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A study on techno-economic feasibility for production of brown rice based extruded snacks

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Abstract
The main objective of this analysis was to study on Techno-Economic Feasibility for Production of Extruded Snacks prepared by brown rice, water chestnut and safed musli powder. In order to determine the techno-economic feasibility three economic parameters i.e. break even quantity, break even sales and break even period were analysed. In break even analysis it was found that in order to produce 15, 00,000 units of 20 g packets of ready to eat extruded snacks of blended flour consisting of blend of Brown rice: Water chestnut flour: Safed Musli Powder in the blend ratio of 80:15:05 with identified infrastructure the break even quantity was 86,93,976 units, the break even sales was Rs. 52163855.42/- and break even period came out to be 46.37 months or approx 4 years. This analysis helps in commercial production of extruded snacks.

Keywords: Break even analysis, extrusion, brown rice

1. Introduction
In modern food industry today extrusion processing becomes very important procedure. Extrusion technology has become famous technique for preparing ready to eat extruded snacks due to its low cost, versatility and no process effluents [1, 2]. There are number of extruded snacks are available in market. The material/ energy and money required for production considerably bags a high cost, so it is necessary to optimize the technical and economic feasibility of extrusion cooking [3]. The aim of this research paper is to analyze the economic feasibility of the extrusion cooking technology. Extruded snacks were prepared by blending of brown rice, water chestnut flour and safed musli powder. Brown rice is wealth of nutrients that are contained in the bran layer. It is rich in dietary fibre, minerals oils, and vitamins, particularly thiamine [4]. The main purpose of break-even analysis is to determine the minimum output that must be exceeded for a business to profit. It also is a rough indicator of the earnings impact of a marketing activity. A firm can analyze ideal output levels to be knowledgeable on the amount of sales and revenue that would meet and surpass the break-even point. If a business doesn't meet this level, it often becomes difficult to continue operation. The break-even point is one of the simplest, yet least-used analytical tools. Identifying a break-even point helps provide a dynamic view of the relationships between sales, costs, and profits. This is very important for financial analysis. Any sales made past the breakeven point can be considered profit (after all initial costs have been paid). Break-even analysis can also provide data that can be useful to the marketing department of a business as well, as it provides financial goals that the business can pass on to marketers so they can try to increase sales. Break-even analysis can also help businesses see where they could re-structure or cut costs for optimum results. This may help the business become more effective and achieve higher returns. In many cases, if an entrepreneurial venture is seeking to get off of the ground and enter into a market it is advised that they formulate a break-even analysis to suggest to potential financial backers that the business has the potential to be viable and at what points. Thus the aim of this analysis was to assess the break even point for commercial production of extrudates.

2. Methodology
The raw material used for production of extruded snacks were brown rice, water chestnut and safed musli powder in blend ratio of 80:15: 05. various unit operations were performed during preparation of extrudates i.e. grinding, drying, conditioning, extrusion-cooking, spicing and packaging etc. In order to determine the techno-economic feasibility of production of extruded

product of brown rice, water chestnut and safed musli powder three economic parameters i.e. break even quantity, break even sales, break even period were calculated as follows (Azam et. al. 2016):

Break even quantity = $\frac{Total\ Fixed\ cost}{Cost\ of\ per\ pack - variable\ cost\ per\ pack}$

Break even sales = $\frac{\text{Total fixed cost}}{\text{cost of per pack} - \text{variable cost per pack}} \times$ cost of per pack

Break Even Period = $\frac{\text{Break even sales}}{\text{Total number of units produced}}$

3. Result and discussion

3.1 Break Even Analysis: Cost analysis for preparation of ready to eat extruded snacks from the identified best blended Brown rice flour, Water chestnut flour and Safed Musli powder.

In calculating the breakeven point certain assumptions were which are listed below. The selling cost of one unit of 20 gram was fixed as Rs. 6/- because at present the similar products are available at retail price of Rs. 10/- and their selling price at factory retail outlet is Rs. 6/-.

A.	**Fixed Cost:**	
1.	**Cost of machines and equipments:**	
S. No.	Machine/Equipment	Cost in Rupees
i.	Food Extruder with accessories	21,00,000.00
ii.	Hammer Mill	25,000.00
iii.	Burr Grinder	42,000.00
Iv	Spice flavor coating drum (capacity 10-15 kg per 10 min)	90,000.00
v.	Automatic Pouch Packaging Machine (3 no. @ Rs. 12,00,000.00 each)	36,00,000.00
vi.	Weighing Balance	26,000.00
vii.	Moisture Tester	50,000.00
viii.	Furniture	28,000.00
ix.	Containers for raw materials and finished products	35,000.00
x.	Crates	20,000.00
Total		**60,16,000.00**
2.	**Cost of land and Building:**	
S. No.	Item	Cost in Rupees
i.	Land area 600 sq. ft. (300+300 Sq. ft.) @ Rs. 500 per sq. ft.	3,00,000.00
ii.	Construction cost @ Rs. 1500 per sq. ft.	9,00,000.00
Total		12,00,000.00
Total Fixed Cost		60,16,000.00+12,00,000.00
		= 72,16,000.00
	Assumptions:	
	Useful life of machines	*= 10 years*
	Useful life of building	*= 20 years*
	Salvage Value	*= 10% of Initial cost*
	Rate of interest	*= 12% p.a.*
3.	Depreciation of machines per year	$= \frac{\text{FC of machines} - \text{Salvage value})}{\text{Useful life of machines}}$
	Salvage Value	= FC of machines – 10% of FC of Machines
		= (60,16,000-6,01,600)/10 = 5,41,440.00
4.	Cost of land and building per year	= (12,00,000.00)/20 = 60,000.00
5.	Fixed cost per year	= 60,000.00 + 5,41,440.00 = 6,01,440.00
6.	Interest @ 12% per year	= (6,01,440.00x 12)/100 = 72,172.80
7.	Total Fixed Cost	= 6,01,440.00+ 72,172.80 = 6,73,612.80 per year
B.	**Variable Cost:**	
S.No.	**Items**	**Cost in Rupees**
1.	Labour Charges:	37,000.00/- per month
	i. Manager/ Supervisor 1 no. @ Rs. 20000/- p.m.	
	ii. Operator @ Rs. 10,000/- p.m.	
	iii. Helper @ Rs. 5,000/- p.m.	
	iv. Watchman @ Rs. 2,000/- p.m.	
2.	Electricity charges for 500 kWh in a month 7/- per kwh	35,000.00 p.m.
3.	Raw Materials required per month:	45,50,000.00
	i. Brown rice (26,000 kg x 0.80 part x @ Rs. 100/- per kg.) = 20,80,000.00	
	ii. Water chestnut flour (26,000 x 0.15 part x @ Rs. 300/- per kg.) = 11,70,000.00	
	iii. Safed Musli Powder (26,000 kg x 0.05 part x @ 1000/- per kg.) = 13,00,000.00	
4	Spices @ 2% @ Rs. 400 per kg.	2,08,000.00
5	Packaging material @ 0.25 per pcs. (13,00,000.00 x.25)	3,25,000.00
6	Repair and maintenance @ 10% of machine cost	6,01,600.00
7	Insurance charges @ 10% of TFC	67361.28
Total		58,23,961.28

3.1.1 The cost of production

Assumptions:		
Capacity	=	100 kg raw materials per h
Operating time	=	10 h/day
Working days	=	26 days in a month
Total installed capacity of unit	=	30,000kg (in terms of kg of materials)
Size of one unit	=	20 g
Total number of units p.m.	=	30000 x 1000/20
	=	15,00,000 units
Assuming the unit to operate at 75% of installed capacity		
Therefore total number of units produced p.m. is	=	11,25,000=00
Cost of one unit	=	Rs. 6/- per unit
Variable per unit	=	Total variable cost / units produced p.m. 58,23,961.28/11,25,000
	=	Rs. 5.17
Break even quantity	=	$\frac{7216000}{(6-5.17)}$
	=	86,93,976 units of 20 g each
Break even sales	=	$\frac{\text{Total fixed cost}}{\text{cost of per pack} - \text{variable cost per pack}} \times \text{cost of per pack}$
	=	$\frac{7216000}{(6-5.17)}$ X 6
	=	Rs. 52163855.42/-
Break Even Period	=	$\frac{\text{Break even sales}}{\text{Total number of units produced p.m.}}$
	=	$\frac{52163855.42}{1125000}$
	=	46.37 months
	=	3.86 years
	=	Approx 4 years

4. Conclusion

The result of cost analysis is tabulated as follows:		
S. No.	**Item**	**Values Rupees**
1.	Fixed Cost	Rs. 72,16,000.00/-
2.	Variable Cost	Rs. 5823961.28/-
3.	Variable cost per pack of 20 g	Rs. 5.17/-
4.	Break even quantity	86,93,976 units of 20g each
5.	Break even sales.	Rs. 52163855.42/-
6.	Break even period	4 years

Therefore, from the break even analysis it was found that in order to produce 15, 00,000 units of 20 g packets of ready to eat extruded snacks of blended flour consisting of blend of Brown rice: Water chestnut flour: Safed Musli Powder in the blend ratio of 80:15:05 with identified infrastructure the break even quantity is 86, 93, 976 units, the break even sales is Rs. 52163855.42/- and break even period comes out to be 46.37 months or approx 4 years.

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