LABOUR PRODUCTIVITY IN PALM OIL PROCESSING AMONG SMALLHOLDER PROCESSORS IN IGBO-EZE NORTH LOCAL GOVERNMENT AREA OF ENUGU STATE, NIGERIA

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Abstract: The study examined labour productivity in palm oil processing in Igbo-Eze North Local Government Area of Enugu State. The study used random sampling technique to select 60 smallholder palm oil processors. Data were collected with questionnaire through primary sources. The collected data were analysed with descriptive tools, cost and return, labour index and regression analysis. The findings showed that processing an average size of ten fresh fruit bunches (FFB) took approximately 8.5 h. In the process of processing the palm fruit, fruit digestion, oil clarification and bunch threshing made more intensive use of labour as they accounted for 4.6 h out of 8.5 h used in the eight stages of the processing. They accounted for ₦1, 537.50 of total labour cost of ₦2, 411.25. Labour cost formed 44.56% of the total cost of processing the 10 FFB. The findings further showed that the processing of the 10 FFB was profitable with net return of ₦1, 788.75. The result further indicated that labour productivity index was 2.99 implying that labour is productive in palm oil processing at a small scale level in the study area. The result of the regression analysis showed that educational level, processing experience, and wage, were positively signed and significant at 5 and 1% levels, respectively, while age inversely and significantly influenced the palm oil processing. Therefore, to increase labour productivity and reduce cost of labour in this enterprise, policies should aim at provision of modern technologies in palm oil processing in order to reduce the cost and intensive nature of labour in the palm oil processing and hence increase the productivity of labour.

Keywords: Labour productivity, labour index, small scale processors

Introduction

The oil palm crop is one of the most important economic crops in the tropics. It is one of the prevalent crops in Nigeria that contributes significantly to the nation's gross domestic products (GDP). In Nigeria, the oil palm is particularly cultivated in the South-East and Nigeria Delta zones. These zones are known as oil palm belt (Bassey, 2006). In the years 1961 -1965, world oil palm production was 1.5 million tonnes with Nigeria accounting for 43% (Babatunde and Oyatoye, 2006), but currently world oil palm production amounts to 14.4 million tonnes with Nigeria which is one of the largest producers in West Africa accounting for only 7% (Nwachukwu *et al.,* 2012). Oil palm production serves as a means of livelihood for many rural families and millions of people in the country. It remains a major vacation in many communities. It involves hundreds of poor producers and processors, as it provides income for many farmers and their dependents, employment for thousands of unskilled, semi-skilled and skilled people. For instance PRESCO Oil Palm Company located in Obaretin Estate near Benin city in Edo State, Nigeria employed over 2,161 workers including Nigerians and non-Nigerians (PRESCO, 2015). Also Okomu Udo oil palm company PLC located in Ovia South LGA in Edo State declared a turnover of ₦ 10.1 billion and ₦8.7 billion and profit after tax of N4.3 billion and N2.7 billion in 2012 and 2013, respectively (Abdul-Qadir *et al*., 2017).

One way of obtaining the economic values of the oil palm is through the processing of the crop into palm oil, palm kernel and alcoholic beverages (Akangbe *et al*., 2011; FAO, 2002). The oil palm processors process oil palm to get these products. Palm oil is a major product of the oil palm. Many processors are engaged in palm oil processing. Nigeria is one of the largest producers of palm oil in the world. There is high demand of this product. The demand for the palm oil is primarily driven by the household consumers and the increasing demand by industries. Although Nigeria is one of the largest producers of the palm oil but she is still a net importer of palm oil owing to the inability to produce enough palm oil to meet local demand (PIND, 2011). Currently the palm oil production does not meet up with the demand. The national production is estimated at 1.3 million metric tonnes (MT) per year while annual national demand is 1.6 million metric tonnes. The deficit of 300,000 metric tonnes is met through import where the nation annually expends an average of ₦75 billion (US$500 million) (FMARD, 2011). This is attributed to the over-reliance on traditional production methods, excessive tapping of palm trees for palm wine and the Nigerian civil war of between1967-1970 (PIND, 2011). These were the factors that constrained Nigeria to meet up with global rise in the demand for palm oil.

There are different techniques used in processing the palm oil and these range from small scale/traditional, semi-mechanized and mechanized methods. Among these processors, the smallholder processors dominate the palm oil industry accounting for about 80% of palm oil production while the semi-mechanized and mechanized accounted for about 16% and 4% respectively (Ohimain and Izah, 2014). These processors are responsible for the bulk of palm oil processed in Nigeria (Olangunji, 2008). The palm oil produced by the smallholders is characterized by poor quality with most of its physio-chemical properties failing to reach national and international standards and limits (Izah and Ohamain, 2013). Both traditional and modern palm oil processing require much labour and they are energy demanding and pass throudifferent stages before the palm oil is realized (Olagunji, 2008). Palm oil production commences with trees producing fruits, harvesting and then processing. The processing involves fresh fruit bunch reception, sterilization and threshing, fruit digestion, pulp pressing, oil clarification, drying and packing. In the small scale processing, fruit digestion (pounding) is the most intensive activity (Kwasi, 2002). The success or failure of processing depends largely upon how labour and other associated resources are efficiently utilized (Ukabi, 2004). In palm oil processing, labour is one of the most crucial resources that is required in palm oil production. The labour here refers to men and women who labour manually in the process in order to earn income. Then the productivity of labour is concerned with the quantity of output that is obtained from the employees. The measure of productivity is the total output per unit of input. Here labour productivity is

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significant because it determines the quantity and quality of palm oil that is produced from the employees as one can easily measure productivity when there is one output and one input. Here, output is palm oil while input is labour.

Productivity is an index that measures output of goods and services relative to input (land, labour, materials etc) used to produce output. As such it can be expressed as output/input ratio (Coelli *et al.*, 1998). Productivity can be expressed into two dimensions, Total Factor Productivity (TFP) and Partial Factor Productivity (PFP). TFP measures the average product of all inputs. It takes into account all land, labour, capital and material resources employed in production and compares them with total amount of output (gross output) while PFP considers only a single input which appears as output/labour, output/capital, etc. Then a measure of productivity here would be litres of palm oil per hours of labour used. Productivity of the labour is a key factor in the efficiency and profitability of the palm oil processing or production as improvement in labour productivity helps to lower costs and hence maximize output of the product per a worker.

In Enugu State, most of the palm oil processing industry is dominated by small/traditional processors. The processing industry seemed to be inefficient which in doubt is influenced by wage of the employees, education and experience of the processors, aging of the farmers, intensive nature of the job, little mechanization of the operations and among others. These factors tend to impede labour productivity. It is against this background that the study examined the amount of labour required in the stages of palm oil processing, estimate how profitable the business is, estimate and the labour productivity in the palm oil processing and to determine the factors that influence the productivity of labour in the output of palm oil processed.

Materials and Methods
Study area
The study was conducted in Igbo-Eze North Local Government Area (LGA) of Enugu State which is in Enugu Ezike Agricultural Zone of the State. The LGA is located in Latitudes 6^0 59$^/$ N and 6^0 98$^/$ N and Longitudes 7^0 27$^/$ E and 7^0 45$^/$ E with land area of 293Km^2 and a population of 259,431 people (NPC, 2006) (Figs. 1 and 2). The local government has two distinct seasons, namely; rainy season (April- October) and dry season (November-March). The annual rainfall ranges between 750 to 1200 mm with mean temperature of 35^0C. Agriculture is the main stay of the people of the area. The majority of the farmers are small scale. They cultivate yam, cassava, maize, vegetables, orange, pineapple, oil palm etc. The LGA is known in Enugu State and her environs as the main producer of palm oil, kernel and wine. The inhabitants of the LGA rear livestock such as goat, sheep, poultry and native cattle known locally as *muturu*.

Fig. 1: Map of Igbo-Eze LGA of Enugu State of Nigeria

Sampling procedure
Multi-stage and purposive random sampling techniques were employed for the study. Purposive sampling was used to select 5 communities that are known for palm oil production in the LGA. In the selection of the respondents, a two stage sampling method was adopted. From the 5 communities selected, 3 villages were randomly chosen from each community, making it 15 villages that were selected. Then from the 15 villages selected, 5 processors were randomly selected from each village chosen, making it a total of 75 small scale processors that were sampled.

Data collection
Data were collected from primary sources through a well-structured questionnaire administered to the respondents. Also oral interview was used to augment the questionnaire administered. The data were collected through the assistance of Extension Agents in the LGA who identified and administered the questionnaire. The data collected from the processors were age, education and experiences of the processors, type and cost of labour, cost of other materials involved in the palm oil processing such as water, transportation, fresh fruit bunch. Other data were stages involved in palm oil processing, quantity and value of palm

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oil realised from the processing. At the end of data collection, out of the 75 questionnaire that were administered to the respondents, only 60 questionnaires were correctly filled and returned. Therefore, those 60 questionnaires were used for the study.
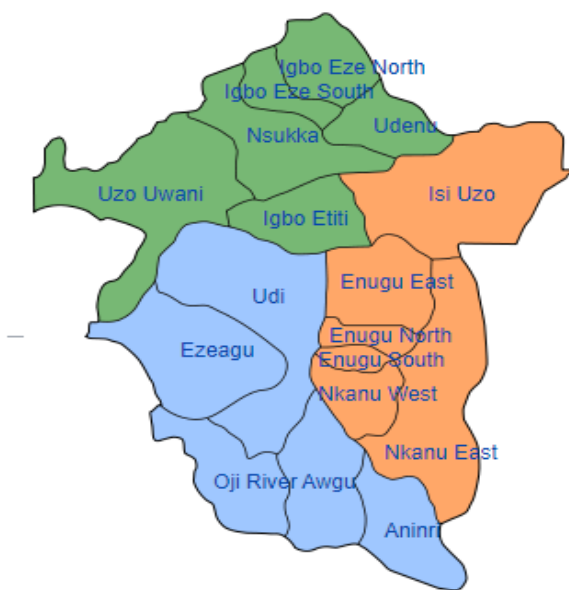

Fig. 2: Map of Enugu State of Nigeria showing the 17 LGAs

Data analysis
The data collected were analysed with descriptive statistics, cost and return, productive index and multiple regression analysis. Descriptive statistics and cost and return were used to find the amount of labour involved in different stages of the processing and to know whether the palm oil processing enterprise was profitable. The model for the cost and return is stated thus:
NR = TR – TC, TC = TVC + TFC or GR = TR – TVC, NR = GR – TFC.
Where: NR = Net Revenue, TR = Total Revenue, TVC = Total Variable Cost, TFC = Total Fixed Cost, GR = Gross Revenue.
The labour productivity index was analysed thus:
Labour Productivity Index = Gross Value of Palm Oil (₦)/Value of Labour used (₦)
In order to determine the factors that influence labour productivity in the palm oil processing, multiple regressions was used to analyse it. The implicit model is specified below:

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, e_i)$,

Where: Y = LP (Labour Productivity – Measured as ratio of gross value of palm oil produced to value of labour), X_1 = Educational level (Year), X_2 = Hired labour (Hour), X_3 = Age (Years), X_4 = Wage (₦), X_5 = Processing experience (Years), X_6 = Gender (Dummy, Male = 1, female = 0), e_i = errors

Results and Discussion
Labour use in a small-scale palm oil processing
Table 1 shows the palm oil processing labour-use and value of the labour involved in processing an average size of ten fresh fruit bunch (FFB) of palm fruit. The Table shows that the highest labour requirement in the palm oil processing was in fruit digestion which amounted to 1.6 h with a value of ₦600.00. This implies that pounding of the fruit is most

labour intensive than other stages as it alone took 1.6 hours out of 8.5 hours involved in the eight stages in the processing the palm oil. This result is in tandem with Kwasi (2002) who observed that in small-scale processing, fruit digestion (pounding) is the most labour intensive activity in palm oil processing. The fruit digestion labour requirement was followed by bunch threshing (1.5 h) and oil clarification (1.5 h) respectively with estimated value of ₦468.75 each while the least labour use (0.4 h) was oil packing/storage with a value of ₦85.00. From the study, the total labour use in processing an average of 10 fresh fruit bunch (FFB) was 8.5 hours (1.06 man- day) and this involves the bunch reception, sterilization and threshing, fruit digestion, pulp pressing, oil clarification, drying and packing. The implication of this finding is that small scale extraction method of palm oil is time consuming, labour intensive and tedious. This result corroborates with the findings of Chinedum *et al.* (2000) who noted that processing fresh fruit bunch to extract oil through traditional method is labour intensive.

Table 1: Labour-use in palm oil processing of ten fresh fruit bunches

Processing Activities	Labour-Use (Man-hour)	Average Cost/ Man-day (₦)	Cost of the Man-hour (₦)
Bunch reception	1.2	2,000.00	300.00
Bunch sterilization	1.0	1,700.00	212.50
Bunch threshing	1.5	2,500.00	468.75
Fruit digestion	1.6	3,000.00	600.00
Pulp pressing	0.5	1,700.00	106.25
Oil clarification	1.5	2,500.00	468.75
Oil drying	0.8	1,700.00	170.00
Oil packing/storage	0.4	1,700.00	85.00
	8.5		**2,411.25**

Source: Field Survey, 2017

Table 2: Cost and return of palm oil processing of ten fresh fruit bunch

Activities	Unit Price (₦)	Quantity	Amount (₦)	%
Variable Cost				
Palm fruit	150/bunch	10 bunches	1,500.00	27.72
Labour		8.5man-hours	2,411.25	44.56
Transport	50/Km	2Km	100.00	1.85
Water	5/litre	100litres	500.00	9.24
Firewood			400.00	7.39
Total Variable Cost			**4,911.25**	
Fixed Cost				
Depreciation of tools			500.00	9.24
Total Fixed Cost			**500.00**	
Revenue				
Palm oil sales	360/litre	20litres	7,200.00	
Total Return			**7,200.00**	
Total Cost			**5,411.25**	
Net Return			**1,788.75**	

Source: Field Survey, 2017

Cost and return of palm oil processing
Table 2 shows the cost and return of processing of the 10 FFB. The Table shows that the 10 FFB yielded 20 litres of palm oil. The revenue generated from the 20 litres was ₦7,200.00, while the total cost incurred in processing the oil was ₦5,411.25 and the net revenue was ₦1,788.75. With regard to cost of processing, the Table shows that the total cost was ₦5,411.25. Out of this, the cost of labour was ₦2,411.25 which indicated 44.56% of the total cost, ₦1,500.00 (27.72%) was spent on the purchase of palm fruit, while ₦500.00(9.24%), N500.00 (9.24%), ₦400.00 (7.39%) and ₦100.00 (1.85%) were spent on water, fixed asset, firewood and transport, respectively. From the findings, labour was the highest cost incurred in the palm oil processing. The result agrees with Kwasi (2002). The labour

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cost was followed by the cost of fresh fruit bunch purchase. The high cost of purchasing fresh fruit indicates the inefficiency of oil palm plantation in the study area despite being an oil palm zone belt. The Table shows that the net revenue was ₦1,788.75. This implies that the small-scale processing of palm oil is profitable. This result agrees with the findings of Ibitoye and Onje (2013) and Ohimain *et al*. (2014).

Productivity of labour
Table 3 shows the index of labour productivity. The Table shows that the processing of the ten fresh fruit bunch had labour productivity index of 2.99. The labour productivity index is greater than one. This implies that labour is productive in the palm oil processing from the partial productivity index obtained in the study area since the labour productivity index is greater than one. The results in Tables 2 and 3 showed that labour productivity in palm oil processing was productive while the palm oil processing was profitable. These findings corroborate with the findings of Obasi *et al*. (2016) who observed that productivity and profitability are two concepts that relate, in the sense that more productive business is also more profitable enterprise.

Table 3: Labour productivity of palm oil processing of ten fresh fruit bunch

Enterprise	Gross Value of the Palm Oil (₦)	Value of Labour (₦)	Productivity Index
Palm oil processing	7,200.00	2,411.25	2.99

Source: Field Survey, 2017

Table 4: Factors that influence labour productivity in palm oil processing

Variable	Linear	Semi-log	Double-log	Exponential
Constant	1.626	6.823	6.316	-4.937
	(3.349)***	(0.549)	(2.149)**	(-0.101)
Educational level	9.779	0.01	-0.967	0.013
	(2.151)**	(5.811)***	(-5.162)***	(0.002)
Hired labour	0.699	2.88E-006	0.694	155.4
	(0.652)	(4.703)***	(4.822)***	(7.833)***
Age	-0.157	-0.077	-0.007	-0.017
	(-2.798)***	(-1.120)	(-0.007)	(-0.028)
Wage	2.260	15.541	2.332	0.331
	(2.035)**	(2.829)***	(1.228)	(0.960)
Processing experience	0.177	0.005	0.046	-332.564
	(4.378)***	(0.103)	(2.947)***	(-0.456)
Gender	0.002	0.284	0.019	2.798
	(3.338)***	(0.833)	(0.007)	(0.284)
R2	0.737	0.718	0.705	0.654
Adjusted R2	0.721	0.704	0.699	0.624
F-ratio	19.509***	17.207***	11.146***	16.328***

Note: **, * significant at 5% and 1% levels**
Source: Field Survey, 2017

Factors that influence labour productivity in palm oil processing
Table 4 shows the factor that influence labour productivity in palm oil processing in the study area. The Table shows that linear model was chosen as the lead equation based on conformity with *a priori* expectation, magnitude of coefficient, and the overall functional form (F-statistics) as well as explanatory power of the variables (adjusted R^2) included in the model. The F-value was statistically significant at 1% level which implies that the independent variables (Xs) included in the model best explained the dependent variable (Y), the labour productivity. From the

Table, the R^2 is 0.737. This implies that the regression model gives good fit and also that 73.7% of the total variation in the labour productivity of palm oil processed was explained by the independent variables included in the model while the remaining 26.3% was due to error of estimation and other factors outside the scope of this study.

The result in the Table 4 indicates that educational level, wage, gender and processing experience were positive and statistically significant at 5 and 1% levels, respectively. This means that these factors had direct relationship with labour productivity in palm oil processing in the study are. The positive and significance of educational level and processing experience at 5 and 1% levels, respectively implies that as the literate level and years of experience of the processors increase, there would be increase in the productivity of the processors as highly experienced and educated processors are expected to adopt new improved technologies that would enhance their productivity of the enterprise. This result is consistent with the findings of Olagunju (2008) which asserted that education plays an important role in palm oil processing in Ondo State of Nigeria and Ini-mfon *et al*. (2013) who noted that increase in experience in palm oil processing promotes performance of the business in their study area. It is noted that gender influences labour productivity positively and significantly at 1% level. This means that more male engaged in the palm oil processing in the study area than their female counterpart. This could be that processing of fresh fruit bunch to extract the oil is labour intensive. This result is in tandem with the findings of Nwankwo and Ojike (2012) who observed that more men participated in pre-extraction and extraction of palm oil in their study area than women who mostly participated in post-extraction of the oil which involved mostly selling of the oil. Wage was positively signed and significant at 1% level. This implies that as the wage of the labourer increases there would be increase in productivity of the labourer. This could be that the wage increase serves as an incentive for the worker to put in more effort to perform the work assigned to him thereby increasing his labour productivity.

On the other hand, the coefficient of the age was negatively signed and statistically significant at 1% level. This suggests that as the processor advanced in age by one year, the labour productivity decreases by 0.157. This means that as the processor gets older they continue to decline with the tedious work of cutting the harvested bunches, keeping them in heaps, boiling and pounding of the fruits, pressing of the pulp and clarification of the oil. Hence the result of age is in line with *a priori* expectation.

Conclusion
The result of the study showed that processing of an average ten fresh fruit bunches took approximately 8.5 hours, which involves bunch reception, threshing and sterilization, fruit digestion, pulp pressing, oil clarification, drying and packing. The findings showed that ₦2,411.25 was the cost of labour alone and this amounted to 44.56% of the total cost (₦5,411.25) involved in the processing of the palm oil. The findings further showed that the processing of the 10 FFB was profitable with net return of ₦1,788.75. The result further indicated that labour productivity index was 2.99 implying that labour is productive in palm oil processing at a small scale level in the study area from the partial productive index obtained. The result of regression analysis showed that educational level, wage, gender and processing experience were positively signed and significant at 5 and 1% levels while age was inversely related to the labour productivity.

The small holder processors should be encouraged to form cooperatives where they can pull their resources together and be able to gain access to credit to enable them purchase mini-

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improved processing machines. These machines use digester and press for easy operation of the activities in the palm oil processing which serve as labour serving device. This is because it is more efficiently and less costly when mini processing machine is used than using traditional method of processing and also this technology would encourage youths to go into palm oil processing industry where they can serve as mill operators and be able to assist the old people in the industry. Therefore, to increase labour productivity and reduce cost of labour in this enterprise, policies should aim at provision of modern technologies in palm oil processing in order to reduce the cost and intensive nature of labour in the palm oil processing and hence increase the productivity of labour.

Conflict of Interest
Authors declare that there are no conflicts of interest.

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