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Research Article

EVALUATION OF PALM FRUITS PROCESSING IN ACCELERATING RURAL DEVELOPMENT IN UMUAGWO, OHAJI EGBEMA L.G.A, IMO STATE, NIGERIA

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ABSTRACT

Palm fruits processing is an age-long agricultural activity in Imo State especially in rural areas such as Umuagwo in Ohaji egbema Local government area (L.G.A), Imo State. There have been some documented researches an the profitability of the palm fruits processing enterprise, but little or nothing had been recorded on the use of the profits accruing from the enterprise. This research was carried out to ascertain the extent agricultural benefits from palm fruits processing has improved the study area. The study area is Umuagwo in Ohaji Egbema L.G.A, Imo State. Primary and secondary sources of date were used. A total of 60 respondents were sampled for the study and well structured questionnaire served as instrument of data collection which bothered on age and experience of the processors, sources of palm fruits, costs of palm fruits processing and the benefits or profitability which was estimated with gross margin analysis. The constraints of palm fruits processing was determined with the use of regression analysis (OLS). The result revealed that experience of the processors had direct relationship with age and most of the processors (30%) sourced their palm fruits from their own plantation and through purchase of fresh bunch of palm fruits. The gross margin per 100 fresh bunches processed was N50, 500 and net margin was N10, 890. Some of the positive and significant determinants of palm fruits processing were quantity of palm fruits processed, cost of processing and processing experience. High cost of palm fruits, poor feeder roads, fluctuation in prices and electricity supply were major constraints to palm fruits processing. The profits from the enterprise were used in market development, construction of village hall, renovation of schools, churches and equipment of rural clinic. The study concludes that palm fruits processing is profitable and benefitable in rural development in the study area. It recommends that processors should form cooperative associations to pool their resources together and establish palm plantations for palm fruits as well as buy in large scale to reduce costs of palm fruits and cost of processing marketing.

INTRODUCTION

The African oil palm *(Elaeis guineensis)* is a tropical plant which belongs to the family *Arecaceae.* It was stated that oil palm originated from the humid tropics of West Africa (Poku, 2002) and cultivated extensively or found growing wild in grooves as over 1.67million hecters of land are cultivated by small holder farmers across the area (Carrier), 2011; Osugiri *et al*., 2006 and Oluseguaji, 2008).

The plant has been domesticated and spread to other parts of Africa and Asia by European explorers who discovered it in the late 14th century (Sridler and Ade-oluwa, 2009 and Ibitoye *et al.*, 2011). It is regarded as one of the most viable and profitable perennial oil crops in Africa and Southeast Asia and no part of the crop is a waste (Komolafe & Joy, 1990; Soyebo *et al.*, 2005 Osugiri *et al.,* 2007 and Onwubuya *et al.,* 2012). It is regrettable that despite the usefulness and economic benefits of the oil palm, its cultivation, production and processing is dwindling in the tropics especially Nigeria. It has been reported that Nigeria which used to be the highest producers of palm oil (Mathew, 2009) is now a net importer, ranking 5th in the world and Malaysia that collected their first palm seedling from Nigeria is now the world's largest producer and exporter of palm oil (Brown and Jacobson, 2005, Ayodele, 2010). Nevertheless, there is yet untapped potentials for massive production of palm oil in Nigeria, especially in the Southeast,

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the study area. This assertion is incontrovertible when viewed at the resilience of some small holder oil palm processors in the rural areas in Imo State (southeast Nigeria), particularly at Ohaji Egbema L.GA where this was conducted, and the proceeds from palm fruits processing were used for rural development.

Development generally, is concerned with enhanced ability to shape one's life (Sen, 1999). In rural development, it is a transformation of society, a movement from traditional ways of thinking, production etc. to modern or advanced methods. This requires total transformation of all aspects of living, otherwise known as multidimensional development (Servaes, 1999 and Madu 2003a).

In addition, the essence of rural development is the improvement of the spatial and socioeconomic environment of rural space which culminates to the enhancement of individual's ability to care for or sustain a healthy living. Rural development possess a challenge because it involves people (with diverse opinion/ability) and natural resources (often in rudimentary stage) with particular focus on the people. Rural area in this context refers to settlements with less than five thousand people with low population density and agricultural related activities dominate their sources of income. One of such activities is palm fruits processing.

Palm oil from palm fruits processing is a very important oil of socio-economic importance in Nigeria, most especially in the Igbo culture. Traditional method of palm oil processing is not only tedious and inefficient, but also time consuming and low in palm oil quality and quantity. There has also been expressed concern by various agencies, particularly Nigeria Institute for Oil Palm Research (NIFOR) on the need to improve the processing techniques associated with palm fruit processing. In Nigeria, oil palm is indigenous to the coastal plain, having migrated inland as a staple crop. For millions of Nigerians, oil palm cultivation is part of the way of life –indeed it is part of their culture. However, during the past decades, the country has become a net importer of palm oil, while in the early 1960's, Nigeria's palm oil production accounted for 43% of the world production, nowadays it only accounts for 7% of total global output. In Nigeria, 80% of production comes from dispersed smallholders who harvest these palm fruits and use manual processing techniques, many oil palm producers inherited abandoned government plantations which were sub-divided and leased to private producers. Everything seems to point at the possible expansion of oil palm plantations in Nigeria- revitalizing old ones and establishing new ones- both aimed at meeting the demand of the national and international market. This study aims at identifying how to assist oil palm processors to encourage mass production of palm oil, provide them with modern machines to improve productivity and extension agents who will put the farmers through on-the-technical know-how of these improved machines if made available. Improved methods of processing would increase production of palm oil and processors revenue to facilitate rural development.

MATERIALS AND METHODS

The study was conducted at Umuagwo, located in Ohaji local government area, Imo state. Umuagwo is a town in the Ohaji Egbema local government area of Imo state in Nigeria. Ohaji Egbema lies in the south western part of Imo state and shares common boundaries with owerri in the east, Oguta in the north and Ogba/Egbema/Ndomi in Rivers state in the south west. It covers an area of approximately 958.010 sq/km, and has an estimated population of 800,904 (NPC, 2006).

Ohaji Egbema local government area comprises of three (3) districts namely: Ohaji East, Egbema North, and Ohaji West. There are 12 council wards. The local government has sixteen (16) autonomous communities namely: Egbema, Umuagwo, Oloshi, Umunwaku, Obile, Obitti, Mgbirichi/Abakuru, Opuoma, Assa, Awarra, Ikwerede, Umuokanne, Obiakpu, Ohuba, Obosima, and Mmahu. In Umuagwo community, there are 8 villages which include: Umuelu-Umuagwo, Umukene-Umuagwo, Umuezewere-Umuagwo, Okohia-Umuagwo, Etuohia-Umuagwo, Umuogbani-Umuagwo, Umuduko-Umuagwo and Umuogbuanua-Umuagwo.

The inhabitants of Umuagwo community are mainly farmers especially palm fruit processors. Their interest was due to their endowment with a suitable soil for growth of palm trees.
Umuagwo was selected from Ohaji Egbema L.G.A. both primary and secondary sources of data were used for the study. Primary data were collected through oral interviews and the use of structured questionnaires designed to obtain information relating to the socio-economic characteristics of the processors, volume of palm oil processed, purpose of engaging into palm fruit processing, the processing technologies used and their achievements from the processing of palm fruits. The secondary data were collected from journals, textbooks, previous projects, internet, and publications.

Descriptive statistics such as the mean, mode, charts, percentage and frequency distribution table were used for the analyses. Gross margin analysis was used to determine the difference between total revenue and total variable cost (Odii, 1998). It is specified as follows:

Gross Margin (GM) = Total Revenue (TR) – Total Variable Cost (TVC)

Net margin analysis was used to determine the net return. It measured the difference between the total processing cost and the total returns from the sales of palm oil per 100 FFB (Fresh fruit bunches). It is specified as follows:

Net margin= Total Revenue (TR) – Total Cost (TC)
Where: Total Cost (TC) = Total Fixed Cost (TFC) + Total Variable Cost (TVC)

The multiple linear regression models are specified as follows:
Linear Function $Q= b_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4 X_4 +-- n_7 + e$
Exponential Function: $\text{Log } Q= b_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4 X_4 +-- n_7 + e$
Semi-Log Function: $Q= b_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 +-- n_7 + e$
Double-Log Function: $\text{Log } Q= b_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 +-- n_7 + e$
Where:

Q = Output (liters for one month)
X_1 = Sex (using dummy variable; 1=male, 0=female)
X_2 = Age (years)
X_3= Labor (man/day)
X_4= Quantity of palm fruits (kg/ton)
X_5 = Processing experience (years)

X_6 = Processing technologies (using dummy variable; 1=manual, 0=mechanical)
X_7 = Processing cost (naira)
b_0 = Constant term
e = Error term
B1-β7 = Coefficients estimated.

Relationship between the age of processors and processing experience

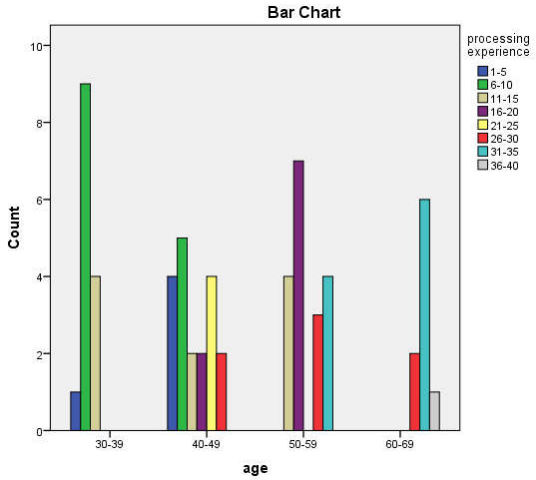

Fig 1 Clustered bar chart showing the relationship between the level of processing experience and age of respondents

Source: field survey data, 2016.

The clustered bar chart shows the relationship between the level of processing experience and age of processors. From the chart above, processors within the age range (30-39) has a higher count (frequency of 9) and a processing experience of 6-10 years, 1-5 years, and 11-15 years. This implies that average processors within the age range (30-39) have enjoyed working in this enterprise for a shorter number of years, and they constitute the working population (independent population) in the study area. Processors within the age range of 60-69 worked for a longer period in the palm fruit processing enterprise and have enjoyed more profit and benefits.

Sources of Processors Palm Fruits in Processing

Table 2 Percntage Distribution of Respondents According to Their Sources of Palm Fruits

Sources of palm fruits	Frequency	Percentage
buying fruit bunches	15	25.0
owned farms	3	5.0
buying and lease	6	10.0
buying and owned farms	18	30.0
lease and owned farms	5	8.3
buying, lease and owned farms	7	11.7
lease and buying	6	10.0
Total	60	100.0

Source: Field survey data, 2016.

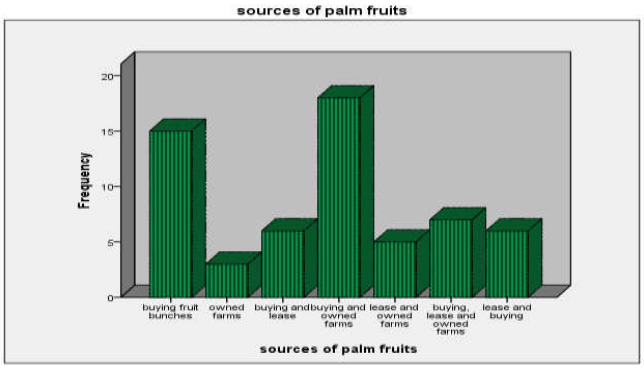

Fig 2 Bar chart showing the processors' sources of palm fruits

Source: Field Survey Data, 2016

Table 2: showed that 25 percent of the palm fruit processors bought every palm fruit bunch used in processing and palm oil production. 5 percent of the processors have their personal oil palm plantation from which they harvest and then use the palm fruit bunches gotten for processing in their private mills. 20 percent of the processors bought and leased palm fruit bunches at the same time to increase the quantity of palm fruits needed for processing. Majority of the processors of about 30 percent buys the palm fruits and had their oil palm plantations (owned farms) where they source the palm fruits used in palm oil production. This implies that majority of the processors acquired land either through inheritance or communal land to grow oil palm trees in order to add up to the quantity bought. 8.3 percent of the processors sourced their palm fruits from leased farms and owned farms. 11.7 percent of the processors buys palm fruit bunches, from leased farms and their own farms at the same time. This was mostly practiced by processors who adopted mechanical processing technology to have enough quantity available for processing and to also have increased output (more liters of palm oil).

Profitability of Palm Fruit Processing

Table 3 Job description in a small-scale palm oil mill and its varying cost per 100 bunches

S/N	Job description	Rates in Naira(₦)	Cost of production for 100 bunches (₦)
I	Offloading from truck	70 per bunch	7000
II	Slicing	10 per bunch	1000
III	Threshing	20 per bunch	2000
IV	Filtration/ sieving	20 per bunch	2000
V	Boiling	500 per pot	1000
VI	Digestion/ pressing	300 per press	1200
VII	Separation of fiber per press	300 per press	1200
VIII	Re-milling/re-pressing	100 per press	400
	Total		**15,800**

Source: Field survey data, 2016.

The total cost of processing 100 FFB (Fresh fruit bunches) and its cost per processing activity is presented in Table 4. It shows the various kinds of activity that took place in the processing of palm fruits to palm oil and their respective wages per 100 bunches in a small-scale oil processing mill.

Table 4 Cost and returns in a palm oil processing for 100 fresh fruit bunches (FFB).

Items	Rate	Price (₦) per quantity	Amount (₦)
Palm oil	5 rubbers (25 litres each)	9,500	47,500
Palm kernel	2 heaps	1500	3,000
Total Revenue			50,500
Variable cost			
Transportation cost of palm fruits	100 bunches	200 per bunch	20,000
Labor cost	100 bunches	Price varies at each stage of processing	15,800
Other expenses (diesel cost)	8 litres of diesel	230 per litre	1,840
Total variable cost			37,640
Fixed cost			
Depreciation on fixed assets	One month		1,970
Total fixed asset			1,970
Total cost (TFC+ TVC)			39,610
Net Margin			10,890

Source: Field survey data, 2016.

Table 4. showed that the income generated from the 100 FFB was 50,500 naira. The cost of processing 100 FFB into palm oil is 39,610 naira, out of which 20,000 naira was used to purchase palm fruits, 15,800 naira was spent on labor and 1,840 naira was spent on diesel, while the total fixed cost which was 1,970 naira is the value on depreciation of fixed assets. The high cost of palm fruit bunches is an indication of insufficient oil palm plantation in the study area despite being a major oil palm producing area in Imo state, Nigeria. Though, most of the palm fruit processors do not have their own oil palm plantation. However, the gross income was 50,500 naira, while the net return was 10,890. According to Ibitoye and Onje (2013), a positive gross margin shows that oil palm processing is profitable and the business can recover its variable cost in the short run.

Table 5 Profitability of Palm Oil processing

Model	Computations	Ratios
Benefit-Cost Ratio	TR/TC	1.27
Rate of Return	Net Return/TC	0.27
Gross Ratio	FC/TC	0.78

Source: Field survey data, 2016.

The profitability analysis of small-scale oil palm processor is presented in Table 5. The benefit-cost ratio is 1.27, the rate of return is 0.27, and the gross ratio is 0.78. The benefit-cost ratio is high (1.27), this shows an increase in returns, indicating that the processing enterprise is profitable and feasible. This means that the BCR can be increased by increasing capital, increasing the use of improved technology (mechanical method of processing) (Olagunju, 2008). The net return varies in palm fruit processing (revenue and cost) due to maintenance of equipment and depreciation of assets which is a causal factor in cost (Simeh, 2002). The profit margin of a processing mill is dependent on the processing variables (Simeh, 2002; Oladipo, 2008; Orewa *et al*.., 2009), the quantity of palm fruits on a bunch processed (Orewa *et al*., 2009) and the ripeness of the FFB at the time of harvest and processing (Ilechie *et al*., 1986).

Factor Affecting the Productivity of Palm Fruits Processing in a Small-Scale Processing Mill

Profitability of palm fruits processing is expected to be influenced by several factors. This section examines the socio-economic factors that influenced the profitability of palm fruits processing and its effect on rural development. This section also determines the testing of the f-statistics.

Table 6 Factors affecting the productivity of palm fruits processing

Explanatory Variables	Linear function (L)	Exponential Function	Semi-log function	Double-log function
Constant	143.517	2.48989	-4450.99	0.08876
Sex (X_1)	-71.2983 (-1.66645)	-0.03360 (-0.92935)	-101.8316 (-2.15987)**	-0.05127 (-1.48314)
Age (X_2)	-1.6115 (-0.9265)	-0.0029 (-1.9818)***	-1.82288 (-0.0085)	-0.2138 (-1.3599)
Labour (X_3)	2.4634 (0.4845)	0.0047 (1.0402)	74.0118 (0.7044)	0.0967 (1.25447)
Quantity of palm fruits (X_4)	0.6238 (3.8726)*	0.0004 (2.92607)*	914.187 (3.1956)*	0.6314 (3.0099)*
Processing Experience (X_5)	4.5479 (2.2742)**	0.0039 (2.309)**	182.462 (2.2959)**	0.1481 (2.5413)**
Processing Technology (X_6)	12.1647 (0.2363)	0.0345 (0.79361)	-8.2477 (-0.1415)	0.0031 (0.0723)
Processing Cost (X_7)	0.00075 (1.76625)***	0.00000025 (0.70614)	460.1985 (1.6619)	0.20685 (1.0187)
R-Square	0.8857	0.80784	0.8631	0.82671
F-Statistic	57.5462	31.2296	46.8216	35.4383
N	60	60	60	60

Source: Field Survey Data, 2016

Figures in parenthesis are t-ratios
* = t significant at 1%
** = t significant at 5%
*** = t significant at 10%
L = lead equation

From the regression results shown on the table above, the Lead equation chosen is the Linear functional form. This is because it has the highest R-square value (0.8857), it also has the highest F-statistic (57.5462).

Interpretation of the regression result based on the Linear functional form is implicitly stated as:

$Y = 143.517 - 71.2983X_1 - 1.6115X_2 + 2.4634X_3 + 0.6238\ X_4 + 4.5479X_5 + 12.1647X_6 + 0.000075X_7 + e$

From the model functional form, out of the seven (7) explanatory variables, three (3) were statistically significant. Quantity of palm fruits ($X_{4)}$ was statistically significant at 1% level, Processing experience (X_5) at 5% level and Processing cost (X_7) at 10% significance level. Labour (X_3), Quantity of palm fruits (X_4), Processing Experience (X_5), Processing Technology (X_6), Processing Cost (X_7) were all positively related to the output of palm oil in litres produced by processors in the study area.

R-square value of 0.8857 indicates that the explanatory variables used in the model were able to explain about 88.57% of the variations in the output of palm oil produced by processors in the study area. From the model function, quantity of palm fruits had a positive relationship with production of

palm oil (output). An increase in the supply of palm fruits used in processing will lead to a proportionate increase in the quantity of palm oil produced per litre. Quantity of palm fruits has a positive coefficient of 6.6238. this means that a unit increase in the quantity of palm fruits processed will lead to 6.6238 increase in the quantity of palm oil produced.

Processing cost had a positive relationship with production of palm oil. This implies that an increase in the processing cost of palm fruits leads to a corresponding increase in the quantity of palm oil produced in litres. It had a positive coefficient of 0.00075. This depicts that an increase in the cost of processing will lead to 0.00075 increases in the quantity of palm oil produced in litres. Processing experience also related positively with production of palm oil. This means that the longer the processors obtains experience in the processing enterprise, the more the processors' knowledge is broadened and processing skills developed. This makes the processor more knowledgeable over time in the art of processing. Processing experience had a positive coefficient of 4.5479. this means that the more an increase in the processing experience in years, it will lead to a corresponding increase in output of palm oil per litre with a higher number of processing experience, processors are more equipped.

Processing technology and labour had positive coefficients, but were not significant. Labour had a positive coefficient, but not significant because, there were two processing technologies adopted in the study area. Manual processing dominated the study area. The manual method of processing fresh palm fruit bunches required more labour to increase production of palm oil. This therefore increased the number of hired labour per man day in any manual processing mill. In the study area, manual processing method was adopted as much as the mechanical processing method was utilized. Labour had a positive coefficient of 2.4634. this implies that an increase in output may or may not necessarily be influenced by the number of labour employed per man-day, when both manual and mechanical processing methods are used within the study area. A unit increase in labour will lead to a 2.4634 increase in the quantity of palm oil processed. Processing technology was not significant, but had a positive coefficient because the method of processing technology adopted by processors influenced the output of palm oil in every processing mill. The mechanical method which involves the use of machinery has the following advantages which includes reduced drudgery, saves time, and increased efficiency in production was practised by few processors in the study area. The manual method of processing was adopted by a greater number of processors, but the output was lesser compared to that from the mechanical processing method. Processing technology has a coefficient of 12. 1647. This means that an increase in the processing technology will lead to 12.1647 increase in the output.

Sex (X_1) and age (X_2) had negative coefficients. This implies that a negative relationship exists between the level of output and the explanatory variables. Age (X_1) had a negative coefficient of -1.6115. This means that as a processor gets older, there is a decrease in the quantity of palm oil produced. Sex had a negative coefficient of -71.2983. this implies that the gender of a processor does not necessary influence the quantity of palm oil produced (output).

From the regression, F-statistic showed that f_{cal} equals 57.54. f_{tab} at 5% significant level equals 2.21. f_{cal} = 57.54 Ftab $_{(0.05)}$ = 2.21 this showed that $f_{cal} > f_{tab}$. This implies that there is a significant relationship between the quantity of palm oil produced in litres and the socio- economic factors of the processors

Indigenous Processing Technologies Used by Oil Palm Processors

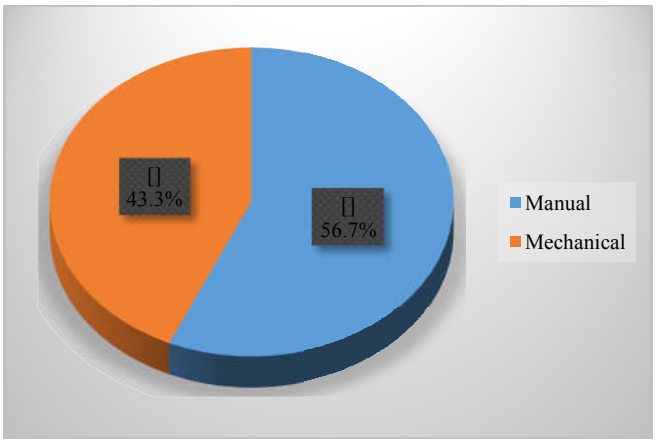

Fig 3 Pie Chart showing the method of processing technologies adopted by processors

The pie chart is a descriptive chart used to show the methods of processing technologies adopted by processors in the study area and its percentage distribution respectively. Greater portion of the pie chart which is about 56.7% of the 360° shows the manual processing technology adopted by the processors in the study area, while 43.3% of the 360° adopted mechanical method of processing. This shows that processing of palm fruits in the study area was basically manual. Very few processors were engaged in mechanical processing technologies.

Effects of profitability of palm fruits processing on rural development

This section looks at the number of items processors have acquired from profits made in the processing of palm fruits and it effect on the standard of living of the processors and its contribution to rural development.

Table 7 Accrued Benefits From Palm Fruit Processing on Rural Development

Items	* Frequency	Percentages	Ranks
Market development	60	30.5%	1st
Construction of boreholes	41	20.8%	2nd
Construction of halls	26	13.2%	3rd
Equipping the clinics	21	10.7%	4th
Renovation of schools	22	11.2%	5th
Building of churches	6	3.0%	6th
Improved communication systems	21	10.7%	7th
Total	**197**		

* Multiple Responses
Source: Field Survey Data, 2016.

Table 7: showed that palm fruits processors in the study area used the profits from this enterprise to develop the rural area. From the table, 60 respondents (30.5%) used the benefits from the processing of palm fruits in developing the markets where the palm oil were sold in the study area. 20.8% of the respondents used the benefits to construct boreholes. The bore-

hole supplied water used in their processing mills. 3% of the respondents reported that a part of the benefits was used to build churches for worship in the rural area. Since the population was made up of Christians, they saw the need to build churches, in which they worshipped. 13.2% of the respondents used the benefits to construct halls for programs and other social activities within the rural area.

10.7 percent of the respondents used the benefits from the processing in equipping their clinics. 11.2% of the respondents used benefits from this enterprise to renovate some primary and secondary schools within the rural area. All these are indications that profitability of palm fruit processing has a positive effect on rural development. Therefore, the null hypothesis which states that the profitability of palm fruits processing has no significant effect on rural development is rejected, and the alternate hypothesis accepted. This has contributed to the level of development in the study area because majority of the villagers are into this palm oil production and with the profits made from this business, they have been able to improve their standard of living individually and the development of the rural area at large.

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