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ECONOMICS OF VALUE ADDITION IN TOMATO

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ABSTRACT
Post-harvest losses during the peak season of tomato production reduce its profitability and availability. Processing tomato into value added products could minimize loss experienced. The study evaluated costs and returns in small scale processing of tomato into tomato dry slices, powder, whole peel and puree. Data was compiled during the training of 200 youth and women on tomato value added products and analyzed using the profitability indicators such as Benefit to Cost Ratio (BCR) and Rate of Return on Investment (ROI). The Highest cost of ₦250, 180 was incurred when 1 tonne of fresh tomato was processed into whole peel tomato; the least production cost per tonne of processed tomato was incurred with tomato puree (₦138,780). The most profit, ₦549,820/tonne of fresh tomato processed, was for whole peel tomato, followed by tomato puree (₦161,220) and the least profit of ₦64,310/tonne from dry tomato slices. Processing tomato into dry slices, powder, whole peel and puree had BCRs of 1.38, 1.08, 3.19 and 2.16. The rate of return on investment of 0.38, 0.8, 2.19 and 1.16 was obtained for tomato dry slices, powder, whole peel and puree indicating profitability of the enterprises. Processing tomato into value added products is profitable, reduces post-harvest losses and may improve stakeholders' income and livelihood.

Keywords: *Tomato, benefit to cost ratio, net profit, return on investment, value-added*

INTRODUCTION

Tomato is highly perishable in the fresh state and lost after harvest due to inadequate processing, packaging and storage facilities (Arah *et al*, 2015). Almost 50 per cent of tomato produced in Nigeria is lost due to poor storage system, poor processing and inadequate transportation in the tomato value chain (Omomia, 2016). Nigeria currently produces 2.3 million metric tonnes against 1.8 million tonnes produced two years ago while the national demand is three million metric tonnes (NIHORT annual report, 2019). In 2016 and 2017, Nigeria imported tomato paste estimated at USD360m annually (PWC, 2018). However, one of the sustainable development agenda is to reduce postharvest losses to 12.3% by 2030 (Niewiara, 2016). Prevention of losses and wastage is of major interest due to subsequent imbalance in supply and demand at the harvesting off-season (Purkayastha *et al*, 2013).

Processed tomatoes serve as an alternative method of tomato preservation and ensure tomato products are available for consumption all year round (PWC, 2018). Tomatoes and tomato products are rich in health-related food components as they are good sources of carotenoids (in particular, lycopene), ascorbic acid, vitamin E, folate and total phenolic compounds (Raul *et al*, 2016). According to Omomia (2016), demand for processed tomatoes is on the rise from both end-consumers as well as manufacturers. Tomato in Nigeria has been processed into several products such as the tomato dry slices, puree but there is inadequate information on the cost and returns of such investment. There is a need to estimate cost and return to promote investment opportunities in the commodity value chain. Furthermore, most empirical studies on Tomato in Nigeria focused on the economics of production and marketing of fresh tomatoes. Examples of studies on economics of production include those of Katanga *et al* (2018) and Ayoola (2018) in Kano, Kogi and Benue State. Shehu and Salman (2017) and Obayelu *et al* (2014) studied the economics of tomato marketing in Lagos State and Kwara states respectively. Past studies on tomato processing emphasized evaluation of drying methods. Hussein *et al*, (2016) evaluated drying methods on the contents of some bio- actives ((lycopene, β-carotene and ascorbic acid) of tomato slices. Surender *et al*, (2018) evaluated the effect of drying on quality characteristics of dried tomato powder while Catalano *et al*, (2013) evaluated experimental System and Tests to Optimize a Tomato Drying Process. None

evaluated economic implications of processing tomato into varied products. The financial implication of processed products may stimulate interest in tomato value-added products and improve participation in the processing chain. The study examined the cost and returns of processing tomato into products to determine enterprise viability.

MATERIALS AND METHODS

The study was conducted at the National Horticultural Research Institute in 2020. Two hundred stakeholders (200), in groups of 5, were trained on tomato value addition to reduce post-harvest loss. The production of value added products tomato dry slices, powder, whole peeled tomato, the puree was demonstrated. Tomato variety UC82 B was purchased from the local market during the peak season and cost/kg calculated. Knives, pots, glass jars, gas burners, sieves, and bowls were purchased and are necessary equipment in the processing (UNIDO, 2004).

Dehydration was with a locally fabricated solar-gas hybrid dryer. Tomatoes were sorted, washed, pulped, concentrated (concentration was achieved by cooking with low heat for 100- 120 minutes until the desired consistency was reached. Concentration was done to evaporate the liquid to obtain a thick pulp), placed in sterilized glass jars which were corked, and pasteurized to develop puree. Other tomatoes were dipped in boiling water for 2 min for removal of the skin and placed into sterilized glass jars, 2.5 milliliters of lemon juice was added as a preservative before corking. The glass jars were pasteurized, resulting in the whole peel tomato product (Cancela, 2015).

For dried products, tomatoes were blanched after sorting, sliced (5 mm thickness) and dried in the fabricated solar-gas hybrid dryer at 55^0C- 65^0C for 12 h. Dried slices were cooled and then packed in low-density poly ethylene bags, labelled and kept in boxes in the dark. To produce tomato powder, dried, sliced, fruit were milled, placed into polyethylene bags and sealed (CTA Practical Guide Series, NO. 12, (2007).

The price of products was determined through a survey of willingness to pay and pricing among trainees including the cost of production. Fully riped, firm, tomatoes were used for all products. For the economic analysis, data were collected on the variable input materials requirement, labour, and depreciation estimated for fixed inputs. Budgetary analysis and profitability indicators were employed to determine the profitability of products. The profit indicators: Benefit to Cost Ratio (ratio of total revenue to total cost), Rate of Return on Investment (the ratio of net profit to the total cost incurred in the processing) were used.

RESULTS AND DISCUSSION

Drying tomato can extend the shelf life of tomatoes and may improve the accessibility of tomatoes to consumers (PLAN, 2017). The cost, returns and profitability indicators of tomato processed into dry tomato slices is presented in Table 1. Processing of 1,000kg of fresh tomato is capable of generating 70kg of dry tomato slices. The variable inputs in the production are fresh tomato, gas, packaging materials and label. Other include labour that will be utilized in washing, slicing and spreading of the tomato in the drier. Depreciation value was calculated for fixed items such as industrial sealing machine, oven and other items such as knives, bowls utilized in the processing. The estimated cost and revenue in the processing of 1 tonne fresh tomato into dry slices were N169, 000 and N233, 310/ton respectively. The net profit was N64, 310/tonne while the rate of return to investment was 0.38 with Benefit to cost ratio of 1.38. The benefit to cost ratio of 1.38 implied that for every one naira spent on the enterprise, N1.38k will be realized while the rate of return on investment of 0.38 indicated that every naira invested in the processing of tomato into dry tomato slices returned N0.380k as profit. The profit level obtained showed the profitability of processing tomato into dry slices. Processing tomato especially during the peak season of production will go a long way in reducing the losses and glut experienced in the fourth and first quarter of the year. The processed product shall improve the availability of tomato during the lean season and may reduce cost being spent on importation of tomato paste. Similar to the findings of this study, Modi *et al* (2017) also

reported profitability of tomato dry slices in India. They reported a profit of Rs341.27 per kg of tomato dry slices produced.

Tomato powder is one of the high value-added product from tomato. The total cost incurred in processing 1 ton of fresh tomato into powder was N181,296/ton while total revenue of N326,666/ton was estimated. The net profit of N145,370 was obtained in the processing of tomato into powder. Rate of return on investment of 0.80 while the benefit to cost ratio was 1.80. The benefit to cost ratio of 1.8 indicated that for every N1 invested in the business, N1.8 will be realized. The return per naira invested was 0.8k indicating that the enterprise is profitable (Table 2).

Total cost and revenue incurred in processing fresh tomato into whole peel were N250,180 and N800, 000/ton respectively. The net profit obtained in processing fresh tomato into whole peel tomato was N549,820. The Benefit to cost ratio obtained was 3.19 while the rate of return on investment was 2.19. The benefit to cost ratio of 3.19 showed that for every naira invested 3.19 will be realized while Rate of return on investment of 2.19 indicated that for every naira invested returned 2.19 as profit. This showed that processing tomato into whole peel product is profitable and worthwhile investing.

Tomato puree is another value added product that can be produced from fresh tomato. The total estimated cost and return in processing fresh Tomato into puree are N138,780/tonne and N300,000/tonne respectively. The Benefit to cost ratio was 2.2 while the rate of return on investment on tomato puree production was 1.2. The benefit to cost ratio of 2.2 showed that for every naira invested N2.2 will be realized while the rate of return on investment of 1.2 showed that every naira invested returned N1.2 as profit indicating profitability of the venture. Kuruba *et al,* 2017 also indicated profitability of tomato sauce production in India, they indicated that every rupee invested in the business yielded 1.14 rupees. Additionally, Moresi and Liverotti (1982) reported profitability of 22% and 16% in tomato paste production in the EEC countries.

CONCLUSION RECOMMENDATION

Succinctly, tomato processing into value added products are profitable and will go a long way in bridging supply and demand gap most especially in the lean season of tomato production. However, whole peel tomato had the highest ROI (2.19) compared to the other value added products. But consumer preference must be taken into consideration in the determination of value added products to promote.

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Table 1: Enterprise budget for dry tomato slices.

Item	Amount (₦)	% of total cost
Variable cost		
Fresh tomato (1 tonne)	60,000	35.5
Cooking gas	61,920	36.6
Packaging materials	3,000	1.8
Label	18,000	10.7
Labor for washing, slicing, spreading in the drier, packaging	15,000	8.9
Fixed cost		
Total depreciation (equipment such as industrial sealing machine, dryer, bowls, knives, sieve)	11,080	6.6
Total cost	169,000	100
Revenue		
Revenue 1000 kg fresh tomato produces 70 kg dry tomato slices @ ₦3,333/kg	233,310	
Net profit	64,310	
BCR	1.38	
ROI (NP/TC)	0.38	

Authors' compilation 2020.

BCR is Benefit to Cost Ratio is the ratio of total revenue to total cost. It shows viability of an enterprise. Values above 1 indicate viability of the enterprise while value that is equal to one is the breakeven point.

ROI = Return on Investment, the ratio of net profit (NP) to total cost (TC). It indicates the net return for a ₦1 investment.

Table 2: Enterprise budget for Tomato powder.

Item	Amount (₦)	% of total cost
Variable cost		
Fresh tomato (1 tonne)	60,000	33.1
Labor for washing, slicing, spreading in the drier, milling, packaging	30,000	16.5
Cooking gas	61,920	34.2
Packaging materials	2,340	1.3
Label	14,040	7.7
Fixed cost		
Total Depreciation (equipment such as milling machine, industrial sealing machine, electric dryer, bowls, knives, sieve)	12,996	7.2
Total cost	181,296	100
Revenue		
Revenue 1000 kg of fresh tomato will produce 70kg of tomato powder @ ₦4,666/kg	326,666	
Profit	145,370	
ROI	1.80	
BCR	0.8	

Authors' compilation 2020

Table 3: Enterprise budget for stored whole peel tomato

Item	Amount (₦)	% of Total cost
Variable cost		
Fresh tomato (1 tonne)	60,000	24.0
Cost of glass jar	128,000	51.2
Labor for washing, blanching, filling, pasteurizing,	37,500	15.0
Cooking gas	15,480	6.2
Label @N6/one	3,000	1.2
Fixed cost		
Total Depreciation (equipment such as burners, bowls, knives, stainless sieve, pot)	6,200	2.5
Total cost	250,180	100
Revenue		
Revenue	800,000	
1000kg of fresh tomato will give 800 kg of whole peel tomato @ ₦ N1,000/kg		
Profit	549,820	
BCR	3.19	
ROI	2.19	

Authors' compilation 2020

Table 4: Enterprise budget for Tomato Puree

Item	Amount (₦)	% of total cost
Variable cost		
Fresh tomato (1 tonne)	60,000	43.2
Labor for washing, draining, milling, concentrating, filling into bottles	37,500	27.0
Cost of glass jar	12,000	8.6
Cooking gas (60kg)	15,480	11.2
Label @N6/one	1,800	1.3
Fixed cost		
	12,000	8.6
Total Depreciation (equipment such as burner, milling machine, bowls, knives, stainless sieve)		
Total cost	138,780	100
Revenue		
Revenue (1000kg fresh tomato gives 150kg tomato puree) @ ₦ 2,000/kg	300,000	
Profit	161,220	
BCR	2.2	
ROI	1.2	

Authors' compilation 2020