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An economic analysis of chicken nuggets processing unit

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Abstract
The study has analysed the cost, returns and feasibility of chicken nuggets production on different categories of processing units. Simple benefit-cost analysis, break-even level, project evaluation techniques have been used to draw the inferences. The results indicated that the cost of production of nuggets was highest on small units (Rs.364.61/kg) compared to medium and large scale units(354.9 and 306.48 per kg). All the processing units are found to be economically feasible with NPV of Rs. 7.76, 39.88 and 92.31 lakhs and IRR of 36%,47% and 71% for small, medium and large scale units respectively. B-C ratio was estimated as 1.52, 1.75 and 2.23 with payback period of 3.17, 2.78 and 2.19years for small, medium and large scale units respectively. Economies of scale is evident form all perspectives like production costs, profits, discounting measures and breakeven point. Sensitivity analysis showed that variable costs and selling price had more impact on profitability and viability of processing plants.

Keywords: Nuggets, meat products, investment analysis, Meat processing, economies of scale, Evaluation

Introduction
Meat processing industry has received greatest attention from policy players in an effort to increase level of food processing by 25% by 2050 from current level of 2%. Many technologies and products have been developed in meat processing industry. Emulsion is one such technology more popular among meat processing technologies and many products are developed with this technology. Nuggets is one such popular meat product prepared by meat emulsion. Being a more consumed item of processed meats, chicken nuggets has good market value.

It can be prepared from all types of meats (chicken, goat, sheep, buffalo, fish).Processed meat products are found to be sound on technical aspects but their worthiness form economic perspectives is not yet established. Hence there is need to study the processed meat products from point of view of economics for the benefit of both producers and consumers.

Hence an attempt has been made to study the economics of production of chicken nuggets and evaluate the feasibility of setting up of meat processing plants on small, medium and large scale for the production of nuggets. Comparison was made among three processing units regarding all aspects of economics to find out the optimum size of processing plant.

Data and Methodology
For achieving the objectives of the study the required data were collected from the studies of NRCM. Primary data pertaining to input use, output yield were collected to compute cost of processing, production and to work out selling price. Data on project cost, cash flows were used to find out the viability of investment. Secondary data was used for outlining baseline assumptions.

Various economic measures were used for evaluating the economics of chicken nuggets. Financial efficiency measures like liquidity ratios, profitability ratios and investment ratios were employed for analysing financial viability of processing plant. Financial feasibility of investment was examined by using the regular project evaluation techniques like Net Present Value (NPV), Internal Rate of Returns(IRR), Benefit –Cost Ratio(B-C ratio), Payback Period etc. Break even analysis was also carried out. Breakeven analysis was employed to estimate the level of production required to recover the fixed capital used on processing units.

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This concept is very important in the business as it indicates minimum amount of business necessary for operating business without loss.

Production process of chicken nuggets
The product is prepared by filling the emulsion into stainless steel moulds smeared with oil and then pressing it for uniform coverage of moulds without air and closing the moulds with lid and cooking in pressure cooker for 30 minutes. After cooking moulds are kept outside for one hour and chilled overnight under refrigerated temperature. The blocks are then removed and cut in the form of nuggets and packed. The process flow of chicken nuggets was presented in annexure-1. Nuggets can also be prepared by another method called enrobing where patties are dipped in battering, breading mixes and then processed. But in this study we consider only cooked patties which are not enrobed(NRCM2011).

The ingredients used in the preparation of prime type of emulsion include : deboned chicken meat(67%), chicken fat (13%), Maida(3%),Spice mixture(1.5%), condiments(3.5%), Ice flakes(9.7%), Polyphosphates(0.3%),Salt(1.7%),Sugar(0.3%), Sodium nitrite(100ppm)(0.01), Sunflower oil(10%). Formulation of emulsion and Composition of ingredients for spice mixture was given in annexures- 2&3

Results and Discussion
1. Basic assumptions
The study uses basic assumptions for evaluating feasibility of functional meat product processing. These assumptions are related to construction and finance, production, working capital and depreciation. All the results are based on these assumptions.

These basic assumptions are same across all types of processing units except capacity in production assumptions and raw material holding period in working capital assumptions. Regarding working capital assumptions raw material holding period of 4 days is taken for small units while 12 days period is assumed for medium and large units. Production capacity is taken as 30kg for small units, 150kg for medium units and 400kg for large units respectively.

Regarding production, it is assumed that the facility will process 30kg/150kg/400kg/day and operate an eight hour shift, six days a week, 50 weeks a year with a capacity utilization rate of 60%,70%,in the first two years and 80% from third year onwards. Regarding Finance ratio of 3:1is taken as banks and equity contribution. For calculation of IRR and net present value(NPV) of the project, cost of capital/interest rate of 12% set by commercial banks for long term loans has been taken Whereas, cost of working capital is taken asat 15% as per the rates fixed by the banks. Depreciation rates for WDV method as given by Companies Act 1956 are considered for calculation of depreciation schedule. Depreciation rates of 10%, 20% and 10% are considered for Buildings, Machinery and Miscellaneous assets respectively. As cost of land is not financed by banks, it is assumed that the entrepreneurs builts processing unit on his own land.

2. Capacity of processing plant
2.1. Installed Capacity
Capacity of the plant is assumed as 30,150 and 400kg/day of nuggets for small, medium and large units respectively. Product yield of 90% is taken for nuggets after considering cooking loss of 10%. Considering 300 working days in a year and yield of the products, the unit has an installed capacity of 8100, 40500 and 108000 kg nuggets. Product yield and Production at full capacity will be as follows

Table 1: Capacity of processing plant

S. No	Type of unit	Product yield	Days	Per day Capacity(Kg)	Annual output (kg/yr)@ 100% capacity
1	Small	90%	300	30	8100
2	Medium	90%	300	150	40500
3	Large	90%	300	400	108000

2.2. Capacity utilization
The capacity utilization varies depending on the capital availability, staff efficiency and availability of raw material.

Table 2: Annual Capacity /capacity utilization for processing plant

Type of unit	Installed Capacity(kg/yr)	Output at utilized Capacity(kg/yr)							
		1	2	3	4	5	6	7	8
		60%	70%	80%	80%	80%	80%	80%	80%
Small	8100	4860	5670	6480	6480	6480	6480	6480	6480
Medium	40500	24300	28350	32400	32400	32400	32400	32400	32400
Large	108000	64800	75600	86400	86400	86400	86400	86400	86400

The plant is assumed to start production at 60% of its installed capacity in the first year and increase its production by 10% every year i.e70%, 80% in the second, third years and levelling off to 80% from 3rdyear onwards respectively. Output at utilized capacities for different units were given in table 2

3. Project set up costs/Capital Investment/Infrastructure required
Project cost comprises investment for establishing an enterprise. The significant elements of project cost are land and site development, building, machinery, other fixed assets, technical know-how expenses, preliminary and pre-operative expenses, including interest during construction period, working capital margin and contingency costs. Investment pattern on different size groups of units is presented in table 3

Table 3: Project Cost on different size groups of processing units (Rs. lakhs)

S.No	Description	Type of processing unit							
		Small	%	Medium	%	Large	%	Overall	%
1	Land and Fencing	1.05	6.92	2.25	4.22	3.75	4.98	2.35	4.90
2	Building	4.64	30.5	9.76	18.30	14.32	19.0	9.57	19.9
3	Machinery andEquipment(M&E)	6.29	41.4	25.73	48.25	33.15	44.0	21.72	45.3
4	Miscellaneous Assets	0.62	4.08	2.57	4.82	3.31	4.39	2.17	4.52
5	Escalation&Contingencies	1.26	8.30	4.03	7.56	5.45	7.24	3.58	7.47
6	Preliminary Expenses	0.59	3.89	4.67	8.76	6.11	8.11	3.79	7.91
7	WorkingCapital Margin	0.72	4.74	4.32	8.10	9.22	12.2	4.75	9.91
8	Total cost	15.18	100	53.33	100	75.32	100	47.94	100

The data presented in Table 3 revealed that the average initial total investment on meat processing plant was Rs47.94 lakhs. Across different categories of units this investment varied between Rs. 15.18 (small units) to 75.32 lakhs and was highest on large units.

The expenditure on machinery accounted for the maximum share and it was 41.4 per cent, 48.25 per cent and 44 per cent for small, medium and large units respectively. Regarding investment on buildings, it was found that in small units this investment constituted about 30.5 per cent, whereas on medium units it was about 18.3 per cent. In the large units it constituted about 19% with average of 19.9%per cent of the total capital investment for overall category.

Preliminary and preoperative expenses accounted for3.89%, 8.76% and 8.11 on small, medium and large units respectively. Escalation and contingencies accounted for 8.3%, 7.56%and 7.24% on small, medium and large units.

Overall investment pattern of processing units showed that machinery and equipment was the major item of cost contributing to 45.3% share followed by Buildings(19.9%).These two items are the major costs for all three categories of plants with the share ranging from 41.4 to 48.25% for equipments and 18.3 to 30.5% for buildings respectively. These two items are followed by escalation and contingencies in case of small units while it is preliminary expenses for medium units and working capital for large units. However, in overall category working capital stands third position after equipment and buildings with share of 9.91%. This can be attributed to high cost of working capital for large units. Overall investment structure shows that meat processing is a capital intensive venture.

4. Means of Finance
The project will be funded through both equity and debt in a 25% to 75% ratio. The debt will be repaid in a time period of 7 years including 1 year grace period. The project is proposed to be financed with a debt equity ratio of 3:1 and the means of finance is as follows

Table 4: Means of Finance

S. No	Source of funds	Small	Medium	Large
	Total Project cost	15.18	53.33	75.32
1	Equity	7.83	13.33	18.83
2	Subsidy	3.78	12.77	17.89
3	Effective bank loan	3.52	27.23	38.60

Credit linked subsidy of Rs. 3.78, 12.77 and 17.89 lakhs for small, medium and large units is also availed through the subsidy scheme of Ministry of Food Processing Industry, GoI called Scheme of Technology Upgradation / Establishment/ Modernisation of Food Processing Industries under National Mission on Food Processing(NMFP) implemented jointly with State Governments which provides

financial assistance to food processing units in the range of 25%(33.33%in subject to a maximum of Rs.75lakhs in difficult areas and 50% in North Eastern States including Sikkim) subject to a maximum of Rs.50lakhs in general areas

5. Working capital
Working capital is the resources used to support a business until it is able to generate resources to support itself. Working capital varies with production level since it is directly related to variable operating expenses. Banks provide loans upto70% of working capital requirement with an interest of 15%.The remaining 30% will be born by the owner in the form of equity. Working capital requirement and its source of fiancé for different plants is presented in table 5.

For small units working capital of Rs.1.68 lakhs is required out of which promoter has to contribute 0.72 lakhs towards margin money. Increasing trend of working capital (table 5) showed that production of functional meat products is capital intensive business requiring average working capital of Rs.11.87 lakhs.

Table 5: Working Capital requirement and contribution

Source	Working capital(Rs. lakhs)		
	Small	Medium	Large
Total	1.68	10.38	23.57
Bank	0.95	6.06	14.35
Equity	0.72	4.32	9.22

6. Project Economics
6.1. Production costs
The production estimates for products are based on their output yields. The output yield/ input output ratio is taken as 90% for nuggets. The information regarding annual expenditure and per kg expenditure in the first year in preparation of nuggets has been depicted in Table 6.

It is clear from expenditure statement given in table6 that in total costs, raw material cost accounts for major share of 54.85%, 56.35% and 65.26% for small, medium and large units with overall share of 58.48%. Raw material cost per kg was estimated as Rs.200 for all units. Labor costs forms the second largest item of cost in total costs next to raw material with overall share of 13.54%(Rs.38.61/kg).Share of labour costs ranges from 11.31%(Rs.34.66/kg) for large units to 16.25% (Rs.59.26/kg)for small units. Depreciation is the third largest item with overall share of 8.11%.Depreciation values were estimated as Rs.40.12, 28.89 and 14.24 per kg of product. It can be concluded that raw material is the major item of cost followed by labour costs and depreciation and packaging materials. Further it is evident that these costs showed decreasing trend along the capacity reflecting efficient utilization of resources on large units resulting in lower costs.

Table 6: Cost of production of nuggets in different sizes of plants

Particulars	Small		Medium		Large		Overall	
	Annual	Per kg	Annual	Per kg	Annual	Per kg	Annual	Per kg
Raw Material	9.72	200.00	48.60	200.00	129.60	200.00	62.64	200.00
Stores, Consumables & Packaging materials	1.17	24.07	5.83	23.99	15.55	24.00	7.52	24.02
Power	0.54	11.11	1.35	5.56	2.52	3.89	1.47	6.85
Utilities	0.22	4.53	0.79	3.25	2.02	3.12	1.01	3.63
Wages and Salary	2.88	59.26	10.94	45.02	22.46	34.66	12.09	46.31
Repairs and maintenance	0.22	4.53	0.79	3.25	2.02	3.12	1.01	3.63
Rent, Taxes & Insurance	0.24	4.94	0.72	2.96	1.74	2.69	0.90	3.53
Admin expenses	0.00	0.00	4.61	18.97	6.19	9.55	3.60	9.51
Selling expenses	0.00	0.00	2.59	10.66	2.59	4.00	1.73	4.89
Interest on term loan	0.70	14.40	2.45	10.08	3.47	5.35	2.21	9.94
Interest on WC	0.07	1.44	0.45	1.85	1.08	1.67	0.53	1.65
Depreciation	1.95	40.12	7.02	28.89	9.23	14.24	6.07	27.75
P&P Amortization	0.01	0.21	0.09	0.37	0.12	0.19	0.07	0.26
Total	17.72	364.61	86.24	354.90	198.60	306.48	100.85	342.00

Note: Annual expenses are expressed in Rs. Lakhs and per kg cost is expressed in Rs.

6.2. Cost and return structure

Cost structure of nuggets showed that the total cost of production was 364.57, 354.9 and 306.45 per kg of product for small, medium and large units respectively.

From table 7 it is evident that on an average variable and fixed costs accounted for 77.25% and 22.75% of total cost of production. In variable costs raw material alone accounted for 73.89%, 74.67% and 78.74% for small, medium and large units respectively with overall share of 75.7%.In case of fixed costs depreciation was the major item of costs accounting for 35.65% of fixed costs for overall category with its share ranging from 27.14 (large units)to 42.68%(small units).

Table 7: Cost and Return structure of nuggets in different sizes of units

Item of cost	Small units(Rs.)	Medium units(Rs)	Large units(Rs)	Overall	
				(Rs)	%
Variable costs	270.66	267.86	253.99	264.17	77.25
Fixed costs	94	87	52.48	77.83	22.75
Total costs	364.57	354.9	306.45	341.97	100
Selling price@10% markup	401	390.4	337.12	376.16	

The decreasing trend of depreciation along with capacity showed efficient utilization of fixed resources on large units. Fixed costs varied from Rs. 94(small units) to 52.48 (large units)with average of Rs.77.83 per kg. For variable costs this range is 270.66 (small units) to 253.99(large units) per kg. Average cost of production of nuggets was estimated as Rs. 341.97with variable costs of Rs. 264.17 and fixed costs of Rs.77.83 per kg.

Further it is evident that all the costs including variable and fixed costs goes on decreasing with the capacity due to efficient utilization of resources resulting in low production costs on larger units.

6.3. Revenue: First year revenues and profit for three types of units is given in table 8

6.3.1. Gross revenue: At the selling price of Rs.401, 390and 337/kg, the small, medium and large units generates gross revenue of Rs. 19.49, 94.87and 218.46lakhs in the first year and this revenue goes on increasing in the subsequent years as capacity increases.

6.3.2. Net income: After considering taxes (Income tax and VAT), the profit is estimated as Rs. 1.68, 8.19 and 18.87 Lakhs in the first year. The overall production of nuggets generates gross returns of 110.94 lakhs and net returns of Rs. 9.58 lakhs which comes to Rs.354.21 and 30.59 per kg.

Both annual gross and Net returns, and per kg returns increased proportionately with the capacity increase during successive years and also increase with size of the plant reflecting economies of scale.

Table 8: Returns from Chicken nuggets production in different sizes of units

Particulars	Small		Medium		Large		Overall	
	Annual	Per kg	Annual	Per kg	Annual	Per kg	Annual	Per kg
Income	19.49	401.03	94.87	390.41	218.46	337.13	110.94	354.21
Expenditure	17.72	364.61	86.24	354.90	198.60	306.48	100.85	322.01
Profit Before Tax	1.77	36.42	8.62	35.47	19.86	30.65	10.08	32.19
Residual value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Profit Before Tax	1.77	36.42	8.62	35.47	19.86	30.65	10.08	32.19
Taxable profit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Income tax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
vat 5%	0.09	1.85	0.43	1.77	0.99	1.53	0.50	1.61
Total taxes	0.09	1.85	0.43	1.77	0.99	1.53	0.50	1.61
Profit after Tax	1.68	34.57	8.19	33.70	18.87	29.12	9.58	30.59
Non cash expenditure	1.96	40.33	7.11	29.26	9.35	14.43	6.14	19.60
Cash profit	3.65	75.10	15.30	62.96	28.22	43.55	15.72	50.20

Note: Annual receipts are expressed in Rs. Lakhs and per kg revenue is expressed in Rs.

7. Financial Evaluation
7.1. Financial Efficiency Measures
7.1.1. Ratio Analysis
On the basis of the projected income statement and related projections different financial ratios are calculated and shown in table9.

7.1.1.1. Profitability:
According to the projected income statement, the project will start generating the profits in the first year of operation.

Profitability ratios(Table9) indicate that on an average functional products generates Gross profit margin of 25.17% and Operating Profit margin of 15.99% and profit margin of 13.64% and Net profit margin of 12.42%.Operating ratio was found to be 84.01%.

Gross and Operating Profit margin of 25.17% and 15.99% indicates that the direct costs incurred in the production of chicken Nuggets accounts for 74.83% and operating expenses including administrative expenses and direct costs account for 84.01% of the profits. Difference between these two (9.18%) gives administrative and selling expenses. It can also be depicted as the earnings before interest and taxes is 15.99%.

Table 9: Financial feasibility Ratios of nuggets production on different size groups of plants

Financial feasibility Ratios	Capacity			
	Small	Medium	Large	Overall
Profitability Ratios				
Gross profit margin (%)	25.49	28.83	21.20	25.17
Operating Profit margin (%)	18.34	16.17	13.46	15.99
Profit margin%	15.55	13.77	11.61	13.64
Net Profit margin (%)	14.43	12.45	10.37	12.42
Investment Ratios				
Return on Total investment	24.05	28.53	38.51	30.36
Return on Equity	96.18	114.12	154.04	121.45
Investment turnover ratio	4.76	3.82	2.72	3.77
Liquidity ratios				
Debt Equity Ratio	1.16	1.15	1.15	1.15
Debt to Capital Turn over	29.10	28.72	28.83	28.88
Debt Service Coverage Ratio	3.29	3.83	4.79	3.97
Operating ratio	81.66	83.83	86.54	84.01

Profit margin indicates the profits before taxes is 13.45% and difference between Operating Profit margin and Profit margin indicates the interest incurred by the project which accounts for 2.35% of profits. It indicates the cost of the capital which is very important in investment decisions. It is used to compare across regions or financing institutions which will affect policy decisions.

Net profit margin indicates the actual profit that is left with the company after all expenses met and it is12.42%in this case. Difference between Profit margin and Net Profit margin indicates that the taxes incurred by the unit accounts for 1.22% of the profits/sales. It is used to compare the tax structure of the countries or states or regions and it has implications for policy making for the growth of sector. All the profitability ratios show an increasing trend over the years.

7.1.1.2. Liquidity
Liquidity ratios like Debt Service Coverage Ratio (DSCR), Debt Equity Ratio, Debt to capital Turn over were found to be kept at an acceptable levels of 3.97, 1.15, 28.88% respectively. These ratios shows that the processing plant is able to meet its obligations on long term liabilities. Further decreasing trend (Table 9) of all these ratios shows that the Debt obligations goes on decreasing over the years and also along with capacity.

Though the DSCR which measures enterprise's capacity to meet term-loan-cum-interest and other long-term commitments/ obligations decreases in the second year it showed increasing trend throughout the period and is kept at acceptable level of 3.97 indicating that the plant generates surplus, adequate to meet repayment obligations. Debt equity ratio which measures the extent to which the promoter's funds are leveraged to procure loans is kept at 1.15. Hence Risk is found to be at the accepted levels and goes on decreasing over time and along with capacity.

All the liquidity ratios showed that the debt obligations decrease over time and surpluses generated by plant will go on increasing over time and also along with capacity.

7.1.1.3. Investment Ratios
Analysis of investment ratios shows that on an average meat plant is able to generate enough returns of 30.36%, 121.45% returns on total investment and equity respectively. Investment turnover ratio is kept at 3.77%.

To sum up, the financial viability indicators revealed that the processing unit is financially viable. Overall, the processing plant under study showed satisfactory performance on account of liquidity, profitability, investment.

7.2. Economic feasibility
In the present study, economic feasibility of processing unit was measured using discounted measures such as NPV, BCR, IRR and Pay Back period. The calculated IRR of the project is 36%, 47%, and 71% and Net Present Value (NPV) at 12% discount is Rs. 7.76, 39.88 and 92.31Lakhs for small, medium and large units respectively.

Table 10: Economic Feasibility measures for chicken Nuggets processing plant

S. No	Feasibility measures	Small	Medium	Large	Overall
1	NPV (Rs. lakhs)	7.76	39.88	92.31	46.65
2	IRR(%)	36%	47%	71%	51.3%
3	BC	1.52	1.75	2.23	1.83
4	Average Returns (Rs.lakhs)	4.78	19.22	34.30	19.43
5	Pay Back Period (Yrs)	3.17	2.78	2.19	2.71
6	DSCR	3.28	3.82	4.79	3.96

The positive NPV (Table 10) implied that the discounted worth of benefits was greater than disconnected worth of cost steams. The project's initial investment will be fully recovered in less than four years(3.17,2.78&2.19 years) with average annual net returns of Rs.4.78, 19.22 and 34.3 lakhs per annum. Low payback period in large units was due to higher realization of returns which reduces the time required to achieve payback output.

Benefit cost ratio being greater than unity(1.52,1.75 and 2.23)reaffirmed that processing plants are viable and on average the plants will give a return of 1.52,1.75 and 2.23 on every rupee investment on small, medium and large units respectively.

According to the discounting criteria the processing plants under study turned out to be economically viable projects with NPV of Rs.46.65lakhs and IRR of 51.3%, BC ratio of 1.83 and payback period of 2.71 years. The plant generates average returns of Rs.19.43 lakhs per year.

7.3. Break Even Analysis

Table 11: Break Even Analysis for chicken Nuggets on different size groups of units

Particulars	Small	Medium	Large
Total output(kg)/yr	4860	24300	64800
Break Even Point(kg)	3500.92	17261.74	40909.80
Break Even Point (as% of Capacity)	72.04	71.04	63.13
Break Even Point (as % of Full Capacity)	43.22	42.62	37.88
Total Revenue	14.04	67.39	137.92
Total Variable cost	9.48	46.24	103.91
Total Fixed Cost	4.56	21.15	34.01
Total Cost	14.04	67.39	137.92
Profit	0	0	0

Break Even Analysis indicates that BEP of output is 3500kgs, 17262kgs and 40910kgs which comes at 72%, 71% and 63.13% of utilized capacity and 43.22%,42.62% and 37.88% of full capacity of small, medium and large units respectively.

Table 11 shows that minimum quantity of 3500kg, 17262 kg and40910kgsper year should be produced in case of small, medium and large units so as to continue production process without sustaining losses. The remaining output(27.96%, 28.96% 36.87%) is considered as margin of safety where profits starts generating. Attainment of BEP at lesser time (Table 11) at higher levels of capacity utilization indicates that the plant is financially feasible. It is evident from table11that margin of safety shows positive relation with capacity showing higher profits on large units. However small units(4860kg), medium units(24300kg) and large units(64800kg) have processed nuggets more than breakeven level indicating that all units are running under profitable conditions. Further variation in these breakeven points was due to efficient utilization of resources.

7.4. Optimal Price Analysis

Optimal Price Analysis(Table 12) showed that selling of optimal units of 3219kg instead of 4860kg at optimum price of Rs. 536/kg over current price of Rs.401/kg on small units generates higher profits (Rs.3.97 lakhs) than current profits(Rs.1.77 Lakhs). NPV and IRR increases to Rs.23.77 lakhs and 43.85% with optimal price and quantity. Project yield Rs.1.05 more returns for every rupee invested over current price and units.

Similarly for medium units optimum quantity and price were estimated as 15955 and Rs.524 per kg. These figures for large scale unit were 40380kgs and Rs. 464/kg.

Table 12: Optimum price analysis for chicken nuggets on different size groups of units

Particulars	Small		Medium		Large	
	Current	Optimum	Current	Optimum	Current	Optimum
Variable Cost per Unit	270.66	270.66	267.86	267.86	254	254
Fixed Cost	4.56	4.56	21.15	21.15	34	34
Selling Price per Unit	401	536	390	524	337	464
selling units	4860	3219	24300	15955	64800	40380
Profit	1.77	3.97	8.52	19.71	19.77	50.78
NPV(Rs. Lakhs)	7.76	23.77	39.88	104.20	92.31	267.01
IRR(%)	36%	43.85%	47%	54.65%	71%	85.69%
BC	1.52	2.57	1.75	2.95	2.23	4.55
Average Returns(Rs. Lakhs)	4.78	8.36	19.22	32.27	34.30	69.33
Pay Back Period (Yrs)	3.17	0.55	2.78	0.61	2.19	0.92

7.5. Sensitivity Analysis

Profits in any business is affected by many variables like variable cost, selling price, fixed costs, capacity etc. Hence for any business or investment appraisal, sensitivity analysis should be carried out in order to estimate the impact of these variables on the profits. In the present case we have analysed how sensitive are our profits to the changes in the variables. The results of sensitivity analysis for medium scale unit are presented in fig 1&2.

The results showed that if the variable cost decreases by 5% over the base scenario, the NPV increases by 49.8% (Rs.59.8lakhs) and if variable cost increases by 5% the NPV will decrease by 39.5%(Rs.24.1 Lakhs) over the base scenario.

Similarly if the Selling Price decreases by 5% over the base scenario, the NPV decreases by 59.8% (Rs.16 lakhs) and if Selling Price increases by 5% the NPV will increase by 70.1%(Rs.67.9Lakhs)over the base scenario respectively. IRR also shows similar trend as that of NPV. It increases to 64.2% and decreases to 33.6% if variable cost changes by 5%(negative and positive). Decrease in selling price by 5% decreases IRR from 47% to 27.5% and increases from 47% to 72.3% if selling price increased.

Capacity also shows similar trend as that of selling price but its effect on NPV and IRR is less compared to Selling price. It shows positive relation with NPV and IRR. If the Capacity decreases by 5% over the base scenario, the NPV decreases by 15.2% (Rs.33.8 lakhs) and IRR decreases to 41.2% from base value of 47%.
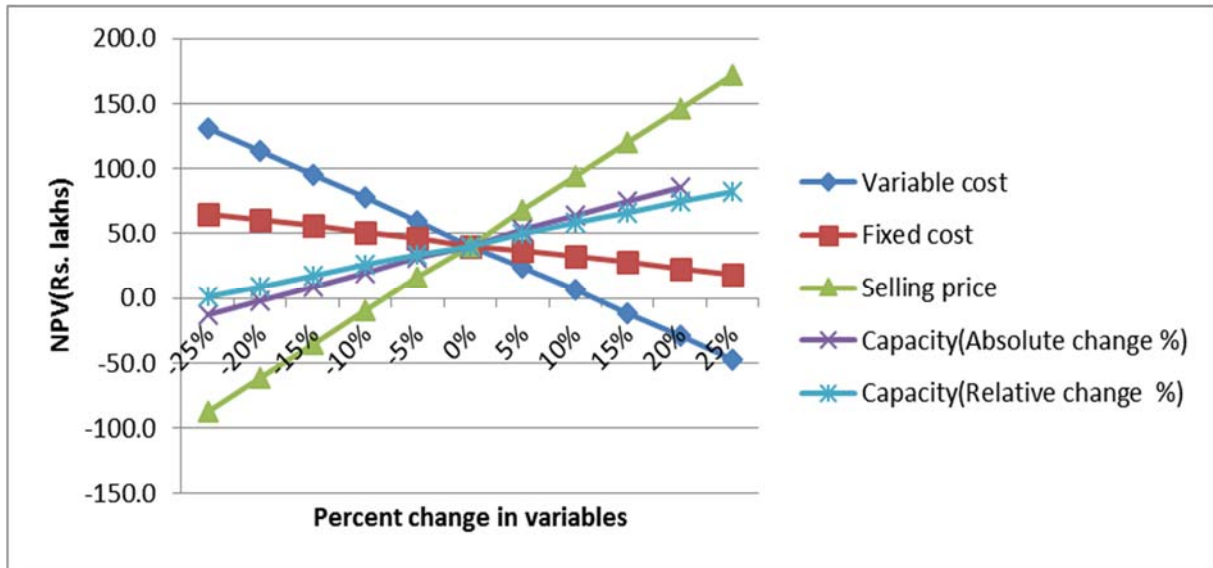
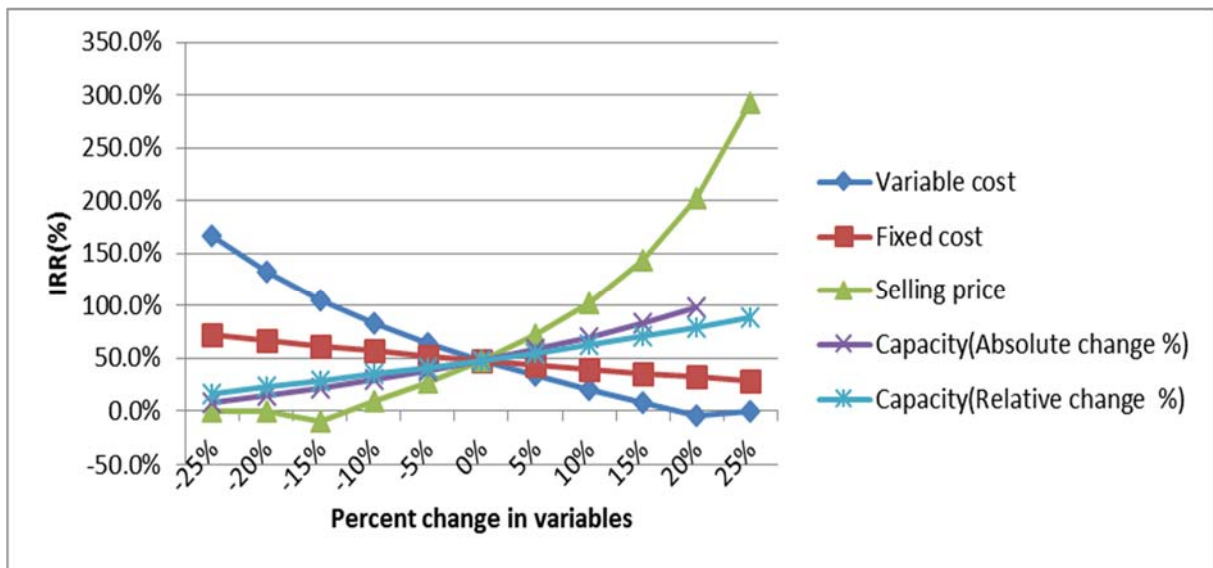**Fig1:** Sensitivity of NPV to the changes in variables

Fig2: Sensitivity of IRR to the changes in variables

Similarly if the Capacity increases by 5% over the base scenario, the NPV increases by 25.5% (Rs.50.1 lakhs) and IRR increases to 55.1% from base value of 47%.

We can conclude that in the present case the selling price cannot be reduced beyond 5% over the base scenario as NPV becomes negative beyond 5% reduction in selling price. Similarly variable cost can not be increased beyond 10% due to negative NPV(Rs.-11.5 lakhs) beyond 10% increase. In both the cases the investment turns out to be unviable or unprofitable. Sensitivity Analysis(fig 1&2) showed that Profits measured in terms of NPV and IRR(%) are more sensitive to variable cost and selling prices compared to capacity.

7.6. Scenario Analysis

Scenario Analysis was carried out by assuming different scenarios and its effects on profitability. In the base scenario sales is assumed to be 90% of its utilized capacity and sales grows @5% per annum. The base values are changed to obtain three scenarios and its effect on profits. For best case scenario the sales volume is assumed as 100% of its utilized

capacity which grows @10%. For most likely scenario sales volume is 80% with 7% growth and it is 60% sales with 2% growth for worst case scenario.

Since scenario analysis exhibit similar results (except estimates are different) across all units, only results for medium scale unit are presented in table 13and discussed

For medium units, the results showed that NPV increases by 224% (Rs.111.47 lakhs), 145.6% (Rs.72.46 lakhs) in best and most likely scenarios over the base scenario(Table13). But in case of worst scenario NPV decreases by 34.9%(Rs.17.37 lakhs). IRR increases from 29.54% to 49.06% and 37.1% in first two scenarios and decreases to 18.87% in third scenario. B-C ratio increases from 1.88 to 3.21, 2.44 in first two cases and decreases to 1.34 in worst scenario. Overall scenario analysis showed that if the sales volume decreases by 66% coupled with 40% decrease in sales growth the business becomes less profitable as indicated by lower NPV(Rs 17.37 lakhs), IRR (18.87%) and BC ratio (1.34).

Table 13: Scenario Analysis of chicken nuggets on medium scale unit

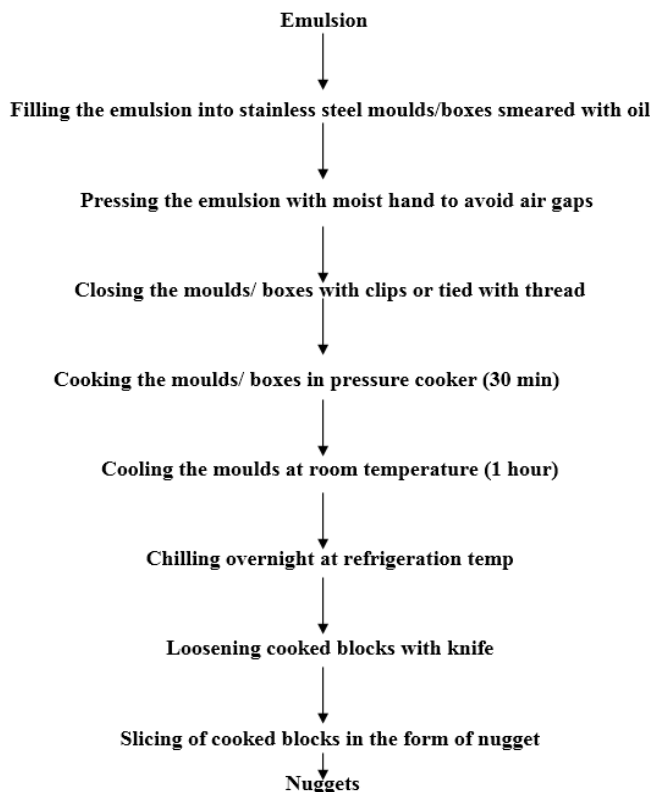| Result Cells	Sales	Scenario			
		Current	**Best**	**Most likely**	**Worst case**
		21870	24300	21870	14580
	Sale growth	5%	10%	7%	2%
	Price	390.41	426	408	390
Casflows 1	(Rs. Lakhs)	7.37	16.42	11.04	4.91
Casflows 2	(Rs. Lakhs)	11.22	21.55	15.27	7.48
Casflows 3	(Rs. Lakhs)	15.66	27.40	20.12	10.43
Casflows 4	(Rs. Lakhs)	20.75	34.08	25.66	13.82
Casflows 5	(Rs. Lakhs)	26.57	41.68	31.99	17.70
Casflows 6	(Rs. Lakhs)	25.34	38.39	29.90	16.89
Casflows 7	(Rs. Lakhs)	31.11	45.85	36.14	20.73
Casflows 8	(Rs. Lakhs)	45.34	61.96	50.88	32.77
NPV	(Rs. Lakhs)	49.76	111.47	72.46	17.37
IRR	(%)	29.54%	49.06%	37.10%	18.87%
BC ratio		1.99	3.21	2.44	1.34
Avg returns	(Rs. Lakhs)	22.92	35.92	27.62	15.59
PBP	yrs	6.22	13.93	9.06	2.17

Conclusions

In the present study economics of chicken nuggets was investigated. Three types of processing units were compared for profitability, viability. Production data was taken from studies of NRCM and analysed using economic criteria like NPV, IRR, BC ratio, Breakeven analysis.

- The total project outlay has been estimated at Rs.15.18, 53.33 and 75.32 lakhs for small, medium and large units respectively.
- The results revealed that for nuggets, the highest share(58.48%) in total cost was constituted by meat which is main raw material, and it was followed by labour costs(13.54%) and depreciation(8.11%). So, there is a need to take corrective policy, management measures to keep the raw material prices as low as possible. The results revealed that the cost of production was higher(Rs.364.61/kg) in the case of small units followed by medium (Rs.354.9/kg) and large units(Rs.306.48/kg) resulting in higher profits on large units which reflected the economies of scale.
- Based on ratio analysis performed, average gross profit margin, operating profit margin, profit margin and net profit were found to be 25.17%, 15.99%, 13.64% and 12.42% respectively.
- Gross and Operating Profit margin of 25.17% and 15.99% indicates that the direct costs incurred in the production of nuggets accounts for 74.83% and operating expenses including administrative expenses and direct costs account for 84.01% of the profits. Interest and taxes incurred by the project which accounts for 2.35%, 1.22% of profits. All the profitability ratios show an increasing trend over the years.
- Risk measured in terms of Liquidity ratios is found to be at the accepted levels and goes on decreasing over time resulting in increased surplus during successive years.
- To sum up, ratio analysis revealed that all the processing units is profitable and financially viable. Overall, the processing plants under study showed satisfactory performance on account of liquidity, profitability, investment.

- According to the discounting criteria the processing plants under study turned out to be economically viable projects with NPV of Rs.46.65 lakhs and IRR of 51.3%, BC ratio of 1.83 and payback period of 2.71years. The plant generates average returns of Rs.19.43 lakhs per year.
- The results of the feasibility analysis showed that the NPV,IRR,BC and Payback periods were quite acceptable for all the categories of the units which clearly indicate the financial worthiness of chicken nuggets production.
- Under base scenario, according to the NPV criteria the processing plants under study turned out to be economically viable projects. The positive NPV (Table 10) implied that the discounted worth of benefits was greater than disconnected worth of cost steams. Benefit cost ratio being greater than unity(1.52,1.75,2.23)reaffirmed that processing plant is viable and on average the plant will give a return of 1.52,1.75, 2.23 with average of Rs.1.83on every rupee investment
- Break Even Analysis showed that margin of safety increases in successive years and it shows positive relation with capacity resulting in higher profits on large units. BEP Attainment of BEP at lesser time (Table 11) at higher levels of capacity utilization indicates that the plant is financially feasible.
- Sensitivity analysis showed that variable cost, and selling price have more influence on profitability of processing units. Any changes beyond 5%(decrease) for selling price and 10%(increase) for variable cost have the capacity to turns the investment unviable or unprofitable.

To conclude, production of chicken nuggets is profitable irrespective of the size of the processing units. But capital intensive nature of the business poses limitations for commercialization of these technologies. This calls for evolving policy measures by the planners to promote the processing units on large scale.

Annexure-I
Process Flow of Emulsion Nuggets

Emulsion

↓

Filling the emulsion into stainless steel moulds/boxes smeared with oil

↓

Pressing the emulsion with moist hand to avoid air gaps

↓

Closing the moulds/ boxes with clips or tied with thread

↓

Cooking the moulds/ boxes in pressure cooker (30 min)

↓

Cooling the moulds at room temperature (1 hour)

↓

Chilling overnight at refrigeration temp

↓

Loosening cooked blocks with knife

↓

Slicing of cooked blocks in the form of nugget

↓

Nuggets

Annexure-II
Composition of ingredients for Emulsion

S. No	Ingredients	Percentage Composition		
		Prime	Choice	Economy
1	Deboned Chicken Meat	67	57	47
2	Chicken Fat	13	8	
3	SGH		15	15
4	Bottle Guard			5
5	Cabbage			5
6	Cooked Potato			5
7	Whole Egg Liquid			5
8	Maida	3	3	3
9	Spice mixture	1.5	1.5	1.5
10	Condiments	3.5	3.5	3.5
11	Ice flakes	9.7	9.7	7.6
12	Polyphosphates	0.3	0.3	0.4
13	Salt	1.7	1.7	1.7
14	Sugar	0.3	0.3	0.3
15	Sodium nitrite	0.01	0.01	0.01
	Total	100	100	100

Annexure-III
Composition of Spice mixture

S. No	Ingredients	Grams per litre of water
1	Anise(soant)	10
2	Black Pepper(kali mirch)	5
3	Capsicum(Mirch)	10
4	Caraway(Ajwain)	10
5	Cardamom(Elaichi)	4
6	Cinnamon(Dalchini)	4
7	Cloves(Laung)	2
8	Corriander(Dhania)	15
9	Cumin(Zeera)	20
10	Dry ginger(Sont)	10
11	Turmeric(Haldi)	10
	Total	100

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