



PREFEASIBILITY OF PRODUCTION OF FISH FEED AT SMALL SCALE

March, 2014

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Note: All Services / information related to PM's Youth Business Loan are Free of Cost

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1. **DISCLAIMER**

The information provided in the present document is to introduce the project background and scope. It furnishes comprehensive information on the subject. The material provided is based on literature reviews supported by data / information generated from R&D work at PCSIR. As far as finances are involved it is based upon certain assumptions which may differ from case to case and time to time. The contained information may vary due to any change in any of the concerned factors, and the actual results may differ accordingly from the presented information. **PCSIR** and its employees do not assume any liability for any financial or other loss resulting from this information, in consequence of undertaking this activity. The prospective user of this information is encouraged to contact technical consultant/relevant Section in case they need technical assistance.

2. **PURPOSE OF THE DOCUMENT:** Prime Minister's Youth Business Loan Scheme for Entrepreneurship

The purpose of this document is to facilitate potential investors in "**Fish Feed Production**" **Business** by providing them a general understanding of the business, with the intention of supporting in crucial investment decisions. The present document/study covers various aspects of project like background information and scope of work, equipment required, availability of equipment and ingredients in the local market, example of feed formulation, manpower requirement, financial components involved in recurring and non recurring expenditures.

3. **INTRODUCTION TO PCSIR LABORATORIES COMPLEX KARACHI**

Pakistan Council of Scientific & Industrial Research (PCSIR) was first established in 1953 at Karachi as an autonomous body registered under the Societies Act of 1860. It was re-constituted by an act of parliament in 1973, allowing it to play direct role in national development, having greater emphasis on providing R&D solutions to Industrial problems, helping Industry to manage and reduce waste and use indigenous material / processes / technology.

4. **EXECUTIVE SUMMARY**

Fish farming has gained popularity in three out of four provinces of Pakistan. Fish farmers usually practice an extensive culture system traditionally, where no supplemental feed is given to fish and at the most fertilizers are used to increase the natural productivity (natural food) in ponds. The use of feed in an aquaculture operation improves the production and in turn increases the profits up to 70 %. Feeding in aquaculture depends on the production system used i.e. extensive, semi-intensive and intensive. In an intensive aquaculture system feed alone costs 60-70 % of the operational cost. There are about 40 essential dietary

nutrients required by fish and shrimp. The formulations are based on the specific nutritional requirements of an animal and preparation involved a lot of technical considerations.

In culturing fish/shrimp in captivity, nothing is more important than sound nutrition and adequate feeding. If the feed is not consumed by the fish/shrimp or they are unable to utilize the feed because of some nutrient deficiency, then there will be no growth. An undernourished animal cannot maintain its health and be productive, regardless of the quality of its environment.

The proposed project “small scale fish feed production” involves a total investment of about Rs. 2.0 million. The project will generate direct employment opportunity for 3 persons, moderate return on investment and a steady growth of business is expected. The prefeasibility encompasses all required information regarding various aspects of starting a Feed production business in Pakistan.

5. INTRODUCTION TO SCHEME

Prime Minister’s Youth Business Loan Program, for young entrepreneurs, with an allocated budget of Rs. 5.0 Billion for the year 2013-14, is designed to provide subsidized financing at 8% mark-up per annum for one hundred thousand (100,000) beneficiaries, through designated financial institutions, initially through National Bank of Pakistan (NBP) and First Women Bank Ltd. (FWBL). Loans from Rs. 0.1 million to Rs. 2.0 million with tenure up to 8 years inclusive of 1 year grace period, and a debt: equity of 90: 10 will be disbursed to SME beneficiaries across Pakistan, covering; Punjab, Sindh, Khyber Pakhtunkhwa, Balochistan, Gilgit-Baltistan, Azad Jammu & Kashmir and Federally Administered Tribal Areas (FATA).

6. BRIEF DESCRIPTION OF PROJECT

6.1 Techniques: Simple technology based on locally fabricated equipment and locally available feed ingredients.

6.2 Location: The business can be initiated in a small area of 120 sq yards preferably located in the vicinity of fish farms and or agriculture lands more preferably in Punjab and less in Sind. Since the feed ingredients are available at a comparatively low cost in Punjab.

6.3 Product: Supplemental and compounded Fish feed

6.4 Target Market: Fish farmers in Punjab and Sindh

6.5 Employment Generation: The proposed project will provide direct employment to two individuals. Financial analysis shows the profitability of proposed business within a month of its operation.

7. CRITICAL FACTORS

- Availability of feed ingredient at low prices in required quantity
- Availability of electricity, gas and water supply
- Proper storage facility

- To maintain the record of production and management practices for successful marketing and traceability.
- To develop strong market linkages for effective disposal of fish feed.

8. INSTALLED AND OPERATIONAL CAPACITY FOR FISH FEED PRODUCTION

Per run capacity = 50 kg /Pelleting Machine

Three machines x 2 runs / 300 kg day

Total feed production 300 x 26 days= 7800 kg/ per month

9. GEOGRAPHICAL POTENTIAL FOR INVESTMENT

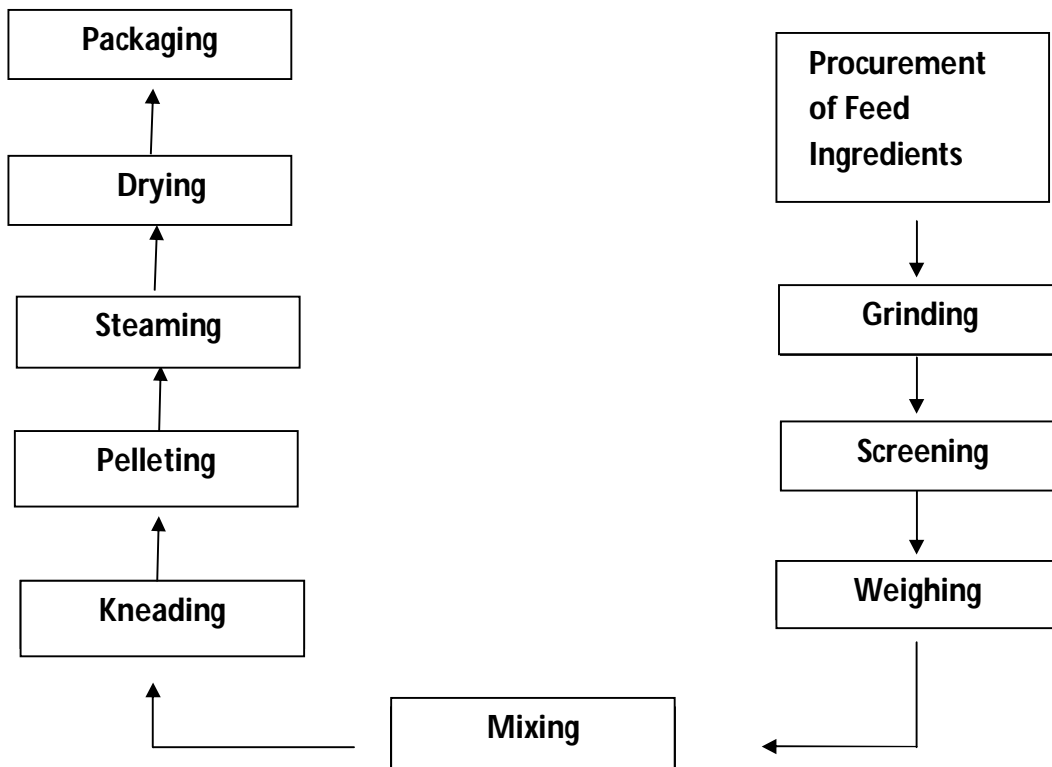
The proposed project should be established in the vicinity of potential fish farming areas such as Mandi Bahauddin, Sialkot, Bahawalnagar, Vehari, Jhang, Muzaffargah, Gujranwala, Thatta, Badin, Dadu, Sibi, Naseerabad, Jaffarabad, Lasbela, D I Khan, Kohat, Mardan, Abbotabad etc. for the ease of marketing

10. POTENTIAL TARGET MARKETS

Local fish farmers

11. PRODUCTION PROCESS FLOW

11.1 Steps in small scale feed preparation



11.2 Nutritional Requirement for Supplemental Feed

Prepared or artificial diets may be either complete or supplemental. Complete diets supply all the ingredients (protein, carbohydrates, fats, vitamins, and minerals) necessary for the optimal growth and health of the fish. Most fish farmers use complete diets, those containing all the required protein (18-50%), lipid (10-25%), carbohydrate (15-20%), ash (< 8.5%), phosphorus (< 1.5%), water (< 10%), and trace amounts of vitamins, and minerals. When fish are reared in high density indoor systems or confined in cages and cannot forage freely on natural feeds, they must be provided a complete diet.

In contrast, supplemental (incomplete, partial) diets are intended to support the natural food (insects, algae, and small fish) normally available to fish in ponds or outdoor raceways. Supplemental diets do not contain a full complement of vitamins or minerals, but are used to help fortify the naturally available diet with extra protein, carbohydrate and/or lipid.

11.2.1 Protein

Because protein is the most expensive part of fish feed, it is important to accurately determine the protein requirements for each species and size of cultured fish. Proteins are formed by linkages of individual amino acids. Although over 200 amino acids occur in nature, only about 20 amino acids are common. Of these, 10 are essential (indispensable) amino acids that cannot be synthesized by fish. The 10 essential amino acids that must be supplied by the diet are: methionine, arginine, threonine, tryptophan, histidine, isoleucine, lysine, leucine, valine and phenylalanine.

Methionine and Lysine are the first two limiting amino acid in feeds which is usually present in fishmeal which can not be replaced by any of the plant sources, that's why desired quantity of fish meal must be used in healthy fish feed production.

Protein levels in aquaculture feeds generally average 18-20% for marine shrimp, 28-32% for catfish, 32-38% for tilapia, 38-42% for hybrid striped bass. Protein requirements usually are lower for herbivorous fish (plant eating) and omnivorous fish (plant-animal eaters) than they are for carnivorous (flesh-eating) fish, and are higher for fish reared in high density (recirculating aquaculture) than low density (pond aquaculture) systems.

Protein requirements generally are higher for smaller fish. As fish grow larger, their protein requirements usually decrease. Protein requirements also vary with rearing environment, water temperature and water quality, as well as the genetic composition and feeding rates of the fish. Protein is used for fish growth if adequate levels of fats and carbohydrates are present in the diet. If not, protein may be used for energy and life support rather than growth.

11.2.2 Lipids (fats)

Lipids (fats) are high-energy nutrients that can be utilized to partially spare (substitute for) protein in aquaculture feeds. Lipids supply about twice the energy as proteins and carbohydrates. Lipids typically comprise about 15% of the fish diet, supply essential fatty acids (EFA) and serve to transport fat-soluble vitamins.

Simple lipids include fatty acids and triacylglycerols. Fish typically require fatty acids of the omega 3 and 6 (n-3 and n-6) families. Fatty acids can be: a) saturated fatty acids (SFA, no double bonds), b) polyunsaturated fatty acids (PUFA, >2 double bonds), or c) highly unsaturated fatty acids (HUFA; > 4 double bonds). Marine fish oils are naturally high (>30%) in omega 3 HUFA, and are excellent sources of lipids for the manufacture of fish diets. Lipids from these marine oils also can have beneficial effects on human cardiovascular health.

11.2.3 Carbohydrates

Carbohydrates (starches and sugars) are the most economical and inexpensive sources of energy for fish diets. Although not essential, carbohydrates are included in aquaculture diets to reduce feed costs and for their binding activity during feed manufacturing. Dietary starches are useful in the extrusion manufacture of floating feeds. Cooking starch during the extrusion process makes it more biologically available to fish.

In fish, carbohydrates are stored as glycogen that can be mobilized to satisfy energy demands. They are a major energy source for mammals, but are not used efficiently by fish. For example, mammals can extract about 4 kcal of energy from 1 gram of carbohydrate, whereas fish can only extract about 1.6 kcal from the same amount of carbohydrate. Up to about 20% of dietary carbohydrates can be used by fish.

11.2.4 Vitamins

Vitamins are organic compounds necessary in the diet for normal fish growth and health. They often are not synthesized by fish, and must be supplied in the diet.

The two groups of vitamins are water-soluble and fat-soluble. Water-soluble vitamins include: the B vitamins, choline, inositol, folic acid, pantothenic acid, biotin and ascorbic acid (vitamin C). Of these, vitamin C probably is the most important because it is a powerful antioxidant and helps the immune system in fish.

The fat-soluble vitamins include A vitamins, retinols (responsible for vision); the D vitamins, cholecalciferols (bone integrity); E vitamins, the tocopherols (antioxidants); and K vitamins such as menadione (blood clotting, skin integrity). Of these, vitamin E receives the most attention for its important role as an antioxidant. Deficiency of each vitamin has certain specific symptoms, but reduced growth is the most common symptom of any vitamin deficiency. Scoliosis (bent backbone symptom) and dark coloration may result from deficiencies of ascorbic acid and folic acid vitamins, respectively.

11.2.5 Minerals

Minerals are inorganic elements necessary in the diet for normal body functions. They can be divided into two groups (macro-minerals and micro-minerals) based on the quantity required in the diet and the amount present in fish. Common macro-minerals are sodium, chloride, potassium and phosphorous. These minerals regulate osmotic balance and aid in bone formation and integrity.

Micro-minerals (trace minerals) are required in small amounts as components in enzyme and hormone systems. Common trace minerals are copper, chromium, iodine, zinc and selenium. Fish can absorb many minerals directly from the water through their gills and skin, allowing them to compensate to some extent for mineral deficiencies in their diet.

11.3 Types of Feed

- Dried (about 10% moisture): easy to made, store transport and feed
- Moist (about 30-45% moisture) more palatable & attractive
- Wet (>50% moisture)

Buoyancy

- Floating
- Sinking

Table 1: Shape and Size of Feed

Shape/form	Particle Size	Stage of Development
Powder	50-125 μ M	early larvae or fry
Granule	500 μ M	Late larvae or fry
Crumble	0.5 -2 mm	post larvae and fingerling
Pellets	2-8 mm	juveniles, adults

Table 2: List of Feed Ingredients Available Locally

Meal (Animal Source)	Meal (Plant Source)	Plant Source	Vitamins & Minerals
Fish meal	Soy bean cake	Broken Rice	Vitamin premix
Bone meal	Mustard oil cake	Rice polish	Mineral premix
Meat meal	Sunflower meal	Rice bran	Yeast (Binder)
Blood meal	Cottonseed cake and meal	Wheat bran	
	Peanut meal	Wheat flour	
		Broken corn	
		Corn gluten	

TABLE 3: TYPICAL FORMULATION FOR COMMON CARP AND TILAPIA FISHES

Ingredient	Percent
Rice bran	10
Rice polish	30
Fishmeal	20
Sunflower meal	15
Corn Gluten	20
Wheat flour	3
Vitamin pre mix	1
Mineral pre mix	1

11.4 Procurement of Feed Ingredients

The procurement of ingredients at lowest price is the major task. Find out the whole sale stores/markets in your area.. The agriculture bye products can be obtained at a far cheaper rate from farm site like, rice bran, wheat bran etc. The other most important matter is to check the quantity and quality of the raw materials procured. Make sure that each ingredient is actually the one which is contained in the formula of the aquaculture feed to be made. The appearance and names of some of the feed ingredients are very similar their analysis may be very different. Use of the wrong ingredient will greatly affect the quality of compound feed.

Make a visual inspection for quality, using appearance (signs of damp on dry materials, fungal growth), smell, texture, etc., as a means of assessing quality. Do not accept unsatisfactory batches of ingredients even if they are offered at a discounted price. It may kill fish/shrimp stock or, at the least, depress growth rate due to the use of damaged ingredients.

11.5 Marking or Labelling

Ingredients are commonly not labelled when they are procured from market except vitamin premixes. Proper, clear, indelible labelling should be used for all stacks of materials and on all containers. Mark the raw materials; mark each batch of mixed ingredients during production with its name and batch number, so that the operators know whether it is the batch they have added a specific ingredient to or not, for example. Don't neglect this simple but essential instruction: MARK IT and insist that your staff follow that rule too.

11.6 Grinding

Do not overload the equipment by trying to force too much material through too quickly. You will cause blockages and equipment failure. Grinders and mincers are very dangerous pieces of equipment. Pay special attention to safety measures.

Choose grinder sieves carefully to produce the required particle size, consistent with speed and economy. Clean the equipment immediately after use. When you mince wet ingredients, collect the liquid as well as the solid material that emerges from the mincer. Don't waste it; it contains valuable nutrients and attractants which are essential parts of the final feed. Don't allow foreign bodies to enter the grinding or mincing machinery.

11.7 Weighing

Accurate weighing is an essential part of good feed production. Use good scales, make sure that they are used and looked after properly.

The manufacture of feeds on a small scale involves a large number of hand weighing operations. The accuracy of these is important. The operator who is doing the weighing must

be provided with a check list specifying how much of each ingredient should be weighed. Weigh each ingredient separately.

Keep the scales clean and don't forget to re-tare (adjust the zero point) after the weighing container has been placed on the scales and before each ingredient is weighed.

11.8 Mixing

Efficient mixing is the key to good feed production. The mixing time for a batch of dry or moist ingredients varies according to the design of the equipment. Generally, dry materials can be mixed more quickly than moist ingredients or mixtures of the two. A general rule would be to allow a mixing time of at least 15 minutes after the last ingredient has been added to the mixer.

The order in which ingredients are added greatly affects mixing efficiency. It is not good just to put all the ingredients into the mixer and then switch it on. Materials such as vitamin mixes, which are added at low inclusion rates, should not be put into an empty mixer. Put one of the major ingredients in first, switch on the mixer and then add the minor ingredient so that it is already mixed into the major component before other ingredients are added. Minor inclusions of liquids such as lipids should be added after the dry components have been mixed. Ideally, such liquids should be sprayed on to the dry mixture to ensure they are evenly distributed.

11.9 Pelleting (Mincing)

Choose the die hole size for the feed which you are making. The rate of production will decrease as the die hole selected gets smaller. Don't overload the mincer.

The extruded product will emerge from the mincer in the form of long strands of spaghetti- or noodle-like consistency. These strands need break up into shorter pieces as they fall into the container placed below the mincer outlet. After extrusion the feed should be placed into marked containers for drying.

11.10 Drying

The feed can be dried in an electrical oven or solar drier or even in a glass chamber with a vent.

11.11 Packing

Dried feeds should be weighed and packed in bags, and bags closed properly with a hand held sewing machine.

12. PROJECT COST SUMMARY

Costs	Rs (in Million)
Capital Cost (Land, Equipment & Accessories)	1400,000
Ingredients and bags	415,000
Operational Cost	181,000
Total	1,996,000

12.1 PROJECT ECONOMICS

Description	Details
Internal Rate of Return (IRR)	
Payback Period (yrs)	4.2
Net Present Value (NPV)	

12.2 PROJECT FINANCING

The detail of financing as provided by the Government is presented in Table 4.

Description	Details
Total Equity (10%)	Rs. 200,000
Bank loan (90%)	Rs 1800,000
Mark up to borrower (per annum)	8%
Tenure of Loan (Years)	8
Grace Period (years)	1

12.3 PROJECT COST

ESTIMATED COST FOR THE PREPARATION OF ~ 7.8 TONS FISH FEED/MONTH

Table 4 : CAPITAL COST (LAND, EQUIPMENT & ACCESSORIES)

	Items	Quantity	Amount in Rs
	Acquisition of land with a store n working shed	120 sq yards	400,000
	Pin Grinder		200,000
	Blade Mixer (Horizontal type)		300,000
	Pelleting Machine	3	150,000
	Bag sewing Machine		50,000
	Weighing Machine	2	100,000
	Solar dryer/drying cabinet		100,000
	Drums / Tubs / Buckets etc.		20,000
	Miscellaneous Expenditures Mixing Tools (spade etc)		50,000
	Furniture and Fixture		30,000
	Total		1,400,000

TABLE 5 : FEED INGREDIENTS AND BAGS

	Items (for three months)**	Quantity	Amount in Rs
	Feed Ingredients		400,000
	Packaging materials	1000 Bags	15,000
	Total		415,000

**** It is advisable to purchase the feed ingredients and packing material in bulk that is, at least a three months supply should be procured at one time. The cost estimates have therefore been included ingredient and bags an amount adequate to prepare ~ 10,000 kg of feed (Table 5).**

Table 6: OPERATIONAL COST /MONTH

	Items (for one month)	Quantity	Amount in Rs
	Labour Cost	3	36,000
	Electrical, Gas, Water		25,000
	Repair and Maintenance Cost		20,000
	Office Equipment		25,000
	Unforeseen Expenditures,		75,000
	Total		181,000

TOTAL PROJECT COST (Table 4 + Table 5+ Table 6) Rs. 19, 96, 000

12.4 SPACE REQUIREMENT

120 sq yards is enough for a small scale feed production unit for installation of feed equipment, a working shed and storage facility

12.5 MACHINERY AND EQUIPMENT

S. No	Item	
1.	Pin Grinder	
2.	Blade Mixer (Horizontal type)	
3.	Pelleting Machine	
4.	Bag sewing Machine	
5.	Weighing Machine	
6.	Solar dryer/drying cabinet	
7.	Drums / Tubs / Buckets etc.	
8.	Miscellaneous bins Mixing Tools (spade etc)	

12.6 FURNITURE AND FIXTURE

Table 1
Chairs 4
Cabinet 1

12.7 OFFICE EQUIPMENT

Computer	1
Printer	1

12.8 RAW MATERIAL REQUIREMENT

Feed Ingredients (mentioned Table 3)

12.9 HUMAN RESOURCE REQUIREMENT

3 persons to operate grinder, mixer, pelleting machine weighing machine, drying of product and packaging

12.10 REVENUE GENERATION

1. INGREDIENTS COST, PRODUCTION CAPACITY AND PROFIT MARGIN

At present the ingredient cost in Sind is Rs 35/ kg for our fish feed formulation with an inclusion of 28-32 % protein. Add approximately Rs. 15.00 to the ingredient cost on the account of utility bills, labour, packaging and transport charges.

The feed ingredient cost can further be decreased by purchasing of some ingredients during their peak or glut season and in bulk quantity, when the cost is normally lowest it can be decreased up to Rs.28/kg.

The market rates of feed ingredients are comparatively lower in Punjab than Sind. The cost of feed ingredients can even be as low as Rs.25/kg in Punjab.

Tip: Set the selling price based on the ingredient cost, utilities cost, labour, packaging and transport charges.

Finally add your profit margin keeping in view the market demand.

Production Capacity

Per machine Per run capacity = 50 kg

Three machines x 2 runs / 300 kg day

Total feed production per month 300 x 26 days= 7800 kg

Profit Margin

Minimum profit margin = Rs 20/ kg feed

Total profit +Rs.156,000/month

Interest rate in the first month: Rs. 13,335/month

Loan Return (optional): Rs. 40000/month (Pay back period: 4.2 years)

Note: In case of any problem in understanding the feed preparation process, design and procurement of equipment, or needs hands on training, contact the address given below:

16 . Contact Details
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