© 2015 IJSRSET | Volume 1 | Issue 6 | Print ISSN : 2395-1990 | Online ISSN : 2394-4099
Themed Section: Science and Technology

Enrobing Technology : Potential Means To Value Addition In Cured Meat Products

K. Varalakshmi
*Scientist, National Research Centre on Meat, Hyderabad, India

ABSTRACT

The economic analysis of value-addition to cured meat through enrobing technology was studied on three types of processing units. The data on input use and output yields were collected form NRCM and Comparative economics were worked out for cooked cuts alone and cooked cuts combined with enrobing. High capital investment (Rs.51.4lakhs) has been found in enrobed cuts than cooked cuts (Rs.41.42 lakhs) indicating capital intensive nature of enrobing technology. Cost of production per kg was found to be highest (Rs.411.04) for enrobed cuts compared to cooked cuts (Rs.346.44).Cost of enrobing and price premiums were worked out to beRs.64.63/kg and Rs 71.1/kg. Value-addition was highest on the large units indicating economies of scale. All the discounting measures showed highest feasibility for enrobed cuts with NPV of Rs.86.76 lakhs, IRR of 86%, BC ratio of 2.43.Payback period was estimated as 2.04 years with annual returns of Rs. 28.16 lakhs. The results showed economic potential and worthiness of combining curing and enrobing technology for the production of enrobed cuts.

Keywords: Enrobing Technology; Value Addition; Chicken Cuts; Feasibility; Processing; Cooked Cuts.

I. INTRODUCTION

Meat is a rich source of high quality protein, containing all essential amino acids and highly bio available minerals and vitamins. Meat is rich in Vitamin B12 and iron which are not readily available in vegetarian diets (www.fao.org). Meat is regarded as an excellent dietary source of vitamins (Boyle, 1994), protein and energy (Lawrie, 1981). In spite of the numerous benefits of dietary meat it is highly perishable due to its high moisture and protein contents which can be utilized by micro-organisms (Hotchkiss and Potter, 1995). Poultry meat provides high quality protein compared to other meats. The protein is an excellent source of essential amino acids. Poultry meat is good source of iron, copper, phosphorous, zinc, vitamin B12 and B6.Meat from chicken provides high quality protein that is low in fat(National agricultural institute, 2014).

India is largest producer of meat with production of producing 5.94 millon tons of meat in the year 2012-13. India is the third largest egg producer and fifth largest poultry-meat producer in the world (Mitra and Bose 2005). By 2003, India was producing 1.6 million tons of poultry - meat, which had risen to 2.0 million tons by 2006 (Hellin and Erenstein 2009), and now stands at 2.2 million tons per annum (www.dahd.nic.in). Poultry meat production in India is second only to China in Asia at present, whereas the annual growth rate over 2003-12 is third after South Asian neighbors Nepal and Pakistan. By 2030, it is expected to reach about 3.0 million tons per annum (Joshi and Kumar2012).

Keeping in view importance of meat in human diet, economy and importance to preserve, many technologies have been developed in meat processing sector and have been evaluated for their technical soundness and acceptability. These technologies include emulsion meat technology, cured, smoked meat technology, restructured and dried meat technologies (NRCM, 2013). But little work has been done on the evaluation of technologies from economic perspectives. Cured product technology is not an excemption. Further it is established by researchers that further processed products can be developed from cured products by enrobing process called enrobed products which have been proved to be helpful in improving nutritional qualities and consumers acceptability and thus posing superiority over cooked cuts (NRCM, 2011). But its worthiness has not been quantified / proved in terms of quantum of value addition, economic benefits and feasibility of investment of processing units for commercial scale production.

Worthiness and acceptability of any technology lies in its economic benefits. Hence, technologies have to weighted against their economic potential. Keeping in view importance of economics evaluation of technologies, the present study has been taken to evaluate the enrobing process in comparison to cooked process.

Enrobing is the process of making "further processed products" by applying edible coating to the products. It includes three distinct steps i.e pre-dusting, battering and breading. Enrobing brings several advantages to meat products such as value addition, improvement in nutritional qualities as well as eating qualities of the products. Enrobing improves texture of the product remarkably increasing consumers acceptability. It also contributes to reducing moisture loss, improving juiciness, tenderness (NRCM 2011).

Enrobing adds value addition to the chicken cuts compared to cooked cuts and brings profits to the producers. But at the same time it adds additional costs on account of additional steps involved in enrobing process compared to cooked cuts. This additional costs and benefits have to be quantified in order to assess the value addition and economic worthiness of integrating curing process with enrobing to judge the superiority of enrobing technology.

Hence an attempt has been made in this paper to evaluate the feasibility of combining curing with enrobing from an economic point of view. The potential advantages and disadvantages of this integrated method are analysed and discussed.

II. METHODS AND MATERIAL

For the purpose of estimating economics of value addition comparison was made between cured cuts with and without enrobing process. In without case chicken cuts were cured and cooked which are called cooked cuts. In "with enrobing process" cooked cuts are subjected to further processing through enrobing process. Here Chicken cuts were cured, cooked and then enrobed and fried. i.e two additional steps are involved in enrobing of cured cuts. With inclusion of two more steps to cooked cuts enrobed products will be prepared (NRCM, 2011). Comparison was made between Cooked cuts and enrobed cuts with regard to costs, returns and feasibility to evaluate the superiority of enrobing process. Comparison was also made among the three processing units i.e small, medium and large units to estimate magnitude of value addition on different units.

For achieving the objectives of the study the required 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 value addition of enrobing process. 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.

Production process of enrobed products: flow chart of preparation of Enrobed cuts is presented in Annexure-1 and ingredients for enrobing (curing, battering& breading) are depicted in Annexure-II, III, IV (NRCM, 2011).

III. RESULTS AND DISCUSSION

Table 1 presents the product mix and initial and final weight of the individual cuts and raw material processed per day for different units for both the products. All the estimates corresponding to individual cuts in the successive tables refers to one piece of final cuts.

3.1. Capacity of Processing Plant

3.1.1. Installed Capacity

Installed Capacity of the plant is assumed as 30,150 and 400kg/day for small, medium and large units respectively. Product yield of 108% and 129% were taken for cooked and enrobed cuts respectively. Considering 300 working days in a year and yield of the products, the small, medium and large units will have

the annual installed capacity of products as presented in table 2. At 100% capacity annual output of enrobed cuts was 11610, 58050 and 154800kg on small, medium and large units respectively.

Table1: Product mix and product yield of cooked and enrobed cuts

S.No	Enrobed cuts	Product mix(%)	Initial Wt (grams)		Final wt(grams)				Raw material(Kg/day)		
					Enrobed cuts		Cooked cuts				
			Whole	One	Whole	One	Whole	One	Small	Medium	Large
			1000		1290		1080				
1	Breast	33.33	500	250	645	322.5	540.0	270	10.00	50.00	133.33
2	Thigh	16.67	250	125	322.5	161.2	270.0	135	5.00	25.00	66.67
3	Drumstick	13.33	200	100	258	129	216.0	108	4.00	20.00	53.33
4	Drummet	6.00	90	45	116.1	58.05	97.2	48.6	1.80	9.00	24.00
5	Back	21.33	320	160	412.8	206.4	345.6	172.8	6.40	32.00	85.33
6	Neck	3.33	50	25	64.5	32.25	54.0	27	1.00	5.00	13.33
7	Wing	6.00	90	45	116.1	58.05	97.2	48.6	1.80	9.00	24.00
	Total	100	1500	750	1935	967.5	1620	810	30	150	400

3.1.2. Capacity utilization

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 3rd year onwards respectively(table3). The results for costs and prices presented in the following section corresponds to 60% capacity utilization in first year.

3.2. Capital Investment

Minimum of Rs. 44.42 lakhs is required for setting up of cooked products (Table4) unit with maximum range of Rs.76.83 lakhs. For enrobed products investment ranges from Rs.14.07 lakhs to Rs.87.96 lakhs with average of Rs.51 .4 lakhs. Investment pattern among the products showed that enrobed products need highest investment for all types of processing units reflecting capital intensive nature of business as more no of machinary, buildings are required to convert cooked cuts to enrobing cuts as more processing steps are involved compared to cooked cuts products.

Table 2: Annual output of products on different categories of processing plants (Kg/yr)

S.No	Enrobed cuts	Final Product(kg/yr)@100% capacity					
		Enrobed cuts			Cooked cuts		
		Small	Medium	Large	Small	Medium	Large
1	Breast	3870	19350	51600	3240	16200	43200
2	Thigh	1935	9675	25800	1620	8100	21600
3	Drumstick	1548	7740	20640	1296	6480	17280
4	Drummet	697	3483	9288	583	2916	7776
5	Back	2477	12384	33024	2074	10368	27648
6	Neck	387	1935	5160	324	1620	4320
7	Wing	697	3483	9288	583	2916	7776
	Total	**11610**	**58050**	**154800**	**9720**	**48600**	**129600**

Table 3: Annual Capacity /capacity utilization for processing plant

Year	1	2	3	4	5	6	7	8
Capacity Utilisation	60%	70%	80%	80%	80%	80%	80%	80%
Enrobed cuts								
Small	6966	8127	9288	9288	9288	9288	9288	9288
Medium	34830	40635	46440	46440	46440	46440	46440	46440
Large	92880	108360	123840	123840	123840	123840	123840	123840

Cooked cuts								
Small	5832	6804	7776	7776	7776	7776	7776	7776
Medium	29160	34020	38880	38880	38880	38880	38880	38880
Large	77760	90720	103680	103680	103680	103680	103680	103680

Reverse is the case with per unit investment where enrobed products showed lower investment per kg of product. This can be attributed to higher yields due to enrobing process which reduces per unit cost and thus exhibits economies of scale. Overall investment pattern of processing units showed that machinery and equipment was the major item of cost contributing to 43.98%& 41.57% share followed by Buildings (19.72%,21.13%) for enrobed and cooked cuts respectively. (not reported here).The differences in capital requirements for the production of the same quantity of chicken cuts without enrobing process result from capital expenditure on equipment for enrobing process(i.e battering, breading etc) and processing building required for additional operations in enrobing process like enrobing and frying of cuts etc. In case of variable costs difference comes from additional expenditure on additional raw materials for enrobing and labour etc.

3.3. Economics

3.3.1. Cost structure

The information regarding annual and per unit estimates of variable costs, fixed costs and total costs (in the first year) in preparation of cooked and enrobed products has been depicted in Table5-8.

Table 4 : Project cost of processing plants for cooked and enrobed products

Product	**Small**		**Medium**		**Large**		**Overall**	
	13.15	135.29	43.27	89.03	76.83	59.28	44.42	70.91
Enrobed	14.07	121.19	52.16	89.85	87.96	56.82	51.40	68.69

Total- Rs.lakhs & Per kg - Rs

Variable costs: It is clear from variable costs reported in table5 that on an average per unit variable costs comes to Rs.288.02/kg and Rs. 355.26 /kg for cooked and enrobed cuts respectively. It varies with size of the plant and also type of product and also size of unit. It varies from Rs.135.29 /kg for small units to Rs.59.28/kg for large units for cooked cuts and from Rs.121.19 to 56.82/kg for enrobed cuts.

Table 5 : Variable costs on different processing plants for two types of processing methods(Rs. /kg&Rs)

	Enrobed cuts				**Cooked cuts**			
	Small	**Medium**	**Large**	**Overall**	**Small**	**Medium**	**Large**	**Overall**
Description	361.48	357.21	347.1	355.26	293.48	289.68	280.9	288.02
Cuts(Rs/cut)								
Breast	108.45	115.20	104.13	109.26	88.05	86.91	84.27	86.41
Thigh	54.22	57.60	52.07	54.63	44.02	43.45	42.14	43.20
Drumstick	43.38	46.08	41.65	43.70	35.22	34.76	33.71	34.56
Drummet	19.52	20.74	18.74	19.67	15.85	15.64	15.17	15.55
Back	69.41	73.73	66.64	69.93	56.35	55.62	53.93	55.30
Neck	10.84	11.52	10.41	10.92	8.80	8.69	8.43	8.64
Wing	19.52	20.74	18.74	19.67	15.85	15.64	15.17	15.55

Among the products, it was highest for enrobed products across all size groups due to additional cost of raw material. Further per unit variable cost decreases along with capacity showing economies of scale for both products with highest magnitude reported by enrobed products. Among the variable costs raw material cost accounts for major share of 84.68% followed by labour(not reported here).

Further comparison of products shows that raw material share is higher for enrobed cuts(84.68%) than cooked cuts(77.18%).

Fixed costs: Regarding fixed costs cooked cuts shows minimum of Rs. 58.42 /kg whereas enrobed cuts shows minimum Rs.55.8s /kg lakhs. Fixed costs shows different picture from variable costs. While variable costs were highest for enrobed cuts fixed costs were highest for cooked cuts. These lowest fixed costs for enrobed cuts (Rs.64.81,60.18 and 42.43/kg) was due to higher yields of enrobing process which spreads the costs among more units of output. Among the fixed costs depreciation was the major item of costs accounting for 31.85% of fixed costs for overall category for enrobed cuts with its share ranging from 27.2 (large units)to 36.7%(small units). (not reported here).

Table 6: Fixed costs on different processing plants for two types of processing methods(Rs. /kg&Rs)

	Enrobed cuts				Cooked cuts			
	Small	Medium	Large	Overall	Small	Medium	Large	Overall
Chicken cuts	64.81	60.18	42.43	55.81	69.67	61.9	43.68	58.42
Cuts(Rs/cut)								
Breast	19.44	19.41	12.73	17.19	20.90	18.57	13.10	17.52
Thigh	9.72	9.70	6.37	8.60	10.45	9.29	6.55	8.76
Drumstick	7.78	7.76	5.09	6.88	8.36	7.43	5.24	7.01
Drummet	3.50	3.49	2.29	3.09	3.76	3.34	2.36	3.15
Back	12.44	12.42	8.15	11.00	13.38	11.89	8.39	11.22
Neck	1.94	1.94	1.27	1.72	2.09	1.86	1.31	1.75
Wing	3.50	3.49	2.29	3.09	3.76	3.34	2.36	3.15

Total costs/cost of production : Total cost structure indicated that among different units small units incurs more costs(Rs.426.3&363.13/kg) compared to large units(Rs.389.53&324.58/kg) for both cooked and enrobed products. This high cost was due to high fixed costs associated with low capacity of small units compared to other types of units. However annual total cost shows different picture showing positive relation with capacity. Among the products enrobed cuts showed highest cost of production for all units due to higher variable cost associated with enrobing process though fixed cost was low. It can be concluded from the cost structure that the annual variable, fixed and total costs shows positive relation with the capacity but per unit variable, fixed and total costs shows negative relation with the capacity for both products. Further it is evident that all the costs(per kg) 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.

Table7: Total Cost of production of chicken cuts on different processing plants for two types of processing methods(Rs/kg&Rs)

Chicken cuts	Enrobed cuts				Cooked cuts			
	Small	Medium	Large	Overall	Small	Medium	Large	Overall
	426.3	417.39	389.53	411.07	363.15	351.59	324.58	346.44
Cuts(Rs/cut)								
Breast	127.8	134	116.8	126.20	108.9	105.4	97.38	103.89
Thigh	63.95	67.31	58.43	63.23	54.47	52.74	48.69	51.97
Drumstick	51.16	53.84	46.74	50.58	43.58	42.19	38.95	41.57
Drummet	23.02	24.23	21.03	22.76	19.61	18.99	17.53	18.71
Back	81.85	86.15	74.79	80.93	69.73	67.51	62.32	66.52
Neck	12.79	13.46	11.69	12.65	10.89	10.55	9.74	10.39
Wing	23.02	24.23	21.03	22.76	19.61	18.99	17.53	18.71

Further comparison among products showed that enrobed products registered highest variable costs whereas cooked cuts showed highest fixed costs but total costs were highest for enrobed cuts as low fixed cost effect is offset by the highest impact of variable costs.

On an average Processing cost of one piece of breast half, thigh, drumstick, drummet, wings comes to Rs.103.89, 51.97,41.57,18.71 & 18.71 respectively for cooked cuts. In case of enrobed cuts, processing cost of individual cuts comes to Rs.126.2, 63.23, 50.58,22.76 &22.76 for one piece of breast half, thigh, drumstick, drummet, wings respectively.

From table 8 it is evident that on an average variable and fixed costs accounted for 83.14% and 16.86% of total cost of production for cooked cuts whereas for enrobed cuts these figures were estimated as 86.42% and 13.58%. This showed that variable costs were higher for enrobed cuts while fixed costs were higher for cooked cuts.

3.3.2. Revenue structure

Selling prices

Table 9 presents the estimated selling prices for chicken cuts in two processes at 10% markup. On an average selling price comes to Rs. 381.08, 452.18/kg, for cooked and enrobed cuts. Selling prices ranges between Rs.399.47 to Rs. 357.04/kg for cooked cuts and this range for enrobed cuts is Rs.468.93 to 428.48/kg. One piece of cooked breast half, thigh, drumstick, drummet, wings were priced at Rs.114.28, 57.16, 45.73, 20.58 & 20.58 respectively. The corresponding figures for enrobed cuts were Rs.138.82,69.55,55.64,25.04&25.04. Similar to costs selling price also shows highest estimates for enrobed cuts compared to cooked cuts. In accordance with costs selling prices also decrease along with size with same markup (this low selling price of large units gives scope for further increasing markup price to get same level of prices of small units which gives higher returns on large units.

Table 8: Share of variable and fixed costs in total costs of meat products (%)

	Cooked cuts		Enrobed cuts	
	Variable	Fixed	Variable	Fixed
Chicken cuts	83.14	16.86	86.42	13.58
Breast	83.17	16.87	86.58	13.62
Thigh	83.14	16.86	86.40	13.60
Drumstick	83.14	16.86	86.40	13.60
Drummet	83.13	16.85	86.41	13.59
Back	83.13	16.87	86.40	13.60
Neck	83.13	16.87	86.37	13.57
Wing	83.13	16.85	86.41	13.59

Table 9: Selling prices of cooked cuts on different processing plants(Rs. /kg&Rs)

Chicken cuts	Cooked cuts				Enrobed cuts			
	Small	Medium	Large	Overall	Small	Medium	Large	Overall
	399.47	386.75	357.04	381.08	468.93	459.13	428.48	452.18
Cuts(Rs/cut)								
Breast	119.79	115.94	107.12	114.28	140.58	147.40	128.48	138.82
Thigh	59.92	58.01	53.56	57.16	70.35	74.04	64.27	69.55
Drumstick	47.94	46.41	42.85	45.73	56.28	59.22	51.41	55.64
Drummet	21.57	20.89	19.28	20.58	25.32	26.65	23.13	25.04
Back	76.70	74.26	68.55	73.17	90.04	94.77	82.27	89.02
Neck	11.98	11.61	10.71	11.43	14.07	14.81	12.86	13.91
Wing	21.57	20.89	19.28	20.58	25.32	26.65	23.13	25.04

3.3.3. Cost of enrobing and value addition

Cost of enrobing

Due to additional cost involved in enrobing process cost of production increases for enrobed cuts compared to cooked cuts. On an average Enrobing process to the cooked cuts increases cost by Rs.64.63/kgwith maximum of Rs.65.8/kg (medium units) and minimum of 63.15 /kg (small units).

Value addition or Premium

Similar to cost of production prices also show differences among the cooked cuts and enrobed cuts. Due to additional cost involved in enrobing process the cost and subsequent selling price increases for enrobed cuts compared to cooked cuts. Similar to additional costs, enrobing process also adds additional prices which are called value addition or premium for enrobing process. Due to enrobing

process, value addition reflected in terms of premium was estimated as Rs.69.47, 72.38& 71.45/kg, for small , medium and large units respectively. On an average enrobing process adds additional premium of Rs.71.1/kg. For individual cuts this premium comes to Rs. 24.54, 12.39,9.91, 4.46&4.46 for One piece of cooked breast half, thigh, drumstick, drummet, wings.

3.4. Investment Analysis

Investment analysis was carried out to evaluate comparative feasibility of investment in enrobed products using discounted cashflows, Ratio analysis, Feasibility measures etc. results of feasibility analysis are discussed below

Table 10 : Cost of enrobing and value addition on different processing plants(Rs. /kg&Rs)

Chicken cuts	Cost of enrobing				Price premiums			
	Small	Medium	Large	Overall	Small	Medium	Large	Overall
	63.15	65.80	64.95	64.63	69.47	72.38	71.45	71.10
Cuts(Rs/cut)								
Breast	18.90	28.60	19.42	22.31	20.79	31.46	21.36	24.54
Thigh	9.48	14.57	9.74	11.26	10.43	16.03	10.71	12.39
Drumstick	7.58	11.65	7.79	9.01	8.34	12.82	8.57	9.91
Drummet	3.41	5.24	3.50	4.05	3.75	5.76	3.85	4.46
Back	12.12	18.64	12.47	14.41	13.33	20.50	13.72	15.85
Neck	1.90	2.91	1.95	2.25	2.09	3.20	2.15	2.48
Wing	3.41	5.24	3.50	4.05	3.75	5.76	3.85	4.46

3.4.1. Ratio Analysis

On the basis of the projected cashflow statement different financial ratios were calculated and shown in table11. Profitability ratios(Table11) indicate that on overall basis, cooked cuts generates Gross profit margin of 21.53% and Operating Profit margin of 14.01% and net profit margin of 10.87%. Corresponding figures for enrobed cuts were 18.66%,13.11%&10.3%. 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 4.52, 1.16& 5.2,1.16 for cooked and enrobed cuts respectively. These ratios shows that the processing plant is able to meet its obligations on long term liabilities. Analysis of investment ratios shows that on an average meat plant is able to generate enough returns of 36.69%, 146.77% & 42.72, 170.87 returns on total investment and equity respectively for cooked and enrobed cuts.

Table11 : Ratio analysis for enrobed and cooked cuts on different processing plants

Financial feasibility Ratio	Cooked cuts				Enrobed cuts			
	Small	Medium	Large	Overall	Small	Medium	Large	Overall
Profitability ratios								
Gross profit margin(%)	21.35	24.00	19.24	21.53	18.23	20.80	16.95	18.66
Operating Profit margin (%)	15.73	13.84	12.45	14.01	14.14	13.23	11.96	13.11
Profit margin %	13.49	11.88	10.80	12.06	12.25	11.61	10.62	11.49
Net Profit margin (%)	12.38	10.64	9.60	10.87	11.13	10.36	9.40	10.30
Investment ratios								
Return on Total investment(%)	28.24	35.56	46.28	36.69	33.26	40.65	54.25	42.72
Return on Equity(%)	112.97	142.22	185.12	146.77	133.03	162.58	216.99	170.87
Investment turnover ratio	3.88	2.96	2.23	3.02	3.21	2.57	1.89	2.56
Liquidity ratios								
Debt Equity Ratio	1.17	1.15	1.15	1.16	1.17	1.15	1.15	1.16
Debt to Capital Turn over	29.25	28.86	28.84	28.98	29.33	28.73	28.72	28.93
Debt Service Coverage Ratio	3.67	4.48	5.4	4.52	4.14	5.04	6.41	5.20
Operating ratio	84.27	86.16	87.55	85.99	85.86	86.77	88.04	86.89

To sum up, the financial viability indicators revealed that all the processing units of cooked and enrobed are products financially viable. Overall, the processing plants under study showed satisfactory

performance on account of liquidity, profitability, investment for all products. Low estimates for enrobed cuts shows the scope for increasing margins by increasing selling price with higher markup percentage.

3.4.2. Economic feasibility

In the present study, economic feasibility of the integrating cooking with enrobing method was analysed using discounted measures such as NPV, BCR, IRR and Pay Back period as well as by comparison with similar analysis of the cook only alternative. The investment appraisal was prepared on the basis of the planned initial investment and expected cash flows for a 8year period discounted at bank rate of 12%.

A high IRR of 86% is indicated for the enrobing method and a net present value (NPV) of Rs.86.76 lakhs over a 8-year period, discounting at a 12% discount rate (Table 12). Also, the payback of this project is achieved in 2.04 years. The investment appraisal indicates economic advantage for enrobing process rather than a only cooked method with IRR of 86% (i.e. over 31% higher). NPV was also in favour of enrobing method.

Table 12: Comparative statement of Economic Feasibility measures

S.No	Feasibility measures	Cooked cuts				Enrobed cuts			
		Small	Medium	Large	Overall	Small	Medium	Large	Overall
1	NPV(Discounted) (Rs. Lakhs)	9.35	46.43	118.40	58.06	13.35	70.04	176.90	86.76
2	IRR(%)	44%	62%	90%	65%	55%	77%	125%	86%
3	BC	1.71	2.07	2.54	2.11	1.95	2.34	3.01	2.43
4	Average Returns(undiscounted)	4.66	18.39	39.83	20.96	5.64	24.98	53.85	28.16
5	Pay Back Period (Yrs)	2.82	2.35	1.92	2.36	2.48	2.00	1.63	2.04
6	Average Returns(Discounted)	1.16	5.80	14.81	7.26	1.66	8.75	22.11	10.84
7	DSCR	3.66	4.47	5.40	4.51	4.14	5.04	6.40	5.19

IV. CONCLUSION

This study investigated potential returns from value addition through an integrated method of producing chicken cuts with enrobing technology. Comparative economics were worked out for cooked cuts alone and cooked cuts combined with enrobing. Following conclusions emerge from the study

- Total costs (variable, fixed and total costs) shows positive relation with size whereas per unit costs showed different picture. They showed negative relation with size reflecting economies of scale. This is evident for both products.
- The value addition reflected in terms of price differential or premium was highest on large units shows increasing trend with capacity reflecting worthiness of large units and economies of scale.
- With the inclusion of two more steps in enrobing value of cooked cuts will be increased to Rs69.47, 72.38 and 71.45 /kg on small, medium and large units with average value of Rs. 71.1/kg.
- Economies of scale were reflected by opposite trends of annual and per unit costs (variable, fixed and total costs) for both the products.
- Among the products enrobed cuts showed highest total costs due to highest variable costs though fixed cost was low.
- The results showed marginal returns in without enrobing process. However, the alternative method (enrobing) showed the possibility of better returns from the integration. Thus there appears to be economic potential for combining curing and enrobing processes for the production of enrobed cuts.
- Difference was observed between the financial performance of the enrobing process and that of similar units producing cooked cuts only, the IRR being slightly in favour of the enrobing method with the NPV at 12% discount rate being marginally higher for the enrobing method. With fairly large and potentially changes in the sale price, the enrobing method could become economically superior.
- All the discounting measures showed higher estimates (NPV of Rs.86.76 lakhs, 86% IRR, BCR of 2.43, DSCR of 5.19) for enrobed cuts compared to cooked cuts showing worthiness of enrobing process compared to cooked method.

The study indicated that incorporation of enrobing in the production of chicken cuts has the potential to provide more financial benefits than cooked cuts. Since enrobing technology is more capital intensive as reflected by capital investment and working capital that limits the commercial production of enrobed products, financial support in the form of easy credit availability, subsidy could help in reaping the benefits of value addition of enrobing technology.

V. REFERENCES

[1] http://www.fao.org/ag/againfo/themes/en/meat/backgr_composition.html

[2] Boyle E. 1994. The nutritive value of meat. Dept. of Animal science and industry, Kansas State University, U.S.A.

[3] Hotchkiss, H.J. and Potter, N.J. 1995. Heat preservation and processing. Food science, 5th Edn. New York, pp: 261-265.

[4] National Agricultural Institute 2014. Just The Facts Introduction to Nutrition systems science, USA. p. 91

[5] Mitra, S. and D. Bose. 2005. Supply chain issues in the Indian poultry-meat industry: the case of a vertically-integrated farm. Working Paper Series No. 575. Indian Institute of Management.

[6] Hellin, J. and Erenstein, O. 2009. Maize-poultry value chains in India: implications for research and development. Journal of New Seeds 10(4): 245-263.

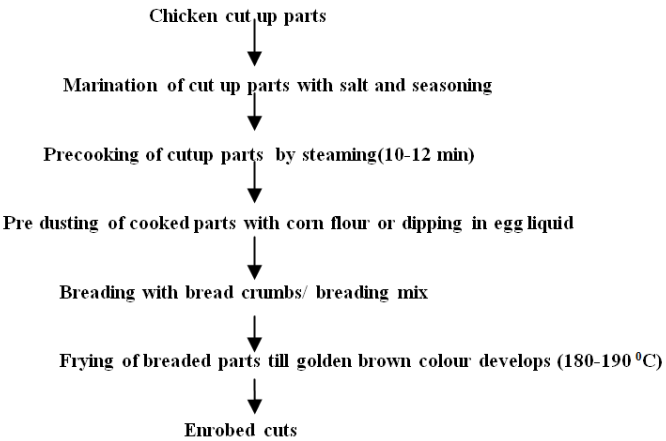
[7] www.dahd.nic.in

[8] Joshi, P.K. and Kumar, P. 2012. Trade, Agricultural Policies and Structural Changes in India's Agrifood System: Implications for national and global markets. TAPSIM Report Summary. Food Demand and Supply Projections for India: 2010-2030. Project Reference. 212617.

[9] NRC on Meat (2013), "Value added meat processing technology", In : NRCM (Ed.). Towards organized meat sector development : Technologies and Success stories. pp.4-8.

[10] NRC on Meat (2011), "Enrobed or coated chicken products", In : NRC on Meat (Ed.), Value Added Chicken Products: An Enterpreneur Guide, Hind Publications. (pp.63-67)

Annexure-I
Process Flow of Enrobed cuts



Annexure-II

Formulation for 1 litre Curing / brine Solution

S.No	Ingredients	Grams per litre of water
1	Common Salt	65
2	Sugar	25
3	Sodium Nitrite	0.5
4	Sodium Ascorbate	1-2
5	Sodium tripoly phosphate	10

Source: NRCM, 2011

Annexure-III

Composition of ingredients for Battering mix

S.No	Ingredient	%	Grams/kg
1	Corn flour	20	200
2	Wheat flour	20	200
3	Rice flour	20	200
4	Besan	20	200
5	Rusk	16.5	165
6	Salt	1.7	17
7	Spice Mix	1.8	18
	Total	**100**	**1000**

Source: NRCM, 2011

Annexure-IV

Composition of ingredients for Breading mix

S.No	Ingredient	%	Grams/kg
1	Rusk powder	30	300
2	Cornflakes	37	370
3	Sugi	20	200
4	Til	10	10
5	Salt	1.5	1.5
6	Spice Mix	1.5	1.5
	Total	**100**	**1000**

Source: NRCM, 2011