	480	480	480	480	480	480	480	480	480	480	480
	Subtotal				1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530	1,530
D	Total Cost	Rs 000			5,680	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580
E	Net Cash Flow	Rs 000			-5,680	1,989	2,024	2,060	2,097	2,133	2,171	2,208	2,246	2,284	2,481
F	IFRR	36.18%													



Table 4: ICID Environmental checklist for the proposed project

For each environmental effect place a cross (X) in one of the columns		Positive or very likely	Positive impact Possible	No impact Likely	Negative impact possible	Negative impact very likely	No judgment possible at present	Comments
Hydrology	1.1 Low flow regime						X	
	1.2 Flood regime						X	
	1.3 Operation of dams						X	
	1.4 Fall of water table						X	
	1.5 Rise of water table						X	
Pollution	2.1 Solute dispersion			X				
	2.2 Toxic substances			X				
	2.3 Organic pollution			X				
	2.4 Anaerobic effects			X				
	2.5 Gas emissions			X				
Soils	3.1 Soil salinity		X					
	3.2 Soil properties		X					
	3.3 Saline groundwater			X				
	3.4 Saline drainage	X						
	3.5 Saline intrusion			X				
Sediments	4.1 Local erosion			X				
	4.2 Hinterland effects			X				
	4.3 River morphology			X				
	4.4 Channel regime			X				
	4.5 Sedimentation			X				
	4.6 Estuary erosion			X				
Ecology	5.1 Project lands	X						
	5.2 Water bodies	X						
	5.3 Surrounding area		X					
	5.4 Valleys and shores			X				
	5.5 Wetlands and plains	X						
	5.6 Rare species		X					
	5.7 Animal migration			X				
	5.8 Natural Industry	X						
Socio-economic	6.1 Population change	X						
	6.2 Income and amenity	X						
	6.3 Human migration			X				
	6.4 Resettlement			X				



For each environmental effect place a cross (X) in one of the columns		Positive or very likely	Positive impact Possible	No impact Likely	Negative impact possible	Negative impact very likely	No judgment possible at present	Comments
	6.5 Women's role	X						
	6.6 Minority groups	X						
	6.7 Sites of value	X						
	6.8 Regional effects	X						
	6.9 User involvement	X						
	6.10 Recreation	X						
Health	7.1 Water and sanitation	X						
	7.2 Habitation	X						
	7.3 Health services			X				
	7.4 Nutrition	X						
	7.5 Relocation effect	X						
	7.6 Disease ecology			X				
	7.7 Disease hosts			X				
	7.8 Disease control			X				
	7.9 Other hazards			X				
Imbalances	8.1 Pests and weeds			X				
	8.2 Animal diseases			X				
	8.3 Aquatic weeds			X				
	8.4 Structural damage			X				
	8.5 Animal imbalances			X				
Number of crosses								

¹ Adapted from International Commission on Irrigation and Drainage (ICID)

Concluding Remarks: The proposed intervention is environment friendly with no apparent negative environmental impact. The intervention shall also improve the livelihood of the people and create employment opportunities for the coastal communities. and is expected to raise the socio-economic conditions of the people of the area as the shrimp and mud crab species are the export commodities.