Pre-Feasibility Study
BIOFLOC FISH FARMING

Small and Medium Enterprises Development Authority

Ministry of Industries and Production
Government of Pakistan

www.smeda.org.pk

HEAD OFFICE
4th Floor, Building No. 3, Aiwan-e-Iqbal Complex, Egerton Road,
Lahore
Tel: (92 42) 111 111 456, Fax: (92 42) 36304926-7
helpdesk@smeda.org.pk

REGIONAL OFFICE PUNJAB	REGIONAL OFFICE SINDH	REGIONAL OFFICE KHYBER PAKHTUNKHWA	REGIONAL OFFICE BALOCHISTAN
3rd Floor, Building No. 3, Aiwan-e-Iqbal Complex, Egerton Road Lahore, Tel: (042) 111-111-456 Fax: (042) 36304926-7 helpdesk.punjab@smeda.org.pk	5th Floor, Bahria Complex II, M.T. Khan Road, Karachi. Tel: (021) 111-111-456 Fax: (021) 5610572 **helpdesk-khi@smeda.org.pk**	Ground Floor State Life Building the Mall, Peshawar. Tel: (091) 9213046-47 Fax: (091) 286908 **helpdesk-pew@smeda.org.pk**	Bungalow No. 15-A Chaman Housing Scheme Airport Road, Quetta. Tel: (081) 831623, 831702 Fax: (081) 831922 **helpdesk-qta@smeda.org.pk**

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Table of Contents

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2. EXECUTIVE SUMMARY

This pre-feasibility document provides information for setting up a medium sized fish farm for producing Tilapia fish by utilizing Biofloc technology.

Biofloc fish farming technology was introduced in the world about 7-8 years ago and it quickly became very popular in India, Thailand, Malaysia, Japan, and some other countries. This technology is relatively new in Pakistan. The trend of producing/farming fish by using Biofloc technology is evolving due to its multiple advantages over traditional fish farming methods.

Biofloc technology is an environmental friendly aquaculture technique. The microbial community in Biofloc system is able to rapidly utilize dissolved nitrogen leached from fish excreta and unconsumed feed and convert them into microbial protein; which can serve as fish meal. It has been realized that the traditional fish meal be used in aquaculture production system as a protein source for the formulation of fish feed can be easily replaced by Biofloc meal. It could be used in brooder and larval feed to obtain better growth performances. Consumption of microorganisms in this system reduces FCR (feed conversion ratio) and subsequently the feed cost. The technology thus leads to decreasing the overall cost of fish production. Promotion of Biofloc fish farming technology can play a significant role in increasing food supplies in the country and ensuring nutritional security of the poor people.

Biofloc technology is an emerging concept which enables the fish farmers to produce fish in bio-secured and controlled environment with less space requirement. Improved water quality, better waste treatment, better disease prevention, improved biosecurity, decreased feed conversion ratio, increased water-use efficiency and increased land-use efficiency are some key advantages of this latest technology for producing fish.

Tilapia, locally known as *Chira Machhli* is in high demand in the local market. Tilapia is rich in nutrients with a high growth rate and it is also good for strengthening immunity system. The production potential of this species of fish is very high. These fish can be produced on a large scale on lesser space compared to that required for fish production using traditional fish farming techniques.

The proposed project will create no hazards to both human and environment.

The farming unit should ideally be set up on 4,500 square feet (sq. ft.) of owned / purchased agriculture land. For setting up Biofloc fish farming, 4 districts of Balochistan, 8 districts of Khyber Pakhtunkhwa, 5 districts of Sindh and 10 districts of Punjab are suitable.

The proposed fish farming unit will have 16 Biofloc tanks, with a maximum capacity of producing 16,000 kgs of fish per year during a season of 7-8 months; during the months from May to December. Average number of fish produced per Biofloc tank will be 2,000; having an average weight of 0.5 kilogram per fish. It means that total fish production per tank will be 1,000 kilograms.

Procurement of healthy, certified mono-sex[1] seed from reliable sources, suitable location, matching of fingerlings' stocking density to feed, and strict pond management are the main critical factors for the production of fish using this technology. The water in the Biofloc tanks can be utilized for 6 months for producing Tilapia.

The total investment cost of this proposed is PKR 6.47 million. This includes capital investment of PKR 5.84 million and working capital of PKR 0.63 million. This project is financed through 100% equity. The Net Present Value (NPV) of project is PKR 0.07 million with an Internal Rate of Return (IRR) of 20% and a Payback period of 5.45 year. Further, this project is expected to generate Gross Profit (GP) ratio ranging from of 31% to 47% and Net Profit (NP) ratio ranging from 2% to 26% during the projection period of ten years. The proposed project will achieve its estimated breakeven point at capacity of 88% (13,180 kg) with annual revenues of PKR 4.23 million.

The proposed project may also be established using leveraged financing. At 50% debt financing at a cost of KIBOR+3%, the proposed Biofloc Fish Farming provides Net Present Value (NPV) of PKR 1.73 million, Internal Rate of Return (IRR) of 20% and Payback Period of 5.46 years. Further, this project is expected to generate Net Profit (NP) Ratio ranging from 5% to 26% during the projection period of ten years. The proposed project will achieve its estimated breakeven point at capacity of 88% (14,143) with annual revenue of PKR 4.24 million.

The proposed project will provide employment opportunities to 7 to 8 persons. High return on investment and steady growth of business is expected with the entrepreneur having some prior experience or education in the related field of business. The legal business status of this project is proposed as Sole Proprietorship.

3. INTRODUCTION TO SMEDA

The Small and Medium Enterprises Development Authority (SMEDA) was established in October 1998 with an objective to provide fresh impetus to the economy through development of Small and Medium Enterprises (SMEs).

With a mission "to assist in employment generation and value addition to the national income, through development of the SME sector, by helping increase the number, scale and competitiveness of SMEs", SMEDA has carried out 'sectoral research' to identify policy, access to finance, business development services, strategic initiatives and institutional collaboration and networking initiatives. Preparation and dissemination of prefeasibility studies in key areas of investment has been a successful hallmark of SME facilitation by SMEDA.

[1] Monosex tilapia are male fishes. Tilapia exhibits early sexual maturity that leads to uncontrolled reproduction. Single-sex culture eliminates this problem, and males are the obvious choice, as they exhibit considerably faster growth and achieve larger size than females.

Concurrent to the prefeasibility studies, a broad spectrum of business development services is also offered to the SMEs by SMEDA. These services include identification of experts and consultants and delivery of need-based capacity building programs of different types in addition to business guidance through help desk services.

National Business Development Program for SMEs (NBDP) is a project of SMEDA, funded through Public Sector Development Program of Government of Pakistan.

The NBDP envisages provision of handholding support / business development services to SMEs to promote business startup, improvement of efficiencies in existing SME value chains to make them globally competitive and provide conducive business environment through evidence-based policy-assistance to the Government of Pakistan. The Project is objectively designed to support SMEDA's capacity of providing an effective handholding to SMEs. The proposed program is aimed at facilitating around 314,000 SME beneficiaries over a period of five years.

4. PURPOSE OF THE DOCUMENT

The objective of the pre-feasibility study is primarily to facilitate potential entrepreneurs in project identification for investment. The project pre-feasibility may form the basis of an important investment decision and in order to serve this objective, the document/study covers various aspects of project concept development, start-up, and production, marketing, finance and business management.

The purpose of this document is to provide information to the potential investors about “Biofloc Fish Farming”. The document provides a general understanding of the business to facilitate potential investors in crucial and effective investment decisions.

The need to come up with pre-feasibility reports for undocumented or minimally documented sectors attains greater imminence as the research that precedes such reports reveal certain thumb rules; best practices developed by existing enterprises by trial and error, and certain industrial norms that become a guiding source regarding various aspects of business setup and its successful management.

Apart from carefully studying the whole document, one must consider critical aspects provided later on, which form the basis of any investment decision.

5. BRIEF DESCRIPTION OF PROJECT & PRODUCTS

Rapid increase in population of Pakistan has made it mandatory that the growing food demand is met while safeguarding the natural resources. In this regard, aquaculture has a crucial role to play in the elimination of hunger, promotion of good health, reduction of poverty and provision of jobs and economic opportunities. Several technologies have been developed to ensure increased and sustainable

production of fish. Biofloc technology or commonly known as BFT is a relatively new aquaculture technology, gaining popularity in the world.

Biofloc fish farming can be used to farm Tilapia (Chira Fish), Catfish (Khagga Fish), Trout, Salmon and Shrimp (Jheenga). This prefeasibility study provides information on Tilapia fish farming using Biofloc technique. Tilapia fish is selected because of its rapid growth, and high protein content as compared to other kinds of fish species. Tilapia fish is also proposed because this fish has a high demand in Pakistani domestic market. 16 biofloc tanks will be used in the proposed farm, each having a production capacity of 1000 kg fish and a total capacity of producing 16000 kg of fish per year in a season of 7 to 8 months.

This project can be used to encourage farmers and unemployed youth to use BFT technology for fish farming in small areas. Thus, this would help in creating employment on a large scale and would require small amount of investment compared to tradition fish farming.

5.1. What is Biofloc technique?

Biofloc is an assemblage of beneficial microorganisms, such as heterotrophic bacteria, algae, fungi, ciliates, flagellates, rotifers, nematodes, metazoans & detritus. A Biofloc consists of a heterogeneous mixture of microorganisms, particles, colloids, organic polymers, cations and dead cells.

Biofloc Technology (BFT) is a relatively new and potentially revolutionary technology that is especially productive for farming Tilapia fish. The technique is meant for improving water quality in aquaculture and also for producing feed for the farmed fish. In Biofloc farm, besides provision of the required quantity of oxygen, controlling the quantity of toxic nitrogen compounds is also one of the major concerns. The main sources of ammonia are the excretion of the cultured organism (farmed fish) and the decomposition of nonliving matter (dissolved and particulate). In BFT, nitrogen conversion takes place in three ways for the removal of ammonia nitrogen. These are photoautotrophic removal by algae, autotrophic bacterial conversion from ammonia to nitrate and heterotrophic bacterial conversion of ammonia nitrogen directly to microbial biomass which becomes feed for the farmed fish.

Biofloc fish farming is less expensive and more productive compared to the conventional fish farming.

Understanding the Biofloc system is essential for having the required production of fish. Biofloc technology is based upon pond management using minimal water exchange. Main features of BFT are as under:

Eco-friendly: BFT offers the benefit of zero-water exchange which means that the entire water from Biofloc tank does not have to be removed and only sludge removal is sufficient to maintain the desired water quality. This feature of Biofloc makes it eco-friendly. In conventional farming, nitrogen is flushed out through water exchange

every 25-30 days to keep fish stress-free[2] and disease-free. The Biofloc technique keeps the pH[3] levels steady and feed on the nitrogen produced by the fish and use up the nitrogen and convert it into proteins, for the farmed fish. This also leads to improvement in use of water.

Improving Water Quality: Biofloc is comprised of bacteria, other organisms, and organic and inorganic matter. The microbial aggregates, through using the chemical energy in the organic matter (nitrogenous compounds assimilated by bacteria), contribute to the control of water quality and toxic nitrogen compounds. The waste in water is treated because Biofloc system reduces solid discharge into the environment by maintaining the organic solids in suspension which helps in controlling the ammonia in the aqua system.

Improvement of Biosecurity: The reduced water exchange decreases pollution, and no external elements are added to the water in Biofloc tanks, this allows for greater biosecurity during production. As a result, the chances of disease decrease to a great extent.

Disease Prevention: The presence of Biofloc also enhances immune functions of the fish. Therefore, an improved immunity in fish and better antioxidant defence mechanism likely results in higher resistance against pathogens, to prevent disease outbreaks.

Improvement of Feed Conversion: Consumption and regeneration of Biofloc can increase feed utilization efficiency of the microbial population by recycling feed residues and/or recovery of some fraction of excreted nutrients.

Improvement of Water Use Efficiency: Since there is no water exchange except sludge removal, this system uses the water in the most efficient way compared to traditional fish farming.

Increasing Land Use Efficiency: Biofloc utilizes less space with more production compared to the traditional pond farming which increases the land utilization efficiency. A 12 feet tank can produce equivalent fish compared to a traditional pond that requires 4,500 sq. feet. (1 kanal) of land.

Cost effective: Fish farmers can cut the cost of farming by half by reducing the cost of feed. Use of Biofloc technology, not only improves quantity, but also the quality of the production. The capital investment required for this technology is low, due to lower space requirement and reduction of investment in terms of construction cost and less water usage.

[2] "Stress is a term used in vet medicine to describe any condition in the environment that causes the release of cortisol and adrenaline in the body. When the cause of the stress is continuous, like poor water quality or harassment from other more aggressive fish, the normal immune functions are blocked, which often leads to sick fish with disease conditions like parasites, bacterial infections and fungi.

[3] pH is a measure of how acidic/basic water is.

Figure 1: Scheme of Biofloc Technology Pond

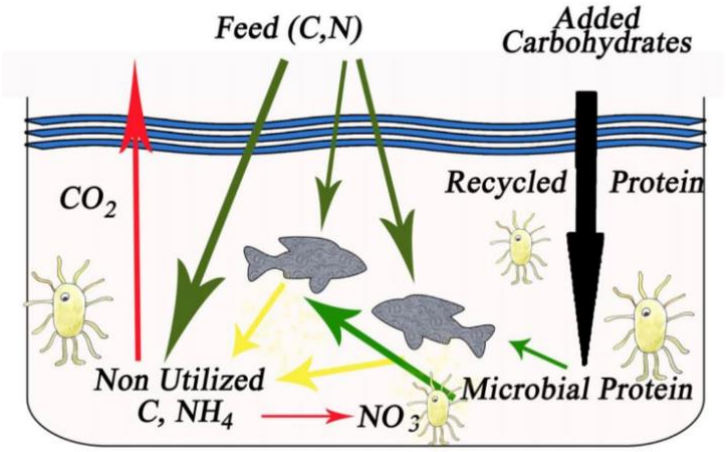


Figure 1 shows the scheme of Biofloc technology pond indicating how recycling of proteins is done.

Biofloc Tank Specifications

The tanks that will be used in Tilapia Biofloc faming will be circular, made up of polythene material and this material will cover the tank from both inside and outside. Each tank will take 225 sq. ft. of area; this area will also include the open space that is left between individual tanks. The diameter of the tank will 4 meters and depth will be between 1 to 1.4 meters. Two thousand Tilapia fish will be stocked in each tank. Each tank will be filled with approximately 12,000 liters of water. All the tanks will be covered by an artificial roof.
Figure 2 shows the image of a typical biofloc tank.

Figure 2: Biofloc Tank

5.2. Comparison of Biofloc Technique with Traditional Fish Farming methods

Farmers can have better productivity with Biofloc system when compared to conventional aquaculture techniques. Biofloc production can decrease mortality rates, increase larval growth and improve growth rates in the cultured species. The other key advantage of Biofloc technology lies in its improved water, land use rates, low environmental impact. The reduced water inputs decrease pollution and allow for greater biosecurity and disease control during fish production.

Biofloc system requires a startup period and yields are not always consistent between seasons. Since farmers must constantly mix and aerate the culture water, energy costs could be higher than expected. In addition to these factors, farmers must consistently manage Biofloc system to prevent nitrite accumulation and to keep alkalinity levels within a healthy range. Monitoring fish health and welfare is also key of biofloc systems, because increase in the levels of suspended solids in the water, will expose fish to environmental stress.

In traditional farming systems, only about 25% of the protein content of feeds is actually utilized by farmed fish. However, by converting ammonia into microbial proteins, these proteins can be consumed by the farmed fish. Biofloc systems are able to double this figure which is one of the main savings for Biofloc farmers.

5.3. Tilapia fish and its certain features

Some typical characteristics of Tilapia fish are narrated below:

- Tilapia have become the second most cultivated fish in Pakistan.
- Tilapia have a small head, light vertical stripes, thick body and light-colored belly.
- Tilapia have a rapid growth rate in comparison with other kinds of fish. The production potential of Tilapia is very high. These can be produced on a very large scale by utilizing less space.
- The males attain large size and at faster rate i.e., 2-3 times that of females. Male and female Tilapia have similar growth rates for the first few months but as they reach sexual maturity, the males continue fast growth, whereas the growth rate of the females slows down, since they have to expend more energy in producing eggs and incubating them in their mouths.
- Tilapia have versatile feeding habits and can grow well on a purely vegetable source of protein. They also consume some aquatic plants, snails, and bacterial films that grow on decomposing organic matter. These are omnivores. Their feed can vary from herbs to bugs.
- Tilapia are very strong resistant to disease and parasites. This makes it highly favorable choice for the fish farmers

- They are tolerant to wide variety of water conditions like high salinity, high water temperature, low dissolved oxygen and high ammonia.
- They are rich in taste nutrients, have Omega 3[4] and are also rich in proteins. In addition to the nutrient value of Tilapia, these fish are also good for immunity system.

Figure 3: Tilapia Fish

5.4. Tilapia and Biofloc

Biofloc systems enable more intensive Tilapia production as they are ideally adapted to Biofloc systems. Tilapias grow well by utilizing the Biofloc as a feed source. The recycling of feed and minimization of water exchange are important contributions to the Tilapia production.

This technology for fish production is mainly for developing, more populous countries, as it requires:

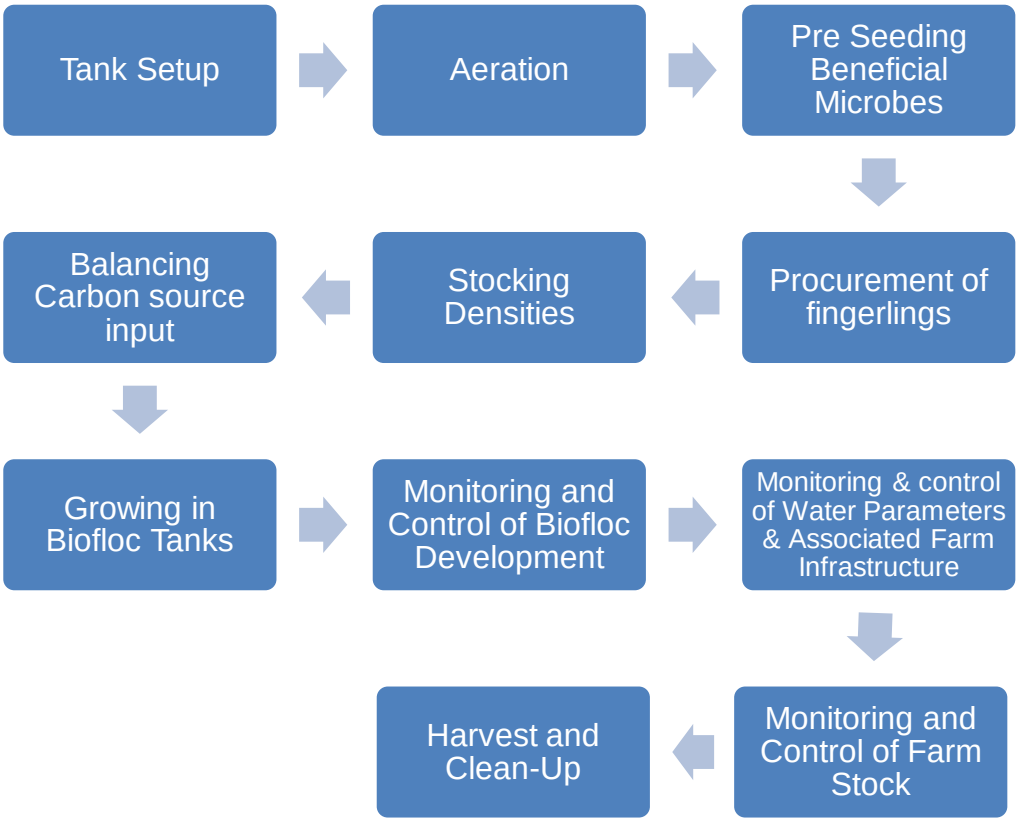
- Less space
- Less resources
- Less water

[4] Omega-3 are the fatty acids that help in keeping the human heart healthy in several ways. They curb inflammation in the blood vessels and the rest of the body.

5.5. Prod0uction Process

Production process of Tilapia by using Biofloc technology is shown in Figure 4.

Figure 4: Production Process Flow



Brief description of production process for producing Tilapia fish using Biofloc technology is provided hereunder.

Tank Setup

It's best to start Biofloc fish farming with lined ponds, concrete ponds or Tarpaulin sheet indoor tanks wherein soil has no influence over water parameters or Biofloc processes. There are areas which experience heavy rainfall; therefore, alkalinity and pH are easily affected in outdoor systems. Therefore, in these areas, having covered tanks is a good option. When indoor tanks are used, there is absence of natural sunlight and algae do not grow in sufficient quantity or in certain cases, do not grow at all. Therefore, these tanks create a Biofloc system based solely on bacteria. The Biofloc system that is produced without algae (because of absence of direct exposure of sunlight) by using bacteria are called "Brown Biofloc Systems ", the name being derived from the color of this system.

Figure 5: Biofloc Tank for the Proposed Project

Aeration

After selection of the right pond or tank setup, provision of aeration system is the next important step. All Biofloc systems require constant motion to maintain both high oxygen levels and to keep solids from settling. Areas without movement rapidly lose oxygen and turn into anaerobic zones, which release large amounts of ammonia and methane.

To prevent this, every pond or tank needs a well-planned layout of aerators. Biofloc systems require up to 6 milligrams of oxygen per liter per hour. In line with the proposed capacity of this proposed tank, it is recommended to install one water pump and one ring blower of 1.5 horsepower.

Figure 6 Aeration Process

Procurement of Fingerlings

The proposed project will require procuring mono-sex Tilapia, weighing (0.2 to 0.5 grams) fingerlings from Tilapia hatcheries. Tilapia can be procured easily from local hatcheries at the rate of PKR 3 per fingerlings. For procuring fingerlings, an advance order is placed in the first quarter of every year (i.e., from January to March). The order is normally placed two months in advance to obtain the fingerlings in the month of April. The hatcheries take 50% payment in advance at the time of placing the order. There are three breeds of Tilapia fingerlings which cost around PKR 3, PKR 10 and PKR 15 each fingerling. Normally, the fingerlings costing PKR 3 is used in the Biofloc farming to keep the cost low, because this is cheap and more affordable for commercial farming.

Department of Fisheries of Government of Punjab has 20 fish seed hatcheries in Punjab. These are located in all the big cities of Punjab. These cities include Lahore, Bahawalpur, Multan, Rawalpindi, Gujranwala, D.G.Khan, Faisalabad, Sargodha and Murree. These hatcheries supply fish seed to the fish farmers of Punjab and other provinces including Azad Jammu Kashmir. Apart from these government hatcheries, many private hatcheries are also working in Punjab, which can be contacted in order to obtain the Tilapia fingerlings.

In order to obtain higher quality of fingerlings, these may also be imported from international market such as India and Thailand. The order has to be placed two months in advance. Figure 7 show the Tilapia Fingerlings.

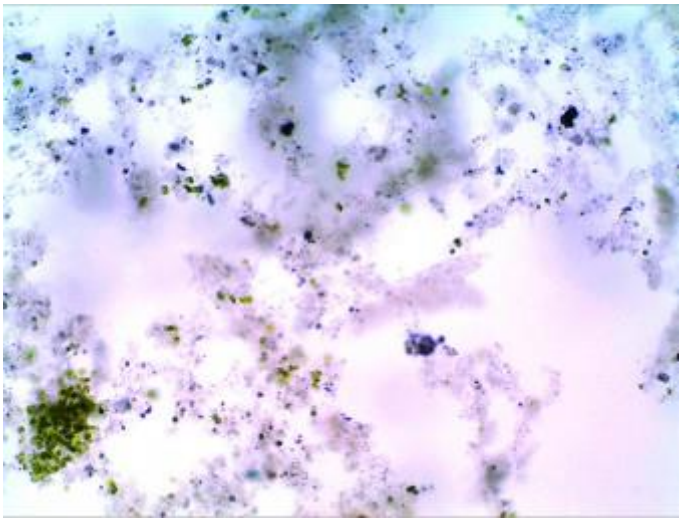
Figure 7: Tilapia Fingerlings

Pre-seeding Beneficial Microbes

To accelerate the development of Biofloc system and stabilize the pond more quickly, the culture water of the pond is pre-seeded. This is done by adding a number of commercial or homemade recipes to the culture water. A simple homemade recipe to quickly produce probiotic and prebiotic microbes uses wheat pollard and Red Cap 48 mixed in a closed drum and left to ferment for 48 hours,

after which the contents can be added to the pond. Figure 8: Pre-seeding Beneficial Microbes presents the pre-seeding microbes.

Figure 8: Pre-seeding Beneficial Microbes



Stocking Densities

In fish-farming systems the stocking density is expressed as the number or weight of fish per unit area (square meters) or water volume (cubic meters).

Due to strong aeration and self-filtering capacity of culture water, high stocking densities can be considered. It is common to stock Tilapia at densities of 200 to 300 fingerlings per cubic meter. Many farmers try to use higher stocking densities but this significantly increases the risk of disease, compromising both the health and welfare of the animals.

Figure 9: Stocking Density

Balancing Carbon Source Input

Ammonia is the most harmful thing which threatens the success of fish farming. If allowed to accumulate in Biofloc systems, fish cannot extract energy from feed efficiently. If the ammonia concentration gets high enough, the fish become lethargic and eventually fall into a coma and die. The main source of ammonia is fish excretion. The rate at which fish excrete ammonia is directly related to the feeding rate and the protein level in feed. High stocking density and intensive feeding lead to the accumulation of organic waste, which results in an increase in ammonia.

The increase in quantity of ammonia has to be controlled during the entire farming period, right from the planting stage of fingerlings to the harvesting stage.

At the start of the farming cycle, the increase in quantity of ammonia in the Biofloc tanks is prevented by ensuring sufficient availability of carbohydrates. The carbon in these carbohydrates enables heterotrophic[5] bacteria to multiply and synthesize ammonia, thus maintaining water quality. The growth of heterotrophic bacteria in the biofloc system leads to removal of ammonia from the system through assimilation into microbial biomass. Any material that contains simple sugars and breaks down quickly can be used, such as molasses, sugarcane or starch.

Fish Growing in Biofloc Tanks

With plenty of aeration, natural light (in most systems) and a readily available source of carbon, Tilapia fish starts to grow quickly. The growth of fish depends on a variety of factors, including feed quality, water temperature, available nutrients and sunlight. The fingerlings are kept in the tanks until they gain the weight above 600 grams. With the Soya based pallet feed, an average weight of 800 grams may be achieved.

The amount of feed given to the fish and the growth in the weight of fish is expressed as a ratio, known as Feed Conversion Ratio (FCR). Simply stated, it is the amount of feed required for production of meat unit. For ideal growth of Tilapia fish, FCR, is 1:2.Figure 10 shows the growing Tilapia in Biofloc tank.

Figure 10: Tilapia Fish in Biofloc Tank

[5]The heterotrophic bacteria use the organic compounds as a carbon source. This community can minimize ammonia accumulation in the water.

Monitoring and Control of Biofloc Development

Water samples must be regularly taken to monitor the tank water. Regular monitoring of water quality parameters, especially dissolved oxygen and ammonia levels, gives a good idea of the system's performance and any need for increasing aeration.

Monitoring and Control of Water Parameters and Associated Farm Infrastructure

Once the Biofloc system has turned brown, aeration must be significantly increased to sustain the high oxygen level. Oxygen level at this stage can reach 6 milligrams per liter per hour, requiring up to six times more energy per hectare compared to that in the start of operations.

There is requirement for good maintenance and monitoring of the aerators and the power system that provides the energy to run this system. Any power failure at this stage can quickly result in total crop failure due to lack of oxygen due to which many heterotrophic bacteria start producing ammonia. It is vital for the aeration system to stay functional at all times.

Monitoring and Control of Farm Stock

Besides maintaining water quality at lower cost and without water exchange, the second goal of a Biofloc system is to improve growth rates and feeding efficiencies, thereby improving the profitability and sustainability of farming operations.

To check how the farm is doing, regular monitoring of the performance of the farm stock, calculating and recording growth rates, overall appearance of the fish, FCR and stock survival (this means that the accumulative number of dying fish stock in Biofloc system is not more than the mortality rate of 3%) is required. It has been estimated that for every unit of growth in the stock from the standard feed, an additional 0.25 to 0.5 units of growth can come from the Biofloc in the system.

Harvest and Clean-Up

Harvesting is done in the last week of October and beginning of November. Fish will be harvested when the fish have attained weight of approximately 500 grams. The fish will be harvested through a small net that can be handled by a single person. After harvesting, the fish are first weighed and then are packed either in polypropylene bags or in the polystyrene boxes (for improved quality during the transportation and handling).

Proper cleaning and preparation of the pond setup is vital after harvest time, which is often underestimated. Although it might seem appealing to reuse the culture water since it took intensive effort to build up the populations of microorganisms, this is not advisable. Pathogens might have built up the culture and can pose a serious biosecurity risk. Research has also indicated that over time, heavy metals can build up in the culture water, which can accumulate in stock, making it unsuitable for human consumption.

5.6. Installed and Operational Capacities

The proposed farm will have maximum operational capacity of producing 16,000 kg fish in a year. For proposed project 16 biofloc tanks are installed which require 3,600 sq. feet (16 Marla) area. The average area required per tanks is 225 sq. ft. (1 Marla). The average number of fish produced per biofloc tank will be 2,000; having an average weight of 0.5 kilogram per fish. It means that total fish production per tank will be 1,000 kgs. For details of biofloc tank specifications refer to section **5.2** subheading **"Biofloc Tank Specifications"**. It is assumed to operate at 100% capacity from 1st year of operations.

Table 1 shows details of maximum annual capacity and operational capacity utilized during first year of operations.

Table 1: Installed and Operational Capacity

Total Number of tanks (A)	Number of Fish Per Tank (B)	Average Weight of Completely Grown Fish (kgs) (C)	Total Capacity (kgs) (A*B*C) = D
16	2,000	0.5	16,000

6. CRITICAL FACTORS

Before making the decision to invest in Biofloc Fish Farming business, one should carefully analyze the associated risk factors. The important considerations in this regard include:

- Tilapia fish cannot bear water temperature below 18. 3°C. Therefore, selected location must have suitable climate with temperature not falling below 18.3°C.and sufficient water availability.
- Water and pond or tank management is the key factor for the production of fish under this technology. As ammonia is highly dangerous for the survival of fish, it must be treated.
- Pond development and maintenance to ensure efficient inflow, retention and drainage of water
- Proper measure will need to be taken to ensure protection against fish theft and fingerlings/fish escape from the Biofloc tank.
- Probiotics[6] as bacteria are essential to consume ammonia in the water. It consumes ammonia and carbon to convert it into feed.
- There is a mortality rate of 3%when fish is transferred into Biofloc tanks at the time of purchase. This is because of distress of fingerlings.

[6] Probiotics are beneficial bacteria which play an important role in the microbial balance of the microorganisms and the water environment. The presence of beneficial bacteria in the Biofloc creates a "natural probiotic" effect, which can act both internally and externally to combat pathogens and improve immune response

- Procurement of healthy, certified, mono-sex seed from reliable sources recommended by the Fisheries Development Board (Federal Department).

7. GEOGRAPHICAL POTENTIAL FOR INVESTMENT

Biofloc projects should be established in areas which have with sufficient water resources and suitable land and climate conditions. The temperature should not fall below 18.3°C.

Considering the above requirements, Tilapia Aquaculture can be established in majority of areas of Pakistan. Suitable districts in this regard are shown in Table 2.

Table 2: Suitable Districts for Biofloc Farming

Balochistan	Khyber Pakhtunkhwa	Sindh	Punjab
• Awaran	• Bannu	• Hyderabad	• D.G. Khan
• Khuzdar	• Charsadda	• Nawabshah	• Faisalabad
• Lasbela	• D.I. Khan	• Shikarpur	• Sargodha
• Sibi	• Karak	• Sukkur	• Gujranwala
	• Kohat	• Thatta	• Gujrat
	• Mardan		• Multan
	• Nowshehra		• Muzaffargarh
	• Swabi		• Okara
			• Sahiwal

In order to obtain support in area selection and technical aspects, the potential investors can contact the Fisheries Development Board (a Federal body) and fisheries and forestry department of each province before the commencement of the project.

Fisheries Development Board has been established to boost up the development of fisheries sector by providing and maintaining a platform to enhance and promote fisheries sector in Pakistan.

8. POTENTIAL TARGET MARKETS

The Tilapia fish can be sold throughout the country, especially within the areas having taste for fresh water fish. These include the non-coastal areas of Balochistan, interior Sindh, Punjab, and Khyber Pakhtunkhwa. The market for Tilapia fish is highly competitive; these fish are in high demand in upper Punjab. These fish are easily available in the local fish markets of Lahore, Gujranwala, Punjab and Rawalpindi.

The mega stores of metro cities like, Hyper Star, Al-Fatah, and Metro etc. may become the potential customers of these fish farms.

Fisheries sector contribute 0.4% to the GDP of Pakistan, recorded a growth rate of 0.6% in 2019-20 (Pakistan Economic Survey 2019-20). Fisheries sector play a crucial role in developing the economy of Pakistan by providing employment to a significant number of people residing in impoverished societies and backward regions. In 2019-20 the fish meat availability to individual Pakistani was 3 kg per capita per annum (Pakistan Economic Survey 2019-20). Pakistan fishing industry is characterized into three categories based on production. These are marine, inland and aquaculture. Among these, the majority of catch is derived from marine and inland fisheries. Table 3 presents the production of fisheries in Pakistan from these three sources (FAO 2019).

Table 3: Production of Fisheries in Pakistan[7]

Method of Fish Production	Fish Production (Tonnes)
Inland	276,501
Marine	346,841
Aquaculture	148,266
Total	**771,608**

As per Table 3 Inland fishing contributes 36%, marine contributes 45% and aquaculture contributes 19% of towards total fish production of Pakistan.

In aquaculture, artificial fish ponds are developed to farm fish, this is commonly known as fish farming or freshwater farming. Aquaculture artificial fish ponds are made on land and also using modern technology like Biofloc.

Table 4 shows aquaculture is widely done in Punjab, Sindh and also on small scale in KPK and Balochistan.

Table 4: Province wise Distribution of Fish Farms[8]

Sindh	Punjab	Balochistan	KPK	Total
49,170	10,400	100	560	**60,230**

As per World Bank Group, 2018 data, aquaculture contributes on an average 150,000 tons of fish annually in the fish market of Pakistan. During the discussion with the owners of the current biofloc fish farm owners, it was highlighted that there are approximately thirty thousand biofloc tanks working in the province of Punjab.

[7] FAO, 2019
[8] State Bank of Pakistan, Publications Fisheries Value Chain, 2014

With respect to aquaculture, Tilapia have huge potential to revolutionize fish farming in Pakistan and they are normally farmed in aquaculture fisheries sector in genetically modified version. Tilapia adds on average 3,000 tons annually. According to the Agricultural Credit and Microfinance Department of the State Bank, industry for Tilapia is relatively small.

All the above-mentioned facts and data related to fish production, per capita fish meat availability, contribution of aqua cultured fish toward total production of Pakistan, points towards points towards the potential of Biofloc fish farming in Pakistan.

9. PROJECT COST SUMMARY

A detailed financial model has been developed to analyze the commercial viability of the Biofloc fish farming. Various cost and revenue related assumptions along with the results of the analysis are outlined in this section.

The projected Income Statement, Balance Sheet and Cash Flow Statement are attached as annexures.

9.1. Project Economics

All the figures in this financial model have been calculated after carefully taking into account the relevant assumptions and target market. The details of project economics are shown in

The financial feasibility analysis provides information regarding projected IRR, NPV and payback period of the study. Financial feasibility results are shown in Table 5.

Table 5: Financial Feasibility Analysis

Description	Values
IRR	20%
NPV (PKR)	71,021
Payback Period (years)	5.45
Projection Years	10
Discount Rate used for NPV	20%

9.1.1. Financial Feasibility Analysis at 50% Debt

The financial feasibility analysis provides information regarding projected IRR, NPV and payback period of the study as per (50:50) Debt: Equity Model. Financial feasibility results are shown in Table 6.

Table 6: Financial Feasibility Debt Financing

Description	Project
IRR	20%
NPV (PKR)	1,727,581
Payback Period (years)	5.46
Discount Rate used for NPV	16%

9.2. Project Cost

Total Project cost of PKR 6,474,721 for our proposed project will be financed through (100%) Equity and is shown in Table 7.

Table 7: Project Cost

Cost Item	Cost (PKR)
Land	900,000
Building	3,715,410
Machinery and Equipment	243,400
Furniture & Fixtures	175,000
Office Equipment	370,000
Office Vehicle	82,315
Pre-Operating Cost	354,834
Total Capital Cost – (A)	**5,840,958**
Working Capital	
Equipment Spare Parts Inventory	3,477
Feed Inventory	130,286
Initial Cash	500,000
Total Working Capital– (B)	**633,763**
Total Project Cost – (A+B)	**6,474,721**

9.2.1. Land Requirement

The proposed Biofloc farming unit will be set up on purchased/owned land. In this regard, a land area measuring 4500 sq. ft. will be acquired in any of the proposed locations. Proposed Project will be set up on agriculture land. That is why its cost is less than average land cost normally used for other business setups in city area. This space requirement has been calculated on the basis of proposed number of Biofloc tanks, manpower, required machinery and equipment.

Table 8 provides the details of space requirement and the associated cost.

Table 8: Space Requirement

Cost Item	% Break-Up	Area Sq. Feet
Management building	6%	270
Biofloc Tanks	80%	3,600
Store	6%	270
Kitchen	2%	90
Washrooms	2%	90
Pavement/driveway	2%	90
Grounds	2%	90
Total	**100%**	**4,500**
Land Cost		**900,000**

9.2.2. Building/ Civil Works

This project would require construction of a building and an electricity connection of 5 KW under agricultural tariff D-1(a). Civil Works includes management building, store, kitchen and washroom. Construction cost of one Biofloc Tank ranges between PKR 70,000 to 100,000. Plastic sheet is used to cover the tank during winter. In Summer, green colored shade net is used to protect the fish from high temperature. Shed will be constructed on approximately 3,600 sq. ft. area. Remaining 900 sq. ft. has been allocated for administration office and driveway. Cost of precast boundary wall to surround the area of 4500 sq. feet has also been included in building/civil works.

Total cost for constructing a building is estimated as PKR 3,715,410. Details of cost related to building are given in Table 9.

Table 9 : Building/ Civil Works

Cost Item	% Break-Up	Area Sq. Feet	Construction Cost Per Sq. Feet (PKR)	Total Construction Cost (PKR)
Management building	6%	270	2,100	567,000
Biofloc Tanks	80%	3,600	356	1,280,000
Store	6%	270	2,100	567,000
Kitchen	2%	90	2,100	189,000
Washrooms	2%	90	2,100	189,000
Pavement/driveway	2%	90	1000	90,000

Grounds	2%	90	1000	90,000
Total	**100%**			**2,972,000**

Table 10: Biofloc Tanks Cost Detail

Number of Biofloc Tanks	Cost per tank	Total tank cost	Total area	Cost per sq. ft.
16	80,000	1,280,000	3,600	356

Table 11: Shed Cost Detail

Description	Area / Length	Per Sq. feet/feet	Cost (PKR)
Green Net Shade sheet	3,600	30	108,000
Greenhouse Clear Plastic Polyethylene	3,600	10	36,000
Galvanized Iron Pipe	1,143	270	308,610
Civil Works (Polls Foundation)- Material cost	34	200	6,800
Labour- Installation			18,000
Labour- Polls Civil Works			6,000
Total			**483,410**

Table 12: Precast Boundary Wall Cost Detail

Description	Area / Length (Running Feet	Per Running Feet	Cost (PKR)
Boundary Wall 75 feet- Length	75	1,400	210,000
Boundary Wall 60 feet- Width	60	1,400	154,000
Iron Gate			40,000
Total			**404,000**

9.2.3. Machinery and Equipment Requirement

Table 13 shows costs, units of measurements, specifications, and total cost for machinery and equipment.

Table 13: Machinery and Equipment Requirement

Cost Item	Unit of Measurement	Specifications	No.	Unit Cost (PKR)	Total Cost (PKR)
Water Pump	Number of Water Pump	1.5 HP	1	15,000	15,000
Ring Blower	Number of Blowers	1.5 HP	1	125,000	125,000
Aeration Tubing	Per Tank	0.6 Inch Diameter	16	400	6,400
Invertor (for UPS)			1	7,000	7,000
Batteries (for UPS)		24 Volt	2	15,000	30,000
Generator		3500 Watt	1	60,000	60,000
Total					**243,400**

9.2.4. Furniture and Fixture Requirement

Details of the furniture and fixture required for the project are given in Table 14.

Table 14: Furniture and Fixtures

Cost Item	No.	Unit Cost (PKR)	Total Cost (PKR)
Office Tables	1	25,000	25,000
Office Chairs	1	10,000	10,000
Executive Tables	1	30,000	30,000
Executive Chairs	1	20,000	20,000
Sofa Set	1	35,000	35,000
Table for Guests	1	15,000	15,000
Guest Chairs	4	10,000	40,000
Total			**175,000**

9.2.5. Office Equipment Requirement

Following office equipment will be required for the proposed project given in Table 15.

Table 15: Office Equipment

Cost Item	No.	Unit Cost (PKR)	Cost (PKR)
Laptop / Desktop	1	80,000	80,000
Printer	1	40,000	40,000
Security System (4 Cams)	4	2,000	8,000
Digital Video Recorder (DVR)	1	12,000	12,000
LED / LCD 23 inch (Surveillance)	1	40,000	40,000
LED Lights	2	5,000	10,000
Water Dispenser	1	20,000	20,000
Air Cooler	1	90,000	90,000
Electronic Weighing Scale (300 kg)	1	20,000	20,000
Water Parameter Testing Kit [9]	1	50,000	50,000
Total			**370,000**

9.2.6. Office Vehicle Requirement

Vehicles are required for the transport of raw material and finished products. Details of the unit and total cost required along with their cost for the proposed project are provided in Table 16.

Table 16: Vehicles Cost

Cost Item	No.	Unit Cost (PKR)	Total Cost (PKR)
Motorcycle	1	80,000	80,000
Registration Charges	1	1500	1500
Total			**81,500**

[9] The Kit includes tools to measure water parameters i.e., pH Level, TDS, Dissolved Oxygen Level Ammonia Kit.
Total dissolved solids(**TDS**) is the term used to describe the inorganic salts and small amounts of organic matter present in solution in water.

9.2.7. Pre-Operating Expense Requirement

The details regarding pre-operating expenses are provided in Table 17.

Table 17: Pre-Operating Expenses

Cost Item	Number of Employee	Number of Months	Per Month Cost (PKR)	Total Cost (PKR)
Farm Officer	1	3	25,000	75,000
Labour	2	2	20,000	160,000
Security Guard	2	1	20,000	40,000
Connection Charges- Electricity			48,600	48,600
Connection Charges- Water			20,000	20,000
Utilities exp.				11,234
Total				**354,834**

9.2.8. Break Even Analysis

Calculation of Product wise break-even analysis is provided in Table 18.

Table 18: Break Even Analysis

Particulars	Amount First Year (PKR)	Profitability Ratio
Sales	4,800,000	100%
Less: Variable cost of sales	3,378,240	70%
Contribution/(deficit)	1,421,760	30%
Fixed Costs	1,253,697	26%
Breakeven (kgs)	14,109	
Sale Price	300	
Breakeven Revenue	4,232,603	
Breakeven Capacity	88%	

9.2.9. Revenue Generationng the first year of operations.

Table 19Table 19 provides details for expected revenue generation of the proposed Biofloc fish farming unit during the first year of operations.

Table 19: Revenue Generation

Description	Sales (kgs) (A)	Price/kg (B)	Total Revenue C=(A*B)
Revenue	16,000	300	4,800,000

9.2.10. Variable Cost Requirement

Variable costs are detailed in Table 20.

Table 20: Variable Cost

Cost Item	Total Cost (PKR)
Cost of goods sold 1 (Fingerlings Cost)	96,000
Cost of goods sold 2- (Feed cost)	1,824,000
Operating costs 1 (Machinery Maintenance)	24,340
Operating costs 2 (Utilities)	78,220
Mortality rate (3%)	2,880
Operating costs 4 - Cost of Probiotics[10]	40,000
Operating costs 1 (Direct Labour)	1,260,000
Travelling expense	48,000
Communications expense (phone, fax, mail, internet, etc.)	4,800
Total	**3,378,240**

[10] Probiotics are beneficial bacteria which play an important role in the microbial balance of the microorganisms and the water environment. The presence of beneficial bacteria in the Biofloc creates a "natural probiotic" effect, which can act both internally and externally to combat pathogens and improve immune response

Table 21: Cost of goods sold 1 – Fingerling Cost

Cost Item	Cost / Fingerling (PKR) (A)	Number of Fingerling (per Tank) (B)	No of Tank (C)	Total Seeds (Units) D=B*C	Total Cost (PKR) (A*D)
Fingerling Cost	3	2,000	16	32,000	96,000
Total					**96,000**

Table: 22 Cost of goods sold 2 – Feed Cost

Cost Item	Feed Conversion Rate (FCR) (A)	Average Cost / kg of Feed (PKR) (B)	Cost per kg of Production (PKR) C=(A*B)	Total Capacity (kgs) (D)	Total Cost (PKR) (C*D)
Feed Cost	1.2	95	114	16,000	1,824,000
Total					**1,824,000**

Table 23: Operating costs - Machinery Maintenance

Cost Item	Machinery Cost	Machinery Maintenance Rate	Total Cost (PKR)
Maintenance Cost	243,400	10%	24340
Total			**24340**

Table 24: Operating costs –Direct Labor

Post	No. of Personnel	Monthly Salary (PKR)	Annual Salary (PKR)
Farm Officer	1	25,000	300,000
Labour	2	18,000	864,000
Total	**3**		**1,260,000**

Table 25: Operating costs –Cost of Probiotics

Cost Item	Production Quantity Sold	Probiotic Cost per KG of Production	Total Cost (PKR)
Probiotics Cost	16,000	2.5	40000
Total			**40,000**

Table 26: Mortality Rate

Cost Item	Seed Input	Mortality Rate	Total Cost (PKR)
Mortality	96,000	3%	2880
Total			**2880**

9.2.11. Fixed Cost Requirement

Fixed cost is detailed in Table 27.

Table 27: Fixed Cost

Fixed Cost	Cost (PKR)
Utilities	56,582
Administration expense	480,000
Promotional expense	96,000
Professional fees (Technical Expert, etc.)	48,000
Depreciation expense	502,148
Amortization of pre-operating costs	70,967
Total	**1,253,697**

9.2.12. Human Resource Requirement

For the 1st year of operations, the Biofloc fish farming shall require the workforce and salary cost as projected in Table 28.

Table 28: Human Resource Requirements

Administration Staff	No of Staff	Monthly Salary (PKR)	Annual Salary (PKR)
Farm Officer	1	25,000	300,000
Labour	4	20,000	960,000
Security Staff	2	20,000	480,000
Total			**1,740,000**

10. CONTACT DETAILS

In order to facilitate the potential investors, contact details of some relevant vendors for the proposed project is given in Table 29.

Table 29: Contact Details

Name of Supplier	Address	Email/ Website	Contact Number
Fisheries Development Board (FDB)	Plot #12, Orchard Scheme, Murree Road Islamabad,	http://fdb.org.pk	051-9230348
Ali Biofloc Fish Farm	Zam Zam Chowk Sargodha	Bossbiofloc@gmail.com	0306-4068080
M/s. Abid Rafique and Co.	Shahrah-e-Faisal Karachi-	www.abidrafique.com	0300-5260128
M/s. Tawakkal Tilapia Hatcheries Muzaffargarh, Punjab	Tilapia Hatcheries Muzaffargarh, Punjab	tawakkalfishhatchery@yahoo.com	049-4001072
M/s. Ayefa Protein Farms (Pvt) Ltd. Business: Tilapia Farm	42 Westwood Colony, Thokar Niaz Baig, Lahore	www.lahoreindustry.com	0322-7172497

11. USEFUL LINKS

Table 30: Useful Links

Name of Organization	E-mail address
Small and Medium Enterprises Development Authority (SMEDA)	www.smeda.org.pk
National Business Development Program (NBDP)	www.nbdp.org.pk
Government of Pakistan	www.pakistan.gov.pk
Ministry of Industries and Production	www.moip.gov.pk
Ministry of Federal Education and Professional Training	www.mofept.gov.pk
Government of Punjab	www.punjab.gov.pk
Security and Exchange Commission of Pakistan	www.secp.gov.pk
State Bank of Pakistan	www.sbp.gov.pk
Federation of Pakistan Chambers of Commerce and Industry (FPCCI)	www.fpcci.com.pk
Technical Education and Vocational Training Authority (TEVTA)	www.tevta.org
Punjab Vocational Training Council (PVTC)	www.pvtc.gop.pk
Punjab Small Industries Corporation	www.psic.gop.pk
Department of Fisheries Government of Punjab	www.punjabfisheries.gov.pk/
Fisheries Development Board of Pakistan	fdb.org.pk/

12. ANNEXURES

12.1. Income Statement

Income Statement

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue	4,800,000	5,337,600	5,935,411	6,600,177	7,339,397	8,161,410	9,075,487	10,091,942	11,222,240	12,479,130
Cost of sales										
Cost of goods sold 1 (Seed Cost)	96,000	103,968	112,597	121,943	132,064	143,026	154,897	167,753	181,677	196,756
Cost of goods sold 2- (Feed cost)	1,824,000	1,975,392	2,139,350	2,316,916	2,509,220	2,717,485	2,943,036	3,187,308	3,451,855	3,738,358
Operation costs 1 (Direct Labor)	1,260,000	1,352,400	1,451,576	1,558,025	1,672,280	1,794,914	1,926,541	2,067,821	2,219,461	2,382,221
Operating costs 1 (Machinery Maintenance)	24,340	26,360	28,548	30,918	33,484	36,263	39,273	42,532	46,063	49,886
Operating costs 2 (Utilities)	78,220	85,070	92,519	100,620	109,431	119,014	129,436	140,770	153,097	166,503
Mortality rate	2,880	3,119	3,378	3,658	3,962	4,291	4,647	5,033	5,450	5,903
Operating costs 4 - Cost of Probiotics per KG of Out put	40,000	43,320	46,916	50,810	55,027	59,594	64,540	69,897	75,699	81,982
Total cost of sales	3,325,440	3,589,629	3,874,883	4,182,889	4,515,468	4,874,586	5,262,369	5,681,114	6,133,300	6,621,608
Gross Profit	1,474,560	1,747,971	2,060,528	2,417,288	2,823,929	3,286,824	3,813,118	4,410,828	5,088,940	5,857,522
General administration & selling expenses										
Administration expense	480,000	515,200	552,981	593,533	637,059	683,777	733,920	787,741	845,509	907,513
Electricity Admin Related	56,582	61,537	66,925	72,786	79,159	86,091	93,630	101,829	110,745	120,443
Travelling expense	48,000	51,520	55,298	59,353	63,706	68,378	73,392	78,774	84,551	90,751
Communications expense (phone, fax, mail, internet, etc.)	4,800	5,152	5,530	5,935	6,371	6,838	7,339	7,877	8,455	9,075
Promotional expense	96,000	106,752	118,708	132,004	146,788	163,228	181,510	201,839	224,445	249,583
Professional fees (Technical Expert, etc.)	48,000	53,376	59,354	66,002	73,394	81,614	90,755	100,919	112,222	124,791
Depreciation expense	502,148	502,148	502,148	502,148	502,148	502,148	458,613	607,612	607,612	607,612
Amortization of pre-operating costs	70,967	70,967	70,967	70,967	70,967	-	-	-	-	-
Subtotal	1,306,497	1,366,652	1,431,912	1,502,728	1,579,592	1,592,074	1,639,158	1,886,591	1,993,539	2,109,768
Operating Income	168,063	381,319	628,616	914,560	1,244,338	1,694,750	2,173,960	2,524,237	3,095,400	3,747,754
Gain / (loss) on sale of machinery & equipment	-	-	-	-	-	-	79,105	-	-	
Gain / (loss) on sale of office equipment	-	-	-	-	-	-	92,500	-	-	
Gain / (loss) on sale of office vehicles	-	-	-	-	-	-	28,810	-	-	
Earnings Before Interest & Taxes	168,063	381,319	628,616	914,560	1,244,338	1,694,750	2,374,375	2,524,237	3,095,400	3,747,754
Subtotal	-	-	-	-	-	-	-	-	-	-
Earnings Before Tax	168,063	381,319	628,616	914,560	1,244,338	1,694,750	2,374,375	2,524,237	3,095,400	3,747,754
Tax	60,000	66,720	74,193	82,502	91,742	144,212	246,156	274,847	393,850	556,938
NET PROFIT/(LOSS) AFTER TAX	**108,063**	**314,599**	**554,423**	**832,058**	**1,152,595**	**1,550,538**	**2,128,219**	**2,249,390**	**2,701,550**	**3,190,816**

12.2. Balance Sheet

Balance Sheet

Rs. in actuals

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Assets											
Current assets											
Cash & Bank	500,000	1,024,491	1,706,558	2,427,092	3,188,411	3,988,001	4,770,353	5,718,277	8,500,553	11,723,912	15,792,148
Accounts receivable	-	228,571	241,371	268,405	298,466	331,895	369,067	410,402	456,367	507,481	564,318
Equipment spare part inventory	3,477	2,372	2,775	3,246	3,796	4,440	5,193	6,074	7,105	8,310	-
Raw material inventory	130,286	89,140	104,551	122,626	143,827	168,693	197,859	232,066	272,188	319,246	-
Total Current Assets	633,763	1,344,574	2,055,255	2,821,369	3,634,501	4,493,029	5,342,472	6,366,820	9,236,214	12,558,948	16,356,466
Fixed assets											
Land	900,000	900,000	900,000	900,000	900,000	900,000	900,000	900,000	900,000	900,000	900,000
Building/Infrastructure	3,715,410	3,343,869	2,972,328	2,600,787	2,229,246	1,857,705	1,486,164	1,114,623	743,082	371,541	-
Machinery & equipment	243,400	206,890	170,380	133,870	97,360	60,850	24,340	417,145	354,573	292,001	229,430
Furniture & fixtures	175,000	148,750	122,500	96,250	70,000	43,750	17,500	355,384	302,076	248,769	195,461
Office vehicles	82,315	69,968	57,621	45,273	32,926	20,579	8,232	167,163	142,088	117,014	91,939
Office equipment	370,000	314,500	259,000	203,500	148,000	92,500	37,000	634,115	538,998	443,880	348,763
Total Fixed Assets	5,486,125	4,983,977	4,481,829	3,979,681	3,477,532	2,975,384	2,473,236	3,588,430	2,980,818	2,373,206	1,765,594
Intangible assets											
Pre-operation costs	354,834	283,867	212,900	141,933	70,967	-	-	-	-	-	-
Total Intangible Assets	354,834	283,867	212,900	141,933	70,967	-	-	-	-	-	-
TOTAL ASSETS	6,474,722	6,612,418	6,749,984	6,942,983	7,183,000	7,468,413	7,815,708	9,955,250	12,217,031	14,932,154	18,122,060
Liabilities & Shareholders' Equity											
Current liabilities											
Accounts payable	-	83,665	90,947	98,892	107,564	117,037	127,390	138,713	151,105	164,677	163,767
Total Current Liabilities	-	83,665	90,947	98,892	107,564	117,037	127,390	138,713	151,105	164,677	163,767
Shareholders' equity											
Paid-up capital	6,474,722	6,474,722	6,474,722	6,474,722	6,474,722	6,474,722	6,474,722	6,474,722	6,474,722	6,474,722	6,474,722
Retained earnings	-	54,031	184,315	369,369	600,714	876,654	1,213,596	3,341,815	5,591,205	8,292,755	11,483,571
Total Equity	6,474,722	6,528,753	6,659,037	6,844,091	7,075,435	7,351,376	7,688,318	9,816,537	12,065,926	14,767,477	17,958,293
TOTAL CAPITAL AND LIABILITIES	6,474,722	6,612,418	6,749,984	6,942,983	7,183,000	7,468,413	7,815,708	9,955,250	12,217,031	14,932,154	18,122,060

12.3. Cash Flow Statement

Cash Flow Statement

Rs. in actuals

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Operating activities											
Net profit	-	108,063	314,599	554,423	832,058	1,152,595	1,550,538	2,128,219	2,249,390	2,701,550	3,190,816
Add: depreciation expense	-	502,148	502,148	502,148	502,148	502,148	502,148	458,613	607,612	607,612	607,612
amortization expense	-	70,967	70,967	70,967	70,967	70,967	-	-	-	-	-
Deferred income tax	-	-	-	-	-	-	-	-	-	-	-
Accounts receivable	-	(228,571)	(12,800)	(27,034)	(30,061)	(33,428)	(37,172)	(41,335)	(45,965)	(51,113)	(56,838)
Equipment inventory	(3,477)	1,105	(402)	(471)	(551)	(644)	(753)	(881)	(1,030)	(1,205)	8,310
Raw material inventory	(130,286)	41,146	(15,411)	(18,076)	(21,201)	(24,866)	(29,165)	(34,208)	(40,122)	(47,058)	319,246
Accounts payable	-	83,665	7,282	7,945	8,673	9,473	10,353	11,323	12,392	13,572	(910)
Cash provided by operations	(133,763)	578,522	866,383	1,089,903	1,362,033	1,676,244	1,995,948	2,521,730	2,782,277	3,223,358	4,068,236
Financing activities											
Issuance of shares	6,474,722	-	-	-	-	-	-	-	-	-	-
Cash provided by / (used for) financing activities	6,474,722	-	-	-	-	-	-	-	-	-	-
Investing activities											
Capital expenditure	(5,840,959)	-	-	-	-	-	-	(1,573,806)	-	-	-
Cash (used for) / provided by investing activities	(5,840,959)	-	-	-	-	-	-	(1,573,806)	-	-	-
NET CASH	500,000	578,522	866,383	1,089,903	1,362,033	1,676,244	1,995,948	947,924	2,782,277	3,223,358	4,068,236

13. KEY ASSUMPTIONS

13.1. Operating Cost Assumptions

Table 31: Operating Cost Assumptions

Description	Details
Operating costs growth rate	8.3% of general inflation rate
Water expenses	7.3% of administration expenses
Travelling expenses	10.0% of administration expenses
Communication expenses	1.0% of administration expenses
Promotional expense	2.0% of revenue
Professional fees (legal, audit, consultants, etc.)	1.0% of administration expenses
Depreciation Rates	
Office vehicles	15%
Furniture & fixtures	15%
Office equipment	15%
Building & infrastructure	10%
Machinery & equipment	15%

13.2. Cost of Goods Sold Assumptions

Table 32: Cost of Goods Sold Assumptions

Description	Details
Seed Cost per Fingerling	6
Feed Cost per Fingerling	114
Mortality rate	3% of seed input

13.3. Revenue Assumptions

Table 33: Revenue Assumptions

Description	Details
Sale price growth rate	11.2%
Production capacity utilization	100%

13.4. Financial Assumptions

Table 34: Financial Assumptions

Description	Details
Project life (Years)	10
Debt: Equity	0:100
Discount Rate used for NPV	20%
Discount Rate used for NPV (50:50 Debt: Equity)	16%

13.5. Cash Flow Assumptions

Table 35: Cash Flow Assumptions

Description	Details
Accounts Receivable Cycle (in days)	10
Accounts Payable Cycle (in days)	15