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Maharashtra Project on Climate Resilient Agriculture

(Project of Government of Maharashtra in Partnership with the World Bank)

DETAILED PROJECT REPORT

(Template)

Poultry Feed Unit

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Between

Nanaji Deshmukh Krishi Sanjeevani Prakalp (PoCRA)

And

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1 Introduction

Across the world poultry market, India ranks sixth (using FAOSTAT rankings). The domestic poultry industry is the fastest growing segment with a compound growth rate of 18%. As per Agricultural and Processed Food Products Export Development Authority (APEDA) India has become the world's fifth largest egg producer. Egg production has increased quadrupled in two decades in our country (30 billion in 2000 to 114 billion in 2020). Similarly, poultry meat production growth, is also very significant, crossing 4.3 MMT in 2020 (www.indiastat.com). It is projected that egg production may reach 136 billion eggs by 2023, with poultry meat production to total 6.2 MMT.

Andhra Pradesh is the country's largest egg producing state. Besides Andhra Pradesh, Tamil Nadu, Telangana, West Bengal, Karnataka, Harayana, Maharashtra, Punjab, Uttar Pradesh and Bihar are major egg producers. In case of poultry meat, Haryana tops the list followed by the West Bengal and Uttar Pradesh. The government of India fixed targets for annual production of poultry with a view to ensure availability of eggs and broilers both to meet domestic consumption as well as export. With this projected development of the poultry industry, the demand for production of balanced poultry feed has become imperative.

Poultry sector in India is largely an organized commercial sector with about 80% of the total market share. The unorganized sector (largely backyard poultry that supplements income generation and family nutrition) has about 20% of the total market share.

In 2020, India's consumption of poultry meat was over 3.9 million metric tons, still quite limited relative to the overall population size. Demand for protein rich food, combined with improved consumer purchasing power is spurring increased poultry meat consumption.

Egg offers as a low cost, highly nutrient dense food which includes a wide variety of essential micronutrients. Eggs can supplement household plant-based diets. In the last two decades, per capita availability of eggs has more than doubled in the country (Figure1.2). Of course, this may not be proportional to the population of the states.

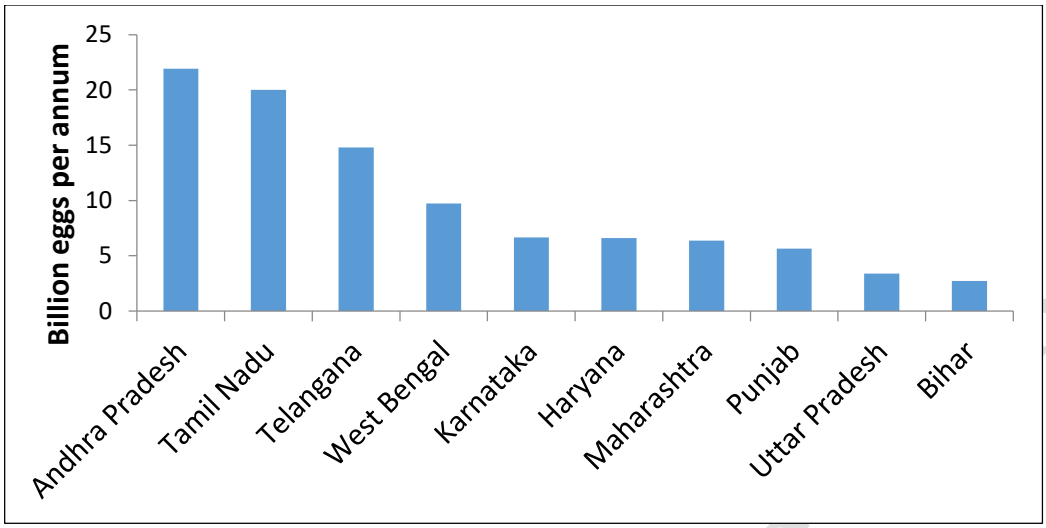

Figure 1.1 Top 10 states in egg production in India (FY 2019-20).

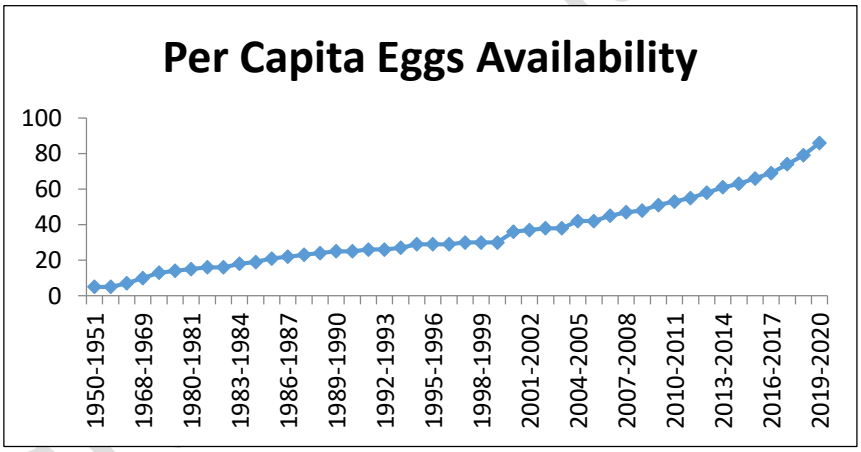

Figure1.2 Per capita eggs availability per annum in India

There is no uniformity in terms of size and housing environment of poultry farms. It may vary from 200 birds to more than 50,000 birds. Typically, small poultry are open sheds while only a few large poultry integrators have controlled-environment housing with automatic feeding and drinking systems. For small farmers, poultry business poses various challenges due to high capital cost requirement which restrict them to adopt sophisticated housing system for better performance of poultry and high price of feed which accounts for more than 80 percent of the total production cost.

2 Poultry feed status in India

The current demand for poultry feed in India is ~25 million tons. Poultry segment dominates the market due to the growing meat consumption leading to the higher demand for poultry feed.

Increasing per capita income, and rising awareness of healthy products among consumers quality poultry products have significantly contributed to the rising demand for poultry feed in India. According to the 19th Livestock Census by Department of Animal Husbandry, growing demand for poultry products will further increase to drive growth in India poultry feed market in the coming years.

The predominant feed grain used in poultry feeds worldwide is maize. The plant protein source traditionally used for feed manufacture is soybean meal, which is the preferred source for poultry feed. Feed supplements like probiotics, vitamins, minerals, amino acids, mold inhibitors, enzymes, preservatives, coccidiostats, antioxidants etc. are mostly imported. Feed represents the major cost of poultry production, constituting about 80 percent of the total cost and about 65-75% of total cost is shared by maize and soymeal.

2.1 Maharashtra Scenario

On the geographical front, South India represents the leading market for animal feed, accounting for the largest market share. In recent years, the market has witnessed growth in Andhra Pradesh, Karnataka and Tamil Nadu, owing to the rise in the manufacturing of poultry products. While poultry integrators are much stronger in regional pockets of Andhra Pradesh, Karnataka and Tamil Nadu, the much larger landscape for the poultry industry and its expansion beyond these belts provide ample opportunity for standalone feed players. The demand is expected to grow by 7-8 percent in near term.

The demand of maize depends largely on demand as feed for poultry and livestock, and partially on its direct demand for human food and industrial uses. Maize is the preferred energy cereal used in poultry feed formulations because of its high energy, low fibre and the presence of pigments and essential fatty acids. Consequently, because it is a primary source of energy, due to its higher level of inclusion in poultry diets (60-70%), it contributes approximately 30%

of the protein requirement of poultry. However, maize, like other cereals, is deficient in certain essential amino acids, such as lysine and tryptophan. Soymeal, a byproduct of soybean oil industry is a common plant protein source, which contain about 44- 45% crude protein. The protein in soybean provides the building blocks for muscles, organs, feathers, and eggs. Maize and soymeal have been considered as the primary feed ingredients in the poultry diets.

Maharashtra holds a great potential to become a hub for poultry feed production as it has significant production of soybean and maize. Maharashtra is second largest producer of soybean in India after Madhya Pradesh. As shown in the maps below, PoCRA districts in Maharashtra contribute significantly to the production of soybean and maize. It should be noted that with the announcement of new biofuels policy in 2018, cropping pattern under maize will increase significantly in these districts in the next few years. It has been estimated that maize productivity will also increase significantly, thus improving the chances of farmers to diversify their market portfolio. Bihar, a major producer of corn in India, accounting for 8 per cent of the national production of corn in 2019-20, has come up with a state-level policy on ethanol production (Government of Bihar, 2021). This could be seen as an opportunity for states like Maharashtra to emerge as alternative markets in poultry feed industry.

The layer industry alone creates the feed demand of about 12 million tonnes with 5-6 percent CAGR. In the near term, significant opportunities exist in layer industry for compound feed demand. With farms consolidating and growing in size in long term, layer farmers will be integrated backwards into feed milling.

Total maize production in Maharashtra is about 2.3 million tonnes (FY 2020). The cumulative production of maize in the 15 districts of POCRA region is about 7 lakh tonnes of which Jalgaon, Aurangabad, Jalna, Buldhana and Amravati contributes to 95% of total production.

Similarly, soybean production in POCRA districts is also quite significant. Cumulative production of thse districts FY 2020 was 39 Lakh tonnes. The production distribution of soybean and maize in PoCRA district and non-PoCRA district is presented in Figure 2.1 and Figure 2.2

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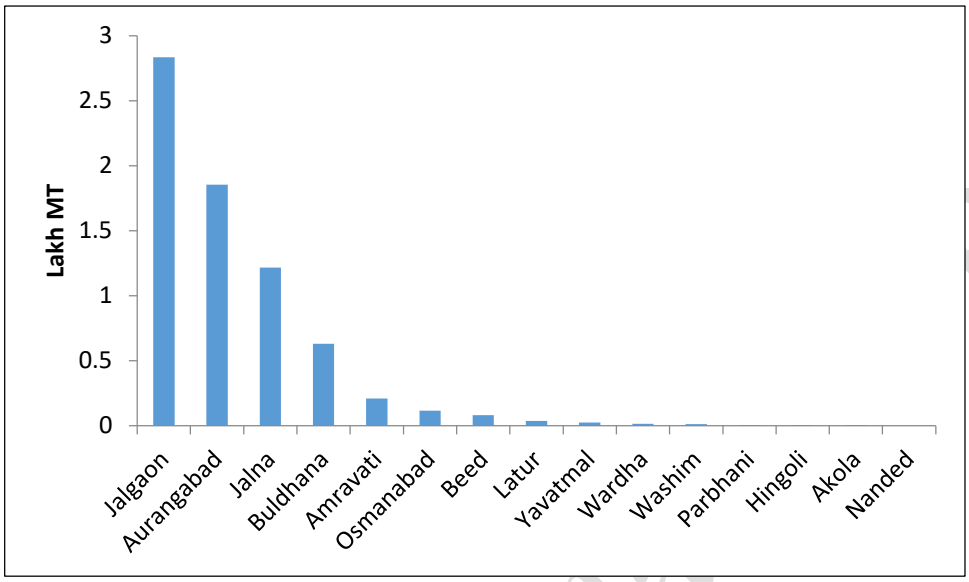

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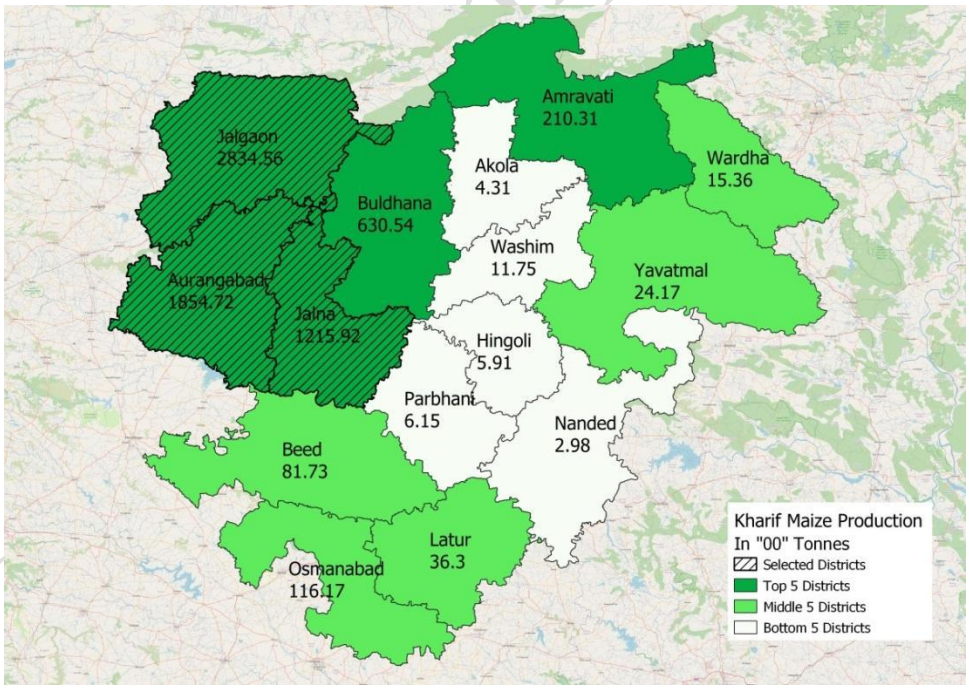
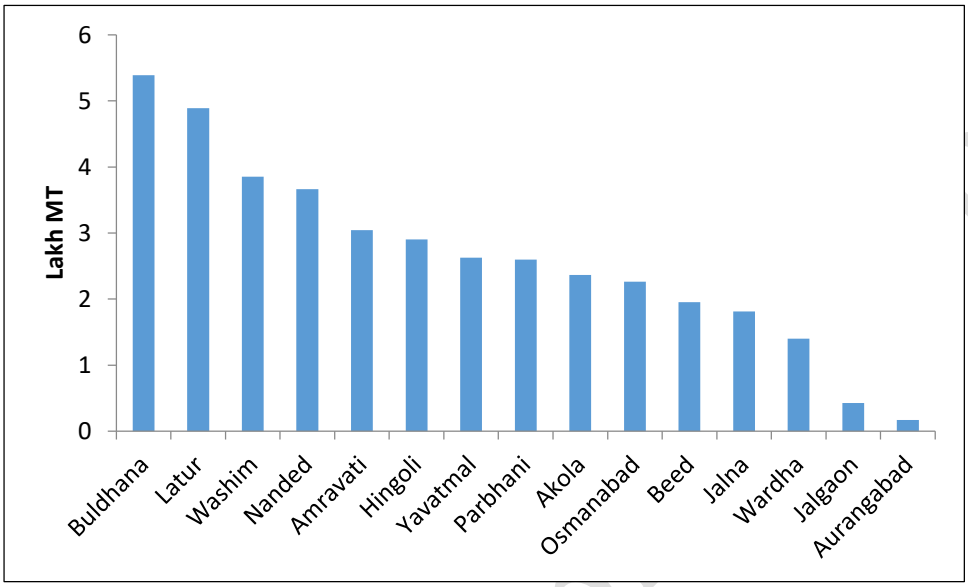


Figure 2.1 Maize production in PoCRA districts of Maharashtra

(a)



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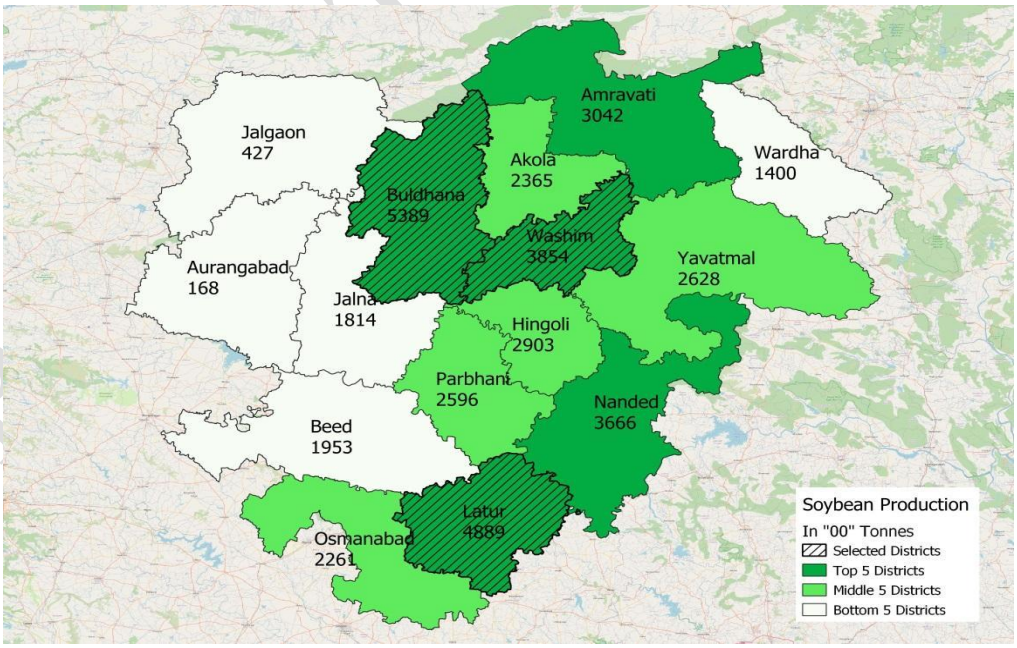
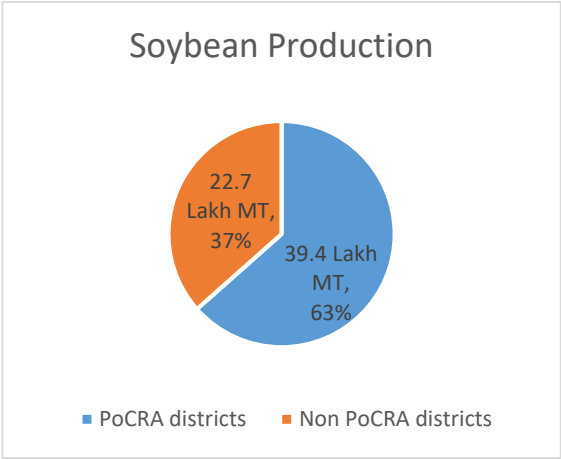


Figure 2.2 Soybean production in POCRA districts of Maharashtra

In this context, feasibility analysis of a poultry feed manufacturing business has been done for POCRA districts that carry a great potential for supplying significant quantum of feed to the state and neighbouring states.



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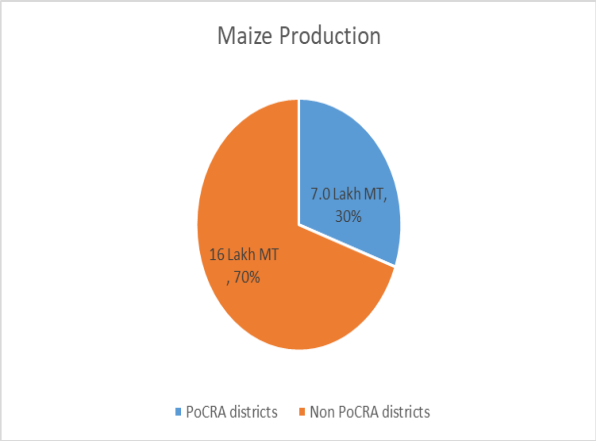


(b)

Figure2.3 Production of soybean (a) and maize (b) in Maharashtra with respect of PoCRA and Non-PoCRA districts

3 Project description (TEA)

Considering the quantum of raw material availability in the region, this project has been proposed for establishment of poultry feed unit of 1 ton per hour. The proposed project will offer flexibility to produce –

- Prestarter feed
- Crumbs (started feed)
- Pellet Feed (Finisher feed)

Since Pellet feed manufacturing is most exhaustive process which subsumes above two processes, all calculations presented in the feasibility analysis are for pellet feed.

3.1 Poultry Feed production process

3.1.1 Raw material procurement

For commercial poultry farming, feed serves as the largest cost of the operation. Therefore, sourcing high quality raw material is of utmost importance for the success of the business. This mixture of various concentrate feed ingredients in suitable proportion is known as compound feed.

Considering that Farmer producer companies in the region are going to be the direct stakeholder of the project, procurement of maize and soymeal (largest cost contributor) can be managed well within 100 kilometers radius of the project site. Even though procurement of raw material can happen from multiple suppliers, consistency of feedstock can be ensured by utilizing selected varieties to minimize variations in proximate composition. The low variability in the unit value realization in case of poultry feed demands greater incentives for the processing sector.

3.1.2 Weighing and quality check:

Raw materials stored in storage area are sent for weighing. High degree of accuracy and precision is required for weighing. After that ingredients are sent to laboratory for analysis. After acceptance from feed laboratory, these ingredients are sent for grinding with the help of equipment's like conveyor and elevators.

3.1.3 Grinding:

Size reduction is an important unit operation of feed manufacturing process. The grinding improves feed digestibility, acceptability, mixing properties, palatability, and increases the bulk density of some ingredients. In a commercial poultry feed mill, hammer mills are the most popular.

The raw materials are grinded in grinding machine to obtain appropriate size of grains. The end product is in form of pellet or mesh. So grinding is done

accordingly. Grinded materials are further separated by means of a sieve, and then stored in the assorting tanks according to the kind of raw materials.

3.1.4 Mixing:

The raw materials are mixed by means of a feed mixer. In this process, fatty ingredients are added to the materials in order to raise the nutritional value of the feed. The feed obtained from the mixer is blended with molasses. Proper mixing is crucial for uniformity of composition of product. Double ribbon blender is used to mix all ingredients after grinding.

3.1.5 Conditioning:

Direct and indirect injection of steam in feed mix for 10-50 seconds is done. Conditioner should have provision for varying conditioning time as per formulation requirement. It adds moisture content of feed to 17-18%.

3.1.6 Pelletization:

In this process, blend of raw material put into a Pelleting machine.

Pellets are made using extrusion principle with the use of temperature, moisture and high pressure. The heat generated in conditioning and pelleting makes the feedstuffs more digestible by breaking down the starches. Pelleting minimizes waste during the eating process. Pellet size may vary from 1.8 mm to 10 mm diameter as per the need. The positive effects of pelleting are higher feed density, no feed ingredient separation, better bacteriological quality, easier ingestion, improved growth and feed conversion ratio. Pelleting of meal leads to hardness and increased durability of the feed meal.

3.1.7 Cooling:

From the pellet machine chamber, the pellets normally flow by gravity into a device for cooling and drying of the pellets. Pellets will leave the pellet mill at temperatures as high as 90°C and moisture contents are high as 20%. For proper storage and handling of the pellets, their moisture content must be reduced to less

than 10%. This is to be accomplished by passing a stream of air through a bed of pellets. This evaporates the excess moisture, causing cooling both by the evaporation of water and by contact with the air. The counter flow pellet cooler has automatic control for optimum cooling. Its air flow opposite to movement of hot pellets results in fast cooling and removal of moisture.

3.1.8 Product Quality Inspection:

Proximate composition of pellet feed is done in the lab. In general practice, protein content 22% minimum, fibre maximum 10%, fat 5% minimum, maximum 2% ash and moisture content should be maximum 10% in the pellet.

3.1.9 Weighing and Packing:

Poultry feed is weighed with the help of electronic balance and packed suitably in a poly bag.

3.1.10 Storage

Packed poultry feed stored in cool and dry place and deliver as per demand.

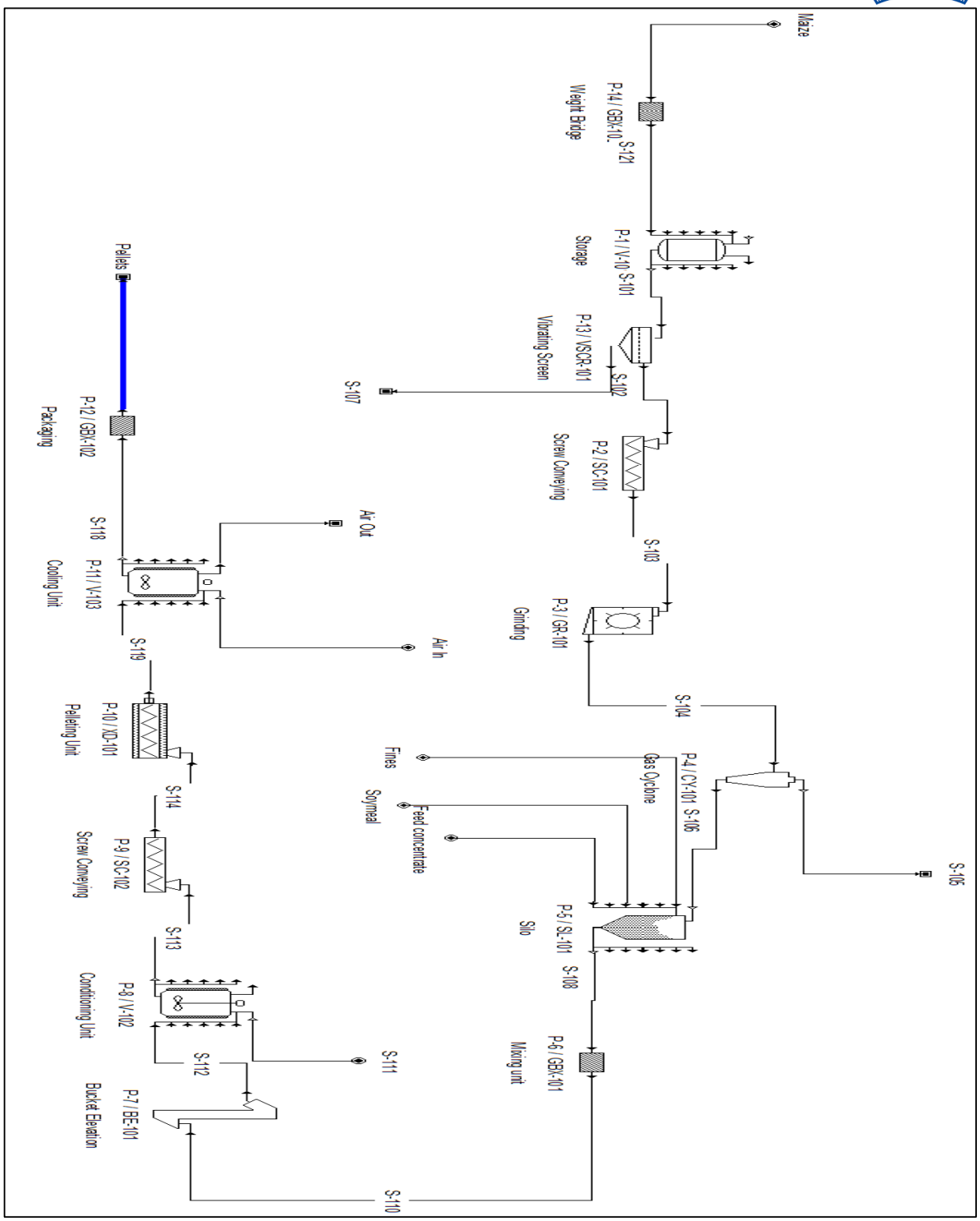
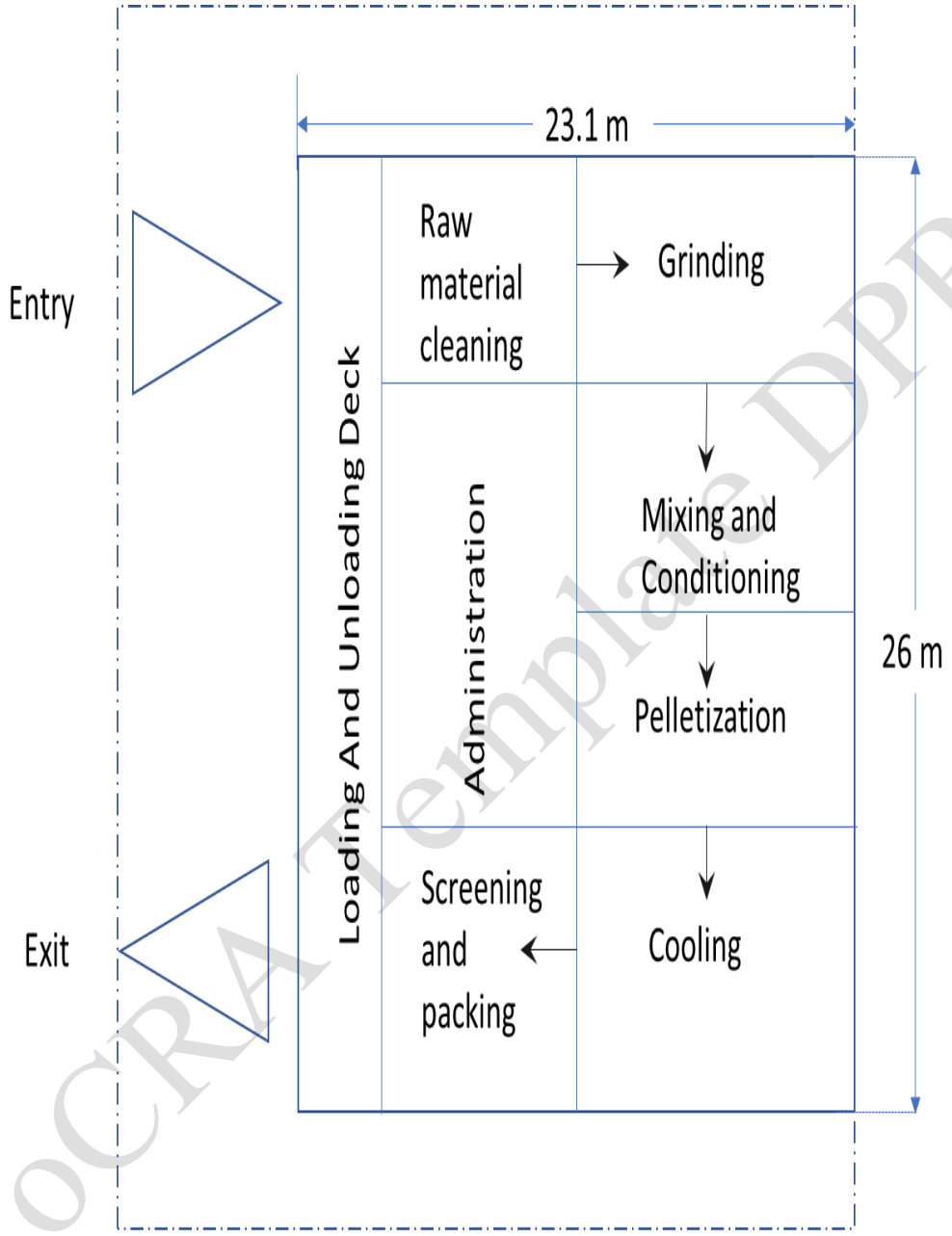


Figure3.1 Process flow diagram of poultry feed pellet production

3.2 Plant Layout



Total Area = 1000 sq. m
Built up Area = 600 sq. m

Figure3.2 Plant layout of poultry feed unit

3.3 Feed Composition

The feed consists of three macronutrients: Carbohydrates, proteins and lipid, together with molasses, and micronutrients (minerals and vitamins). Major raw materials required for the manufacture of poultry feed are maize, soymeal, molasses, salt, limestone (ground), other grains (optional), meat bone meal, vitamins, amino acids and minerals. A ration of corn and soybean meal is recognized as technically superior for raising broilers, but other ingredients are sometimes substituted based on availability and price. Animal feed for modern high-performance breed is blend of grains, protein meals, vitamins, minerals and a number of feed additives pelleted and crumbled to suit ingestion by different age of birds. The feed composition may vary depending upon the age of the bird and end use. Largely, the change is observed in the protein content of feed composition. In the analysis, two different compositions based on protein content were evaluated as follows –

Table 3-1 Feed compositions for 1 TPH feed model

S.No.	Ingredients	Composition 1 (%)	Composition 2 (%)
1	Maize	65	55
2	Soya meal	23	33
3	Dicalcium phophate	1	1
4	Meat bone meal	2	2
5	Mustard DOC	2.35	2.35
6	Soybean Oil	1	1
7	Mineral and Vit. mixture	0.2	0.2
8	Methionin + Tryptophane	0.3	0.3

9	Lysine	0.15	0.15
10	Rice bran deoiled	3	3
11	Molasses	1	1
12	limestone	1	1

Composition 2 has 10% more soymeal which may be needed as a special dietary requirement for poultry birds. In that case, poultry feed price would also vary depending upon the protein content of the feed. For example, broiler birds have higher protein requirement as compared to layer birds. Within broiler birds, protein requirement may vary from 19 to 22% depending upon the age of the bird. Likewise, 14-17% protein is considered good for layer birds.

In our analysis, we have assumed two compositions with 17 and 21% proteins, respectively by the changing the ratios of maize and soybean meal.

Wholesale market price for layer feed and broiler feed has seen an unprecedented change all across the globe. In India, layer and broiler feed price has shot up by more than 70% in the last 5 years. In 2021, there was a sharp spike in the feed prices due to soybean meal becoming expensive which is one of the most critical sources of protein in poultry feed. As per Soybean Processors Association of India, soybean price has increased by 156% in one year. Likewise, maize price has also increased significantly. This has led to increase poultry layer feed price from INR 32/kg (in Jan 2020) to INR 43/kg (in April 2022). Similarly, for broiler birds feed, price has changed from INR 35/kg to INR 50/kg (in April 2022).

Our techno-economic analysis showed that breakeven point (NPV =0) for both compositions are INR 31/kg and INR 33.5/ kg feed. However, to be able to make a good business case, we have taken as assumption of selling price of INR 35/kg of feed (irrespective of composition type). This price is the outcome of the average wholesale market price average of last 3 years. This conservative approach still shows good commercial potential of both feed types as discussed in the economics section.

Moving average of poultry feed for last three years (INR of 38.3/kg) shows very promising picture of the commercial viability of the process considering moving average procurement prices.

3.4 Economic analysis

3.4.1 Capital Investment Cost

In this study, an economic analysis was conducted to estimate the NPV, IRR, and PBP, respectively which is based on the capital investment, and on operating costs of the refinery. Model for integrated biorefinery was constructed in Superpro designer software. Capital investment costs are estimated based on the purchased costs of each piece of operating equipment (Table 19-1). The purchased costs for the major equipment items were based on budgetary quotations from equipment suppliers. In those instances where the capacities of the equipment in the model vary from the equipment, costs are adjusted for capacity using standard engineering scaling factors. The mass and energy balance outputs from the processing model were used to evaluate the capital and operating costs. Equipment cost information was derived from literature, equipment suppliers.

Direct Fixed Capital Cost (DFC) is a sum of Direct Cost (DC), Indirect Cost (IC), and contingency. The DC estimated is based on total equipment purchase cost (EPC). The plant considered here is assumed to be financed with 75% loan and 25% equity. The plant has a 15-year lifetime with 5 % salvage value at the end.

Table 3-2 shows economic evaluation parameters considered for the base case i.e. 1 ton per hour (TPH). The annual depreciation cost is calculated via the straight-line method.

Table 3-2 Economic evaluation parameters for 1 TPH Poultry feed model

Time parameters	Value	Financing parameters	Value
Analysis year	2022	Equity and loan	25% and 75%
Project life	15	Depreciation method	Straight line

Construction period (months)	12	Depreciation period	10 years
Start up period (Months)	1	Income tax	35%
Inflation rate (%)	6	Discount rate (%)	10
Operating parameters		**Construction plan**	**Value**
Annual operating time (days)	300	1st year (% DFC)	75
Start up cost (% DFC)	5	2nd year (% DFC)	25
Salvage Value (%DFC)	5		

Table 3-3 Summary of equipment list for 1 TPH feed model

Description	**Unit Cost (INR)**	**Cost (INR)**
Receiver Tank	200,000	200,000
Vessel Volume = 481.97 L		
Screw Conveyor	74,000	74,000
Pipe Length = 15.00 m		
Grinder	200,000	200,000
Rated Throughput = 433.50 kg/h		
Cyclone	74,000	74,000
Rated Throughput = 433.78 L/h		
Silo/Bin	100,000	100,000

Vessel Volume = 873.26 L		
Generic Box	400,000	400,000
Rated Throughput = 668.04 kg/h		
Bucket Elevator	50,000	50,000
Elevator Length = 10.00 m		
Blending Tank	200,000	200,000
Vessel Volume = 818.45 L		
Screw Conveyor	143,000	143,000
Pipe Length = 15.00 m		
Extruder	500,000	500,000
Screw Diameter = 9.56 cm		
Blending Tank	100,000	100,000
Vessel Volume = 831.85 L		
Generic Box	400,000	400,000
Rated Throughput = 679.23 kg/h		
Generic Box	800,000	800,000
Rated Throughput = 433.50 kg/h		
Unlisted Equipment		360,000
	TOTAL	**3,601,000**

Table 3-4 Fixed capital estimate summary

4A. Total Plant Direct Cost (TPDC) (physical cost)	
1. Equipment Purchase Cost	3,601,000
2. Installation	907,000

3. Process Piping	0
4. Instrumentation	720,000
5. Insulation	0
6. Electrical	1,440,000
7. Buildings	1,080,000
8. Yard Improvement	360,000
9. Auxiliary Facilities	720,000
TPDC	8,829,000

4B. Total Plant Indirect Cost (TPIC)

10. Engineering	883,000
11. Construction	2,649,000
TPIC	3,531,000

4C. Total Plant Cost (TPC = TPDC+TPIC)

TPC	12,360,000

4D. Contractor's Fee & Contingency (CFC)

12. Contractor's Fee	0
13. Contingency	1,236,000
CFC = 12+13	1,236,000

4E. Direct Fixed Capital Cost (DFC = TPC+CFC)

DFC	13,596,000

Table 3-5 Summary of raw material cost (Composition 1)

Bulk Material	**Unit Cost (INR)**	**Annual Amount**	**Unit**	**Annual Cost (INR)**	**%**
Fines	18.00	74,412	kg	1,339,416	1.01
Maize	18.00	2,715,444	kg	48,877,992	36.99
mixture	50.00	576,000	kg	28,800,000	21.79
soy meal	50.00	1,060,301	kg	53,015,040	40.12
Water	120.00	995	MT	119,367	0.09
TOTAL				**132,151,815**	**100.00**

Table 3-6 Summary of raw material cost (Composition 2)

Bulk Material	Unit Cost (INR)	Annual amount	Unit	Cost (INR)	**%**
Fines	18	69,602	kg	1,252,843	1.01
Maize	18	2,297,009	kg	41,346,158	36.99
mixture	50	576,000	kg	28,800,000	21.79
soy meal	50	1,520,640	kg	76,032,000	40.12
Water	120	956	MT	114,743	0.09
TOTAL				147,545,744	100

Table 3-7 Summary of utilities cost for 1 TPH poultry feed model

Utility	**Unit Cost (INR)**	**Annual Amount**	**Ref. Units**	**Annual Cost (INR)**	**%**
Std Power	10.00	409,181	kW-h	4,091,813	86.73

Steam	888.00	596	MT	528,958	11.21
Chilled Water	5.00	19,397	MT	96,985	2.06
TOTAL				4,717,756	100.00

Table 3-8 Annual operating costs for (A) Composition 1 and (B) Composition 2

Item	**Composition 1**		**Composition 2**	
	Cost (INR)	Contribution (%)	Cost (INR)	Contribution (%)
Raw Materials	132,152,000	91.07	147,546,000	91.93
Labor	2,680,000	1.85	2,680,000	1.67
Facility Dependent	2,707,000	1.87	2,707,000	1.69
Laboratory/QC/QA	402,000	0.28	402,000	0.25
Utilities	4,718,000	3.25	4,718,000	2.94
Advertising/Selling	2,445,000	1.68	2,445,000	1.52
Total	145,104,000	100	160,498,000	100

<u>Manpower (Labor) requirement</u>

The manpower cost has been assessed based on an organization structure and requirement to run 2 shifts of operation per day. It is estimated that total manpower cost would be approximately Rs. 26.80 Lacs per annum.

Table 3-9 Manpower (Labor) requirement

	Number	Unit cost (in Lakhs)	Total (in Lakh rupees)
Manager	1	6	6
Maintenance Engineer	1	5	5
Accountant	1	2.4	2.4
Technical operator	2	2.2	4.4
Labors	6	1.2	7.2
Guard	1	1.8	1.8

Table 3-10Summary of project economics for feed compositions

	Composition 1	Composition 2
Total Capital Investment (INR)	28,911,000	30,388,000
Annual operating cost (INR)	145,104,000	160,491,000
Net Unit Production cost (INR/kg)	29.67	32.66
Product Selling price		
Pellets (INR/kg)	35	35
Net Profit		
Pellets (INR/year)	16,940,000	7,460,000
IRR % (after taxes)	27.1	51.9
Payback period (years)	1.7	4.1

3.4.2 Sensitivity analysis

It is evident through analysis that raw material is the predominant contributor in deciding the fate of the project. Likewise, the market price of feed product would also strongly affect the economic viability of the process. Likewise, plant capacity, days of plant operation etc. will

have bearing on the economic viability of the plant. The sensitivity bounds are chosen based on what is expected due to market fluctuations. This was accomplished by evaluating NPV after changing one parameter keeping other parameters constant. To test the sensitivity of results, tornado charts were constructed for baseline scenario and associated variables sensitivities.

3.4.3 Raw material price

Base case Scenario: Maize- Rs. 18/kg, Soymeal - Rs. 50/kg and Feed mixture - Rs.50/kg

Low price: Maize- Rs. 15/kg, Soymeal - Rs. 40/kg and Feed mixture - Rs.40/kg

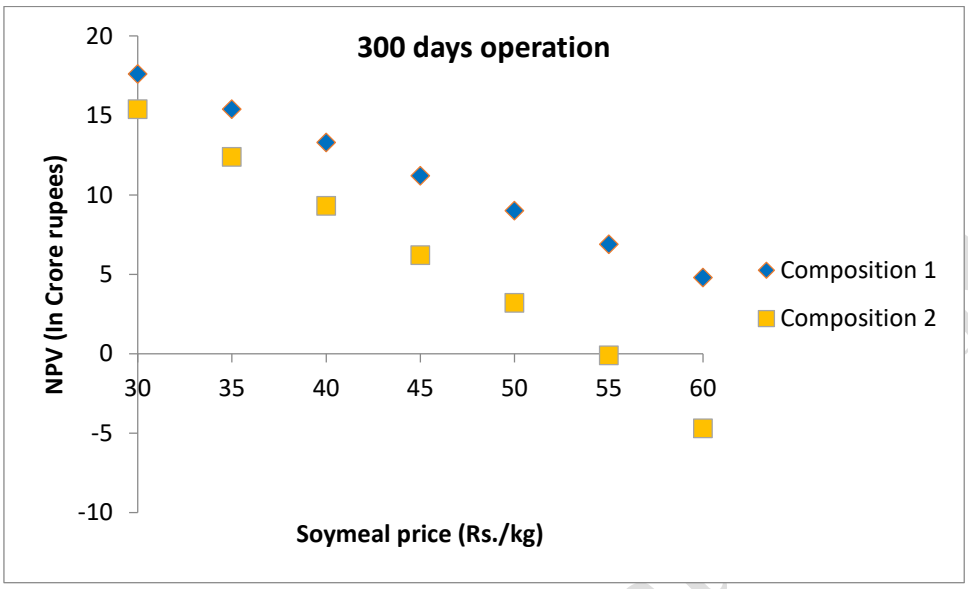
High price: Maize- Rs. 21/kg, Soymeal - Rs. 60/kg and Feed mixture - Rs.60/kg

3.4.4 Effect of soymeal price on NPV

Historical data shows that soymeal price was considered quite stable and it would hover between 20 to 30 rupees per kg. Last year, unprecedented increase in Soybean price had rattled the animal feed sector. Since soybean meal is a major constituent of poultry feed, volatility in soymeal would directly affect poultry feed cost of production.

As mentioned above, for base case scenario, soymeal price is considered INR 50 /kg. If price moves towards right by 10%, NPV for composition 2 becomes Zero, which implies that project is not viable. However, if proportion of soymeal is kept below 25% in the final feed composition for the same price hike, project may turn out to be profitable (Figure 19.8) for 180 days and 300 days of operation.

(a)



(b)

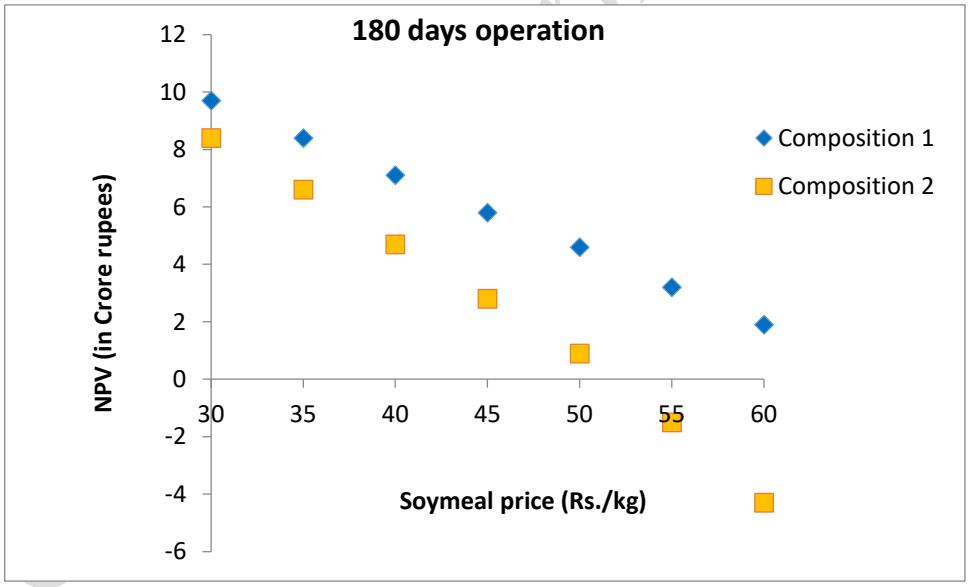


Figure3.3 Effect of operating days on NPV for both feed compositions

3.4.5 Effect of plant capacity on NPV

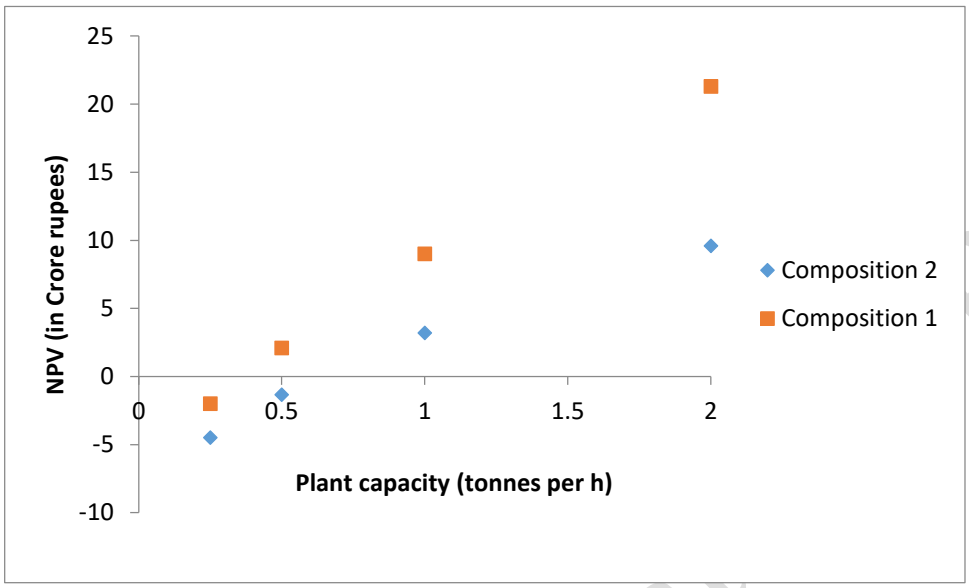


Figure3.4 Effect of plant capacity on NPV for both feed compositions

3.4.6 Conjoint analysis

(i) Effect of raw material price and no. of days of operation on NPV

It is evident from the Figure3.5 that raw material price inflation would directly affect project economics. Project viability comes out to be negative for 180 days of operation.

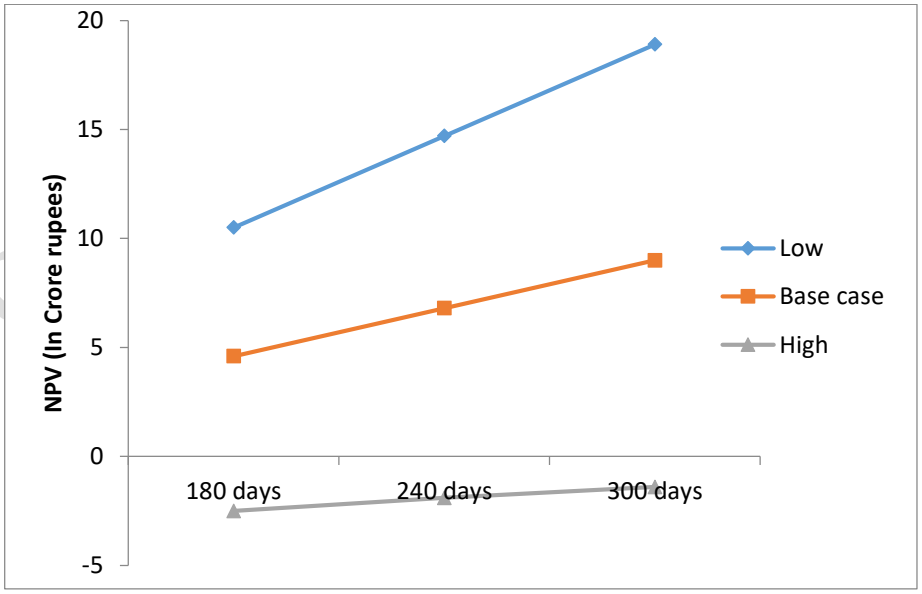


Figure3.5 Effect of raw material price and operating days on NPV

3.4.7 Effect of raw material price and pellet selling price on NPV

The most important factors affecting the project economics is variability on raw material and selling price of pellets.

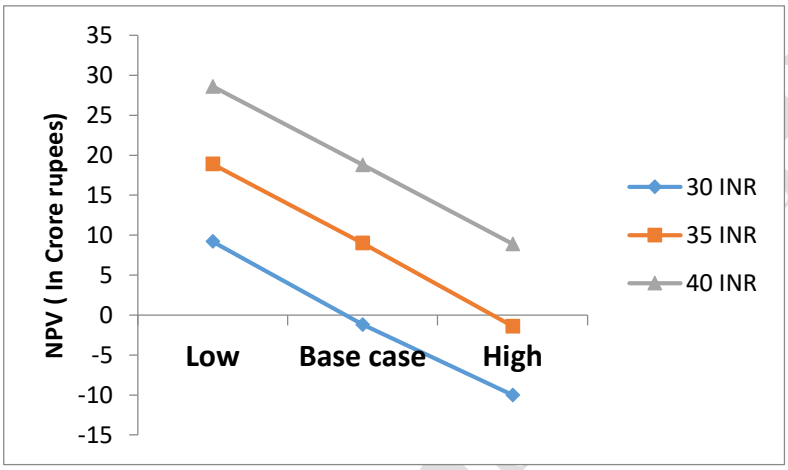


Figure3.6 NPV w.r.t Pellet price

Benefit Cost Ratio (BCR):

(i) Effect of plant capacity and feed compositions on BCR

	0.25 TPH	**0.5 TPH**	**1 TPH**
Composition 1	-1.14	**1.01**	**3.14**
Composition 2	-2.33	-0.59	**1.05**

It is apparent from the above Table that project economics is viable at 1 TPH capacity for both feed compositions. Scaling down the plant capacity to 0.5 TPH is still a profitable venture for 1st feed composition whereas project economics for 2nd feed composition doesn't seem viable.

(ii) **Effect of operating days and feed compositions on BCR (for 1 TPH model)**

BC ratio	**180 days**	**240 days**	**300 days**
Composition 1	**1.6**	**2.4**	**3.14**
Composition 2	0.3	0.7	**1.06**

For feed composition 1, all operating days (180 days through 300 days) present a great potential for the business viability as BCR is more than 1.0 in all three cases. However, for feed composition 2, reducing no. of days of operation from 300 days to 240 days or lower adversely affects the project economics. It is therefore suggested to run the plant for 300 days if all other parameters are constant.

(iii) Effect of pellet selling price and feed composition on BCR (for 1 TPH and 300 days model)

BC ratio	INR 30	INR 35	INR 40
Composition 1	-0.3	**3.1**	**4.3**
Composition 2	-3	**1.06**	**3.33**

Current market price of poultry pellet is varying between 40 and 45 rupees per kg. It is apparent from the above table that project economics is favourable wen pellet selling price is ≥ 35 rupees.

3.5 Breakeven points

The project is viable for all prices of soymeal for composition 1 both for 180 and 300 days of operation. In case of composition 2, the project is viable if the cost of soymeal is below ₹55 when operated for 300 days and below ₹50 if operated for 180 days.

The plant must operate at least at1 tonne per hour for both the composition. In case of composition 1, the plant can operate at least at 0.5 tonne per hour. The price of pellets should be at least ₹35 for the project to be viable the low case, base case and high case scenario mentioned above.

3.6 Monte Carlo Simulation

Sensitivity analyses (one factor at a time) poses a limitation of not strictly representing real-life scenarios when more than one orthogonal parameters could vary simultaneously, making

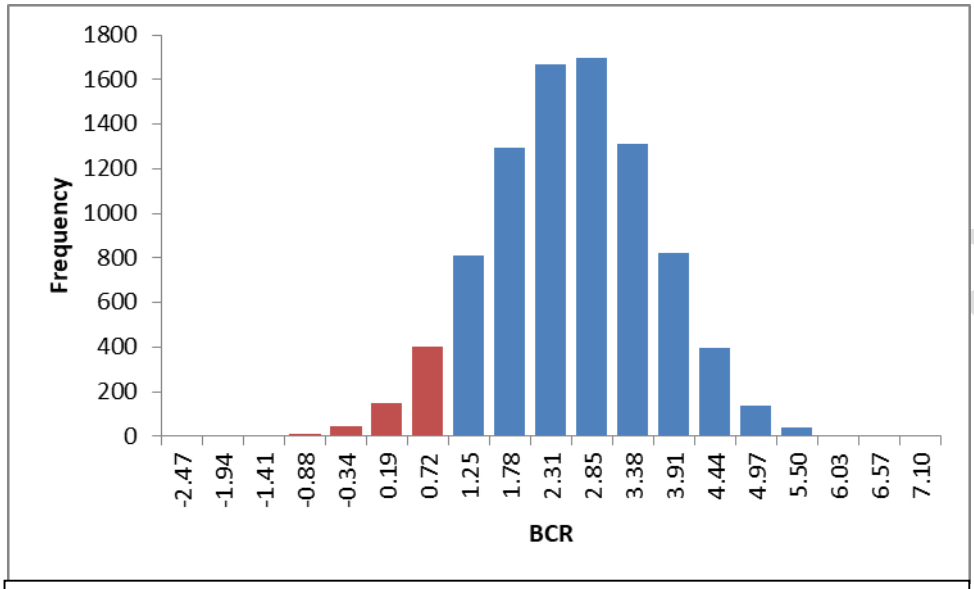
the analysis complicated. As discussed before, processes under evaluation are strongly affected by uncertainties that are associated with the process design and model development, or can be associated with raw material variability, volatile prices of products, investment cost etc. In order to establish the confidence in the new project, possible uncertainties and the risks should be carefully analysed. In this context, Monte Carlo simulation method was used as an intriguing method for solving stochastic system problems. This method provides approximate solutions to a variety of mathematical problems by performing statistical sampling experiments on a computer. To achieve this, a probabilistic model based on Monte-Carlo method was developed with varying process parameters and various economic parameters. The model consists of equations that separately estimated the total revenue, and operational costs associated with the process in order to calculate NPVs and BCRs.

Parameters that may vary simultaneously are as follows –

	Min	Max	Mode	Average
Input				
Maize price	18	22	18	20
Soymeal price	40	60	50	50
Mixture price	45	55	45	50
Fines	18	21	18	19.5
Output				0
Pellet price	30	40	40	35

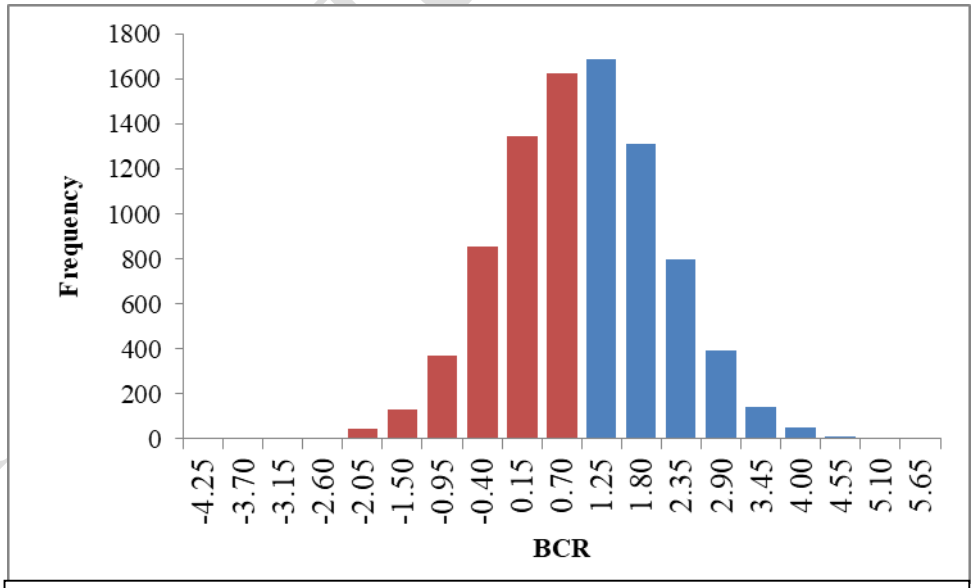
Simulation results:

The following graphs show the probability of success of venture for (1) Composition 1 Feed and (2) Composition 2 Feed.



Probability of Success: 0.96

Figure3.7 Profitability probability of composition 1 feed using Monte Carlo simulation Blue bars denote probability of BCR > 1 and red bars indicate BCR < 1.



Probability of Success: 0.60

Figure3.8Profitability probability of composition 2 feed using Monte Carlo simulation

Blue bars denote probability of BCR > 1 and red bars indicate BCR < 1.

3.7 Project viability

The Internal Rate of Return (IRR) of the project is 140% and 41%, for two compositions, which are significantly higher than the bank return rate of 10%. Analysis of BCR ratio under various conditions revealed that project is viable for feed composition 1, even under less operating days and reduced plant capacity. For feed composition 2, project is viable when plant capacity is kept at 1 TPH or higher. In addition, plant has to operate for 300 days.

Hence, the project is financially viable. The NPV of the project is positive at a discount factor of 10% during the period of operation considered. This implies that the project generates sufficient funds to cover all its cost, including loan repayments and interest payments during the period.

The situation may change further depending upon the selling price of the pellet. In this project, pellet selling price of 35 rupees per kg is a very conservative figure. As stated above, current wholesale market price is hovering between 40 and 45 rupees. This may change the overall scenario for the feed composition 2. A detailed uncertainty analysis using Monte Carlo method clearly shows that probability of success of the venture is very high (~96%) when soymeal contribution as a protein source is limited within 25% (Figure3.7 and Figure3.8). On the other hand, dependency on soymeal as a protein source esp. for high protein diets when selling price of pellets is floats between 30 and 40 rupees per kg, makes it a risky proposition (Probability of success is 60%). However, same venture could be considered profitable when pellet selling price varies between 35 and 45 rupees per kg (which is quite realistic as change in price of the product proportional to the change in the process of raw material). Considering the current wholesale market price regime (INR 43/kg) and current raw material price, probability of success turned out to be more than 95% in composition 2. Considering shift in selling price from INR 35/kg to INR 38/kg for composition 2, payback period would drop from 4.1 to 1.8 years. Similarly, IRR improvement would quite significant (from 41% to 133%).

3.8 Subsidy entitlement

Since total capital investment requirement is about 1.32 crore rupees, eligible FPCs can apply under POCRA program for maximum a subsidy of 60 lakhs for the project.

3.9 Project implementation and schedule

The key factors that would facilitate successful and timely project implementation are:

- Selection of proper technology and plant machinery vendors.
- Adequate diligence in formulating the technical concept and system design.
- Selection of contractors for civil construction and erection of equipment.
- Formulation of an effective project team led by an experienced Project Manager.
- Establishment of an efficient system for project planning & monitoring including reporting procedures for progress review & co-ordination.

3.10 Implementation Schedule

It is proposed in the analysis that the project implementation will take 12 months before plant operation begins. First six months will be allotted for pre project activities and the rest should be done within the next six months from the date the project is approved by the Ministry of Economic Affairs.

3.11 Occupational Health and Safety

All workers in the plant will be provided with and shall be mandated to use protective gear and equipment to ensure their personal safety.

Mandatory safety trainings will be conducted on a regular basis from time to time in order to ensure that safety procedures are followed at all times. A safety inspector shall be appointed (plant manager) to monitor and ensure compliance to safety norms and procedures.

4 Backward and Forward Linkages

4.1 Raw material supply

For raw material supplies, maize, limestone and soy meal can be procured locally. Rice bran and molasses could be procured from rice mills and sugar mills. There are many suppliers who can be contacted for raw material procurement. A list of some vendors has been given below –

Oil Cake

(i) Shree Ganpati Enterprises

No. 2647, 1st Floor Street

Raghunandan, Naya Bazar

New Delhi-110006, India

Contact Number: +91-9811077100, 011-43536445

(ii) Marudhar Foods Private Limited

B-108, Asthivinayak Complex

2nd Floor, Outside Dariiyapur Darwaja

Ahmedabad-380004

Gujarat, India

Contact Number: +91 7965437111

Bone Meal

(i) Global Enterprise

No. 10, Green Park Society, Opposite M.S. Public School, Near Pirkamal Masjid, Danilimada

Ahmedabad: 380028, Gujarat

India

(ii) Sri Sai Sagar Traders

No. 206, Ellora, Sant Muktabai Marg, Vile Parle East

Mumbai: 400057, Maharashtra

India

Contact Number: 08045136604

(iii) Giriraj Chemicals

No. 201-A, IInd Floor, Sumedha Market Complex, RDC Raj Nagar

Ghaziabad: 201002, Uttar Pradesh

India

Contact Number: 09643203160

Molasses

(i) Canny Overseas Private Limited

B-170, Priyadarshini Vihar

New Delhi - 110092

Delhi, India

Contact Number: 08045359140

(ii) Atlas

No.55, K.J.Building

34/A Khadak Street, Near Snow White Hotel

Masjid Bunder (W)

Mumbai: 400009

Maharastra, India

Contact Number: 08046035474

a) Plant machinery

(i) Metal Tech Engineers

(ii)

V.P.O. - Chari, Tehsil. - Khamano, Distt .

Fatehgarh Sahib, (Punjab) -141 801

(ii) Pratap Enterprises

Opp. U.K Palace,

G.T Road Khanna, (Punjab) -141401

(iii) Priti International

Bhowanipore, Kolkata West Bengal

(iv) Feed Milling Tech

Por, Vadodra, Gujarat

4.2 Forward Linkage, Marketing potential and marketing strategy

The demand for animal feed is mainly influenced by the awareness of farmers on the importance of the compound feeds, size of population, and development of modern poultry farms and availability of the product at right price. A wide network of dealers shall be created by the sales and marketing team of the FPC. The FPC would sell its products in B2B mode and in retail under its own brand name. Expenses incurred in creating marketing channels and network has already been added in the project cost. Based on our research, the following channels **(**Figure4.1**)** for marketing of feed could be utilized. The trading of poultry feed is a profitable venture to the dealers and sub-dealers as it gives a good margin to them.

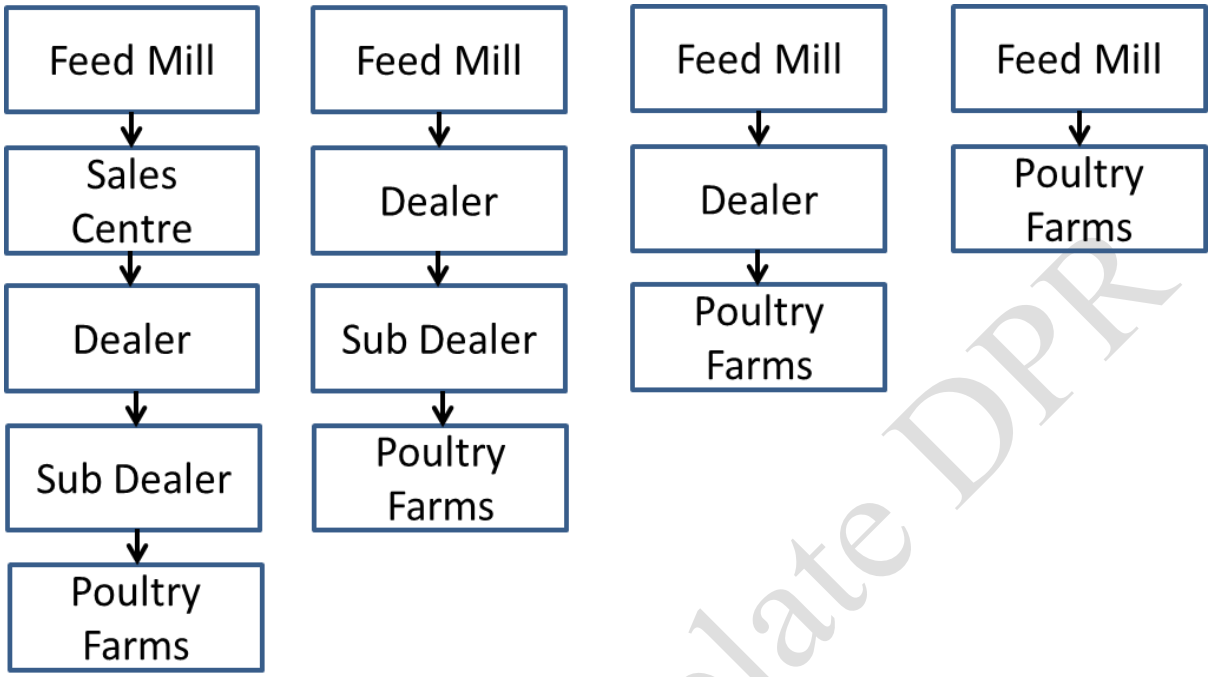


Figure4.1 Distribution channels for poultry feed

5 SWOT analysis

A SWOT analysis of the Poultry Feed units has been carried out keeping in mind the technology, marketing, product quality, skills, inputs, innovation, business environment and sustainability

Strength	**Weakness**
1. Inputs: Availability of raw materials from local dealers. 2. Business environment: (a) Exponential growth in domestic demand. (b) High production potential of the plant.	1. Input: (a) Volatile price of soymeal may affect the profitability of the plant. (b) Sourcing of high quality raw materials can be a challenge.

(c) Not highly crowded business in the region. Hence, competition is not severe. 3. Environment sustainability: No such unit operation in the process which harms the environment. 4. Skill/Manpower: (a) Automated plant would not require many labours. (b) Presence of ICAR research institutes for training. 5. Technology sophistication: Practical know how available to run the plant with minimal obstructions. To create poultry feed testing facility for whole region.	2. Business environment: Lack of knowledge of regulatory frameworks and government schemes. 3. Skill/Manpower: Lack of interaction between enterprises and technical institutes for providing technical training. 4. Innovation: Potential to represent the state in the poultry feed sector has not been leveraged.
<u>Opportunity</u> Potential to represent the state in the poultry feed sector. Engage technical and industry	**<u>Threat</u>** Input: Increase in rate of raw material. Business environment: Competition from vendors manufacturing products at lower costs.

Like Cargill and Godrej for skill development programs. Expansion of feed portfolio to a wide range of feed in the region.	Change in policies and regulatory environment might affect business. Skill/Manpower: Presence of large private player in the region in future may attract manpower to shift.

6 BIS standards for poultry feed

In India, BIS standards are followed for poultry feed. Table 6-1 shows the BIS standards.

Table 6-1 BIS standards for poultry feed

Characteristics	**Broiler starter feed**	**Broiler finisher feed**	**Chick feed**	**Grower feed**	**Layer feed**	**Breeder feed**
Moisture max %	11	11	11	11	11	11
Crude protein min %	23	20	20	16	18	18
Crude fibre max %	6	6	7	8	8	8
Acid insoluble ash max %	3	3	4	4	4	4
Salt (as (NaCl) Max %	0.6	0.6	0.6	0.6	0.6	0.6
Calcium min %	1.2	1.2	1.0	1.0	3.0	3.0
Available phosphorus min %	0.5	0.5	0.5	0.5	0.5	0.5
Lysine min %	1.2	1.0	0.9	0.6	0.65	0.65
Methionine min %	0.5	0.35	0.3	0.25	0.3	0.3

Metabolizable energy (ME) Kcal/ kg	2800	2900	2600	2500	2600	2600
Manganese, mg/kg	90	90	90	90	90	90
Vitamin A, IU/kg	6000	6000	6000	6000	6000	6000
Vitamin D3, IU/kg	600	600	600	600	1200	1200
Vitamin E, mg/kg	15	15	15	10	10	10
Vitamin K, mg/kg	1	1	1	1	1	1
Riboflavin, mg/kg	6	6	6	3	3	3
Biotin, mg/kg	0.2	0.2	0.2	0.15	0.15	0.15
Choline	1400	1600	1300	900	800	800
Pyridoxine, mg/kg	5	5	5	5	5	8
Aflatoxin, max, P.P.b.	50	50	50	50	50	50

7 List of Statutory Clearances Required

The following table mentions the list of statutory clearances required to set up the processing unit of poultry feed.

S.NO.	Approval and Clearances required	Departments/Offices to be consented
1	State Investment Promotion Board, Stage – I clearance	Department of Industries
2	Environmental clearance	Maharashtra State Pollution Control Board
3	GST registration	Commercial Taxes

4	Change in land use	Land revenue department
5	Sanction and supply of power	DISCOM
6	Sanction and supply of water	