

Employment and socioeconomic effects of semi-mechanized palm oil mill in Bayelsa state, Nigeria

Abstract

The unemployment rate in Nigeria has risen in the past few years. Several industrial activities such as oil palm enterprise are capable of employing millions of people. This study evaluated the employment and socioeconomic influence of semi-mechanized oil palm processing in Elebele, Bayelsa State, Nigeria. Direct observations and interviews from the processing units of the mill were the methods used in obtaining data. The mill was found to employ 11 workers as each personnel have the capacity of producing 9.1 liters of FFB per day. The labor force comprised of agile men and women in the ratio of 72.7 and 27.3% respectively. During processing, women are involved in sieving activities while men are involved in bunch reception, bunch loading on stripper, stripping, sieving, sterilization/boiling, digesting/pressing, clarification and oil drying. The age of the processor were within the age brackets of 21 – 30, 31 – 40, 41 – 50 and ≥ 51 years representing 11%, 35%, 27% and 27% of the total work force respectively. The educational background showed that 13, 35, 30, 22 and 0% are holders of first degree, diploma, secondary school certificates, standard six certificates and no standard six certificate respectively. The years of experience indicates that 45, 33, 16 and 6% have been in the business for <10, 11 – 20, 21 – 30 and >30 years respectively. The study accentuates the significance of employment creation by semi-mechanized oil palm processing in ~~in~~ Nigeria.

Keywords: employment, oil palm processing, semi-mechanized, socioeconomics

1 Introduction

Nigeria is a country with about 167 million people. The country is the 8th and 6th major world producer and exporters of petroleum products (Adeleke, 2012). The nation is blessed with several other mineral resources such as natural gas, tin, iron ore, coal, lead, zinc limestone, niobium and arable land for agricultural purposes. Yet Nigeria is poor with high rate of unemployment. Federal Government has developed some programmes towards reducing poverty, but this has not yielded positive result thus far (Adeleke, 2012). The United Nations (UN) Human Poverty Index in 2006 rated Nigeria among the 25 poorest nations of the world. According to National Bureau of Statistics the unemployment rate for Nigeria are 31.1, 13.6, 12.6, 14.8, 13.4, 11.9, 13.7, 14.6, 14.9, 19.7 in 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009 (Alexander et al., 2012) and 21.1 and 23.9 in 2010 and 2011 respectively (Fanimu and Okere, 2012; Adeleke, 2012) of the population of each year **Fig. 1**. Before 2009, Nigeria was Africa second largest economy with a gross domestic product (GDP) of about US\$40 billion, yet over 33% of her populace ~~lives~~ live below the poverty line of US\$1/ day (Ugwu 2009). Despite the upsurge in population, the country has continued to experience poor economic growth and development. The principal cause of poverty in Nigeria is unemployment resulting from joblessness especially among the active labor force (youth of ages 15 to 45 years).

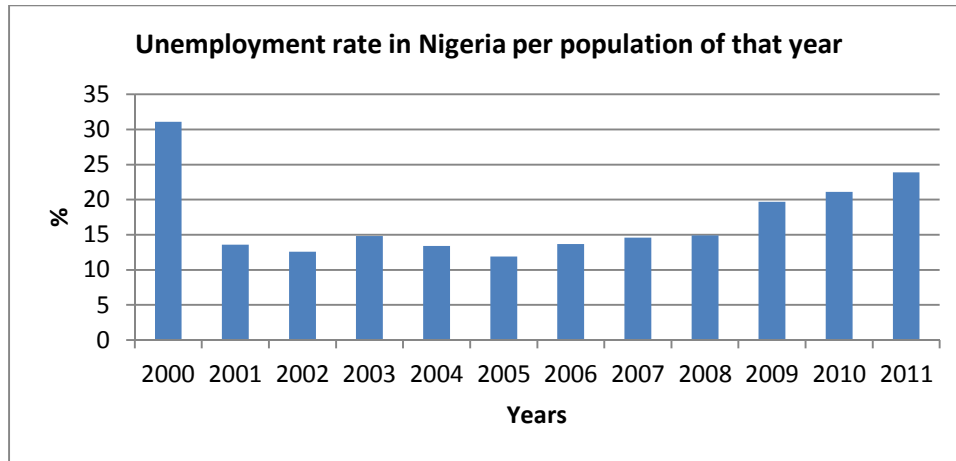


Fig. 1: Unemployment rate in Nigeria depending on the population size

The poverty and employment currently experienced in Nigeria is linked to corruption and mismanagement of (Ohimain, 2010), low productivity, poor and unfavorable government policies, frequent change of power, and under performance of most manufacturing sector. In Nigeria there is no alliance between the supply skill and labor market needs. The environment is characterized by lack of transparency, unreliable power supply, weak quality of regulation and enforcement rules, multiple rules, offices, fees and agencies cutting across the three tiers of government, in addition, access to finance are other major constraints (World Bank, 2013). But the only means of breaking the potency of poverty and unemployment is through small scale business. According to Adeleke (2012) National Council of Industries in 2008 defined Nigeria small scale enterprises as business enterprises whose total costs and/ or expenditure excluding land is not more than one hundred million naira and a workforce of 11 – 70 on full time staff strength. The country has several promising small scale enterprise that could serve as source of livelihood to many family especially in the rural setting but they have failed to recognize this due to level of illiteracy and poor attitude toward work. World Bank (2013) stated that in Nigeria, over 10 million adult are illiterate and 7 million children have dropped out from school representing 16.7% and 11.7% respectively, these due to poor quality of education in the country. **Social economics appears to influence the unemployment rate in Nigeria.** According to Awogbenle and Iwuamadi (2010), the statistics from the Federal Bureau of Statistics show that Nigeria has 80million, representing 60% of the total population as youth (Awogbenle and Iwuamadi, 2010). Out of these, about 64million are **were** unemployed and about 1.6million are underemployed (Alexander et al., 2012). The rate of unemployment rate among youth of secondary school graduate is about 40 and 31% and **were** within the age of 20-24 and 15-19 respectively, these implies that about 71% of the urban unemployed are from 15-24 years old (Alexander et al., 2012). Alexander et al. (2012) reported that unemployment has wreaked havoc irrespective of the age bracket, educational group and sex. According to them National Bureau of Statistics presented 4.6% of unemployed youth **are were** within the ages of 15 and 24 in March 2009. Of these, 21.3% were unemployed with post-secondary education, 22.3 and 21.0% has primary school education and no formal education respectively.

Nigeria has over 100 universities, several polytechnics, monotecnics and colleges of education producing graduates for the country in different fields (Adeleke, 2012). Fanimu and Okere (2012) reported that of the 1.37 million and 1.98 million students that enrolled into higher

education of learning in 2006 and 2007 respectively has resulted in 3.2million graduates entering the labor force in 2010 and 2011 without job. This may be attributed to the increase in unemployment. Shadare (2012) reported that unemployment and under- employment lead to rural urban drifting resulting to overcrowding and unsettled labor force. Other negative penalties of unemployment include poverty, frustration, depression, hostility, food insecurity, criminal acts (robbery, prostitution, illegal bunker of petroleum, bombing activities, kidnapping and hostage taking) and general insecurity of life and property (Adebayo 1999; Egbuna, 2001; Ohimain et al., 2012a).

The petroleum industry generates three quarters of government revenues and more than 90% of foreign exchange earnings, agriculture continues to play an important role in the economy, contributing 26% of total GDP in 2005, with crop production accounting for an estimated 85% of this total, livestock for 10% and forestry and fisheries generate the remaining 5% (Ugwu, 2009). Prior to the oil boom of the 1970s, Nigeria is a major exporter of agricultural commodities such as cocoa, groundnuts, cotton, rubber, and palmoil, but presently they export non-oil products such as cocoa, beans and butter, rubber, leather, and hide and skins (Ugwu, 2009). Currently there have been an intense effort for diversify her economic resources through strengthening of the agricultural sector that the country once abandoned for petroleum (Ezealaji, 2011). ~~It~~ **Generally**, agriculture generates nearly 90% of Nigeria export and employment for about 65% of the total labor force. In particular, the cultivation and production of oil palm is a major source of livelihood for millions of Nigeria especially those residing in the rural area (Akanbe et al., 2011; Olagunju, 2008; Ohimain et al., 2012a,b).

Oil palm is one of the most economic plants found in Nigeria (Akanbe et al., 2011; Soyebbo et al., 2005). Oil palm have been severally referred to as the most productive oil bearing crop in the world (Izah and Ohimain, 2013; Akanbe et al., 2011; Okechalu et al., 2011; Ngando et al., 2011; Dimelu and Anyaiwe, 2011; Rupani et al., 2010; Singh et al., 2010; Sumathi et al., 2008; Ugbah and Nwawe, 2008) with an hectare producing 10 – 30 tonnes/hectare/annum (Singh et al., 2010, 2011; Sridhar and AdeOluwa, 2009; Chavalparit et al., 2006; Mahlia et al., 2001). Nigeria oil palm market is dominated by smallholders who typically occupy about 80% of the national palm oil production (Olagunju, 2008; Ohimain et al., 2012b; PIND, 2011). Smallholder uses rudimentary equipment for palm oil processing (Ohimain and Izah, 2013a). The oil yield by smallholder processing is low and in the range of 9.4 – 12.8% and 26.0 – 28.2% for *Dura* and *Tenera* varieties respectively (Ohimain et al., 2013a). There are many indicators of strong economic growth in palm oil global demand (Sheil et al., 2009).Palm oil has emerged as the main global source of vegetable oil due to adequate availability, versatility in usage and lower cost, as compared to other vegetable oils (WWF-India, 2013). Palm oil forms nearly 33% of the world vegetable oil production mix. Hence, it could be used to diversify the current rate of unemployment in Nigeria. Ohimain et al. (2012a) and Olagunju (2008) reported that it could create employment for several millions of people. However, oil palm industry has been recognized for its contribution towards economic growth and rapid development through biofuel (Ohimain et al., 2012a). Nigeria has entered into the biofuel industry and it has the potential of creating enormous employments. For example, the employment effects of the twelve Global Biofuel Limited bioethanol factories when fully installed and operational could employ 696,000 staffs (Ohimain, 2010). The two biodiesel refineries proposed for industry in Cross Rivers State could generate several thousands of employment both at farm and factory. Oil palm sector is

capable of providing about 4 million direct employment opportunities in more than 20 oil palm producing states in Nigeria, and indirectly to others that may be involved in processing and marketing (Ahmed, 2001).

Palm oil constitutes big business, traded internationally as communities and immeasurably critical to the survival of the economics of many countries and their people (Oladipo, 2008). It provides income for many farmers and their dependents. This connotes that an efficient and strong palm oil sector in Nigeria will enable the poor to be part of the solution to poverty challenge through provision of employment and a means of livelihood (PIND, 2011). It is obvious that employment opportunities abound in the oil palm sector, beginning from the plantation stage. Beyond the plantation, employments are also generated in other stages of oil palm production value chain including processing, marketing and other non-farm enterprise such as the sale of farm and agricultural processing implements, agro-chemicals etc (Ohimain et al., 2012a). Beside the employment effects, the socio economic characteristics of oil palm processors are also important. Several useful works have been carried out on small scale oil palm production. These include the economics on small scale palm oil processing in Rivers State (Ekine and Onu, 2008), economics of oil palm processing in southwestern Nigeria (Olagunju, 2008), social economics of oil palm production in Osun State (Soyebo et al., 2005), socioeconomics influence on oil palm technologies in Delta State (Ajayi and Solomon, 2010) and employment effects in Rivers State (Ohimain et al., 2012a), but no study have been focused on the employment and socioeconomics influence of semi industrialized oil palm processing in Bayelsa state, Nigeria, hence the need for this study.

2 Methodology

A field trip was undertaken on 6th to 7th June, 2013 to a semi-mechanized palm oil mill at Elebele, Bayelsa State, Nigeria. The mill is located at latitude and longitude of N 04° 52' 12.8" and E 006° 18' 51.2" respectively. The process of oil palm extraction at the mill is presented in Fig. 2. Physical observations and interview of oil palm processors were the approach used to obtain data. Also the detailed head count of all the workers found participating in the various processing activities was carried out. Beside physical observation, Information were elicited from oil palm processors using interview schedule, on the employments effects of oil palm processing, designations of work based on socioeconomics characteristics (such as gender, age, years of experience, size of house hold etc) and the duration/ time of the various activities in the processing mill (Ohimain et al., 2012a).The data were analyzed using descriptive statistics.

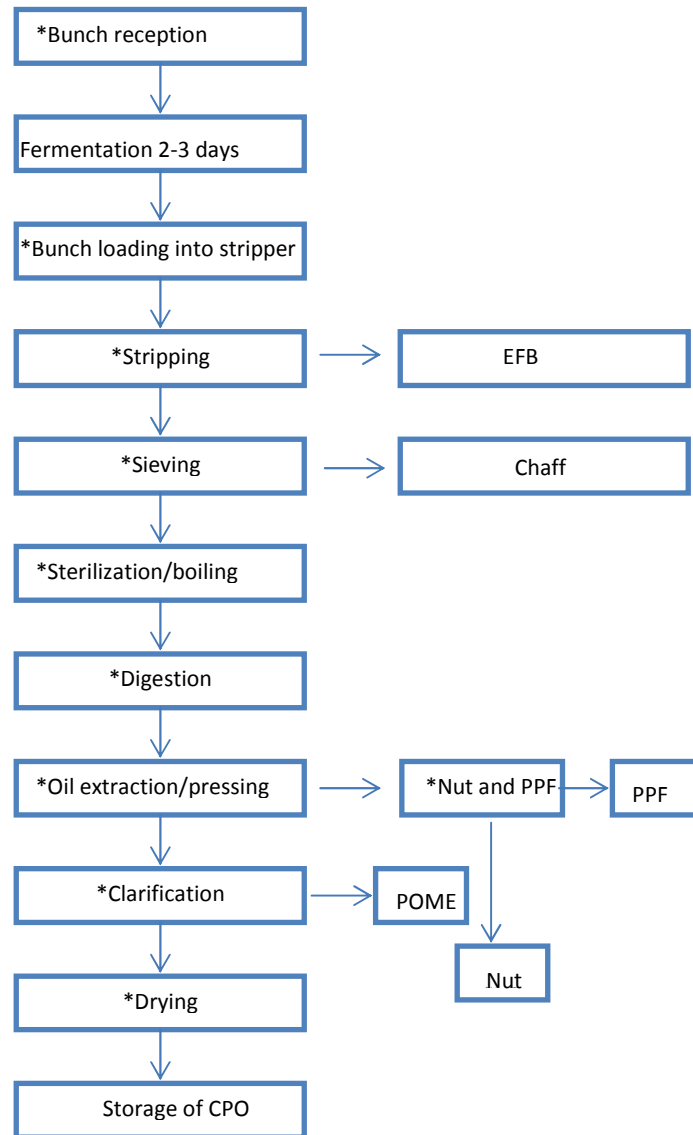


Fig. 2: Flow-chat of a semi-mechanized oil palm processing in Bayelsa Palm.

(EFB = empty fruit bunch; PPF= palm press fiber; CPO = crude palm oil; POME = palm oil mill effluents; *processing phase in oil palm processing that requires employment)

3 Results and Discussion

The efficiency of palm oil processed per personnel and staff strength is presented in Table 1. The total labor force comprises of 11 staff. They were found to be doing the work with simplicity. They process 74 FFB day. However average weight of FFB were 13.5kg. The volume of FFB produced were 100litres. The productivity of CPO per personnel is 9.1 liters/day. Smallholder's processors typically have 3 –12 staff involved in oil palm processing (Ohimain et al., 2012a). Ohimain et al. (2013a) reported that the average weight of FFB processed by smallholders in Nigeria ranged from 12.7 – 15.7kg depending on the variety. Ohimain et al. (2012a) reported that smallholder processors produce 8.9 – 74 liters of CPO depending on the quantity of FFB available. The authors reported that one of the mills could process up to 700 FFB into 680 liters

of CPO. Authors have previously reported that the use of manual/rudimentary equipment in oil palm processing lead to loss of CPO in the range of 25 – 75% of FFB (Orewa et al., 2009; Ekine and Onu, 2008). Ohimain and Izah (2013b) reported that semi-mechanized palm oil mill share about 50% of the characteristics of smallholder processors. In this study, production processes is usually accomplished the same day unlike smallholder processor that take between 4 – 10 days to complete CPO generation from FFB. In traditional processing, fermentation of FFB and PPF take 2 – 4 days each of the 4 – 10 days respectively (Ohimain et al., 2012a – d; Ohimain et al., 2013a,b; Ohimain and Izah, 2013b, c; Izah and Ohimain, 2013). Also, Olagunju (2008) reported that low number of personnel involved in processing may be attributed to the availability of FFB. In all the processing activities the low number of staff engaged may be associated to the number of FFB available for processing because the study was carried out at the end of the peak period (period of high oil palm production).

Table 1: The efficiency of palm oil processed per personnel and staff strength

Number/quantity of inputs and outputs	Activity breakdown	Volume and quality of output
Quantity FFB Processed	No. of FFB/day	74
	Average weight (kg)	13.5
Number of Workers (employment effects)	No. of staff/day	11
Volume of oil produced (liters)	CPO volume/day	100
Volume of oil produced /personnel (liters)	CPO volume/personnel	9.1

The various activities requiring employments during oil palm processing are bunch reception, stripper loading, stripping, sieving, sterilization, digestion, oil extraction, clarification, drying and fiber and nut separation (Table 2). The number of staff involved in the various processing activities include 2 (bunch reception), 2 (bunch loading into stripper), 1 (stripping), 3 (sieving), 1 (sterilization), 2 (digestion), 2 (oil extraction), 1 (clarification), 1 (oil drying) and 1 (fiber separation). The source of energy utilized for the processing activities is manual (bunch reception, bunch loading on stripper, sieving, and oil drying), mechanical (stripping, digestion, pressing, clarification and fiber separation) and manual/mechanization (for sterilization/boiling). Ohimain et al. (2012a) reported that the number of staff that participate in oil palm processing activities are carried out in order of 1 – 3 (bunch reception), 1 - 2 (threshing), 1 – 2 (sieving), 1 – 2 (sterilization), 1 – 3 (digestion/pressing) in smallholders mill. Like traditional oil palm processing that requires bunch reception, bunch slicing, threshing of palm fruit, sieving, boiling and processing digestion/pressing in semi-mechanized method of palm oil processing is devoid of second fermentation and subsequently repressing of PPF. Akangbe et al. (2011) reported that stripping, mixing, sterilization, digestion, skimming and clarification activities require training for efficiency performance.

The gender of palm oil processors per activity is presented in Table 2. Apart from sieving of stripped fruit that is done by females all the other processing activities are carried out by males. Bunch reception, bunch loading on stripper, stripping, sieving, sterilization/boiling, digesting, pressing, clarification, oil drying and fiber separation were carried out by 2, 2, 1, 3, 2, 2, 1, 1 and 1 staff respectively with some workers undertaken more than one activity per shift. This result is similar to the findings of Ohimain et al. (2012a) that reported that bunch reception, slicing, boiling, digesting/pressing are carried out by males, while sieving and fiber separation are carried out by females, while threshing is carried out by either male or female in smallholder palm oil mills. They stressed that the nature of the processing activities make females not to be involved in most activities. Akangbe et al. (2011) reported contrary views stating that, women are were involved in all the processing activities in Oyo state, Nigeria. FAO (2005) also reported that men cultivate oil palm while women undertake milling activities and marketing of products. The time duration used to execute each of the processing activities are 33, 35, 32, 25, 45, 15, 5, 12, 30 and 56 minutes for bunch reception, bunch loading on stripper, stripping, sieving, sterilization/boiling, digesting, pressing, clarification, oil drying and fiber separation respectively. The time taken to complete each of the processing activities is dependent on the physical strength of the processor for the activities that require manual energy (bunch reception, bunch loading on stripper, sieving and oil drying). Activities like boiling rely heavily on the quantity of solid fuel that is fed into the boiler and how spontaneous they are done. The clarification depends on the size of the poly vinyl chloride pipe that is used to discharge the POME from the palm oil.

Table 2: Itemization of activities according to number of personnel, gender and energy utilization

Activities	Time (mins)	Personnel (No.)	Gender	Energy source
Bunch reception	33	2	Male	Manual
Bunch loading on stripper	35	2	Male	Manual
Stripping	32	1	Male	Mechanized
Sieving	25	3	Female	Manual
Sterilization/Boiling	45	1	Male	Manual/mechanized
Digesting	15	2	Male	Mechanized
Pressing	5	2	Male	Mechanized
Clarification	12	1	Male	Mechanized
Oil drying	30	1	Male	Manual
Fiber separation	56	1	Male	Mechanized

Note: Some staff did undertake more than one processing activity

Socio economics of oil palm involves the age, gender, educational background and years of experience. These factors are the determinants of profit efficiency in oil palm venture (Kadurumba and Ume, 2011).

Table 3: Socio economics characteristics of oil palm processors in Nigeria

Socio-economics	This study	Ekine and Onu, 2008	Ajayi and Solomon, 2010	Soyebo et al., 2005	Ohimain et al., 2012a
-----------------	------------	---------------------	-------------------------	---------------------	-----------------------

Age, %					
21 – 30	11	6.7 – 14.6	33.0	1.9	14.0
31 – 40	35	6.7 – 31.3	20.0	24.5	31.0
41 – 50	27	29.9 - 53.3	23.0	23.5	25.0
>51	27	31.3 – 33.3	24.0	50.0	30.0
Gender, %					
Male	72.7	62.5 – 68.9	74.0	79.4	73.0
Female	27.3	31.1 - 37.5	26.0	20.6	27.0
Educational background, %					
Above first degree	0	8.8 – 29.9	-	-	-
First degree	13	8.8 – 14.6	-	-	9.0
Diploma	35	0.0 - 8.3	14.0 above WASC	-	7.0
WASC	30	39.6 – 51.1	25.0	-	34.0
Standard six	22	11.1 - 14.6	34.0	-	32.0
Below standard six	0	0.0 - 20	27.0	-	18.0
Years of experience, %					
<10	45	-	23 < 10years	14.7	-
11 – 20	33	-	77 > 10 years	28.4	-
21 – 30	16	-	-	19.6	-
>30	6	-	-	37.3	-
Processors type	Semi-mechanized	Traditional	-	-	Traditional
State	Bayelsa	Rivers	Delta	Osun	Rivers

The age of the processor at the mill were 11%, 35%, 27% and 27% within the age brackets of 21 – 30, 31 – 40, 41 – 50 and ≥ 51 years respectively (Table 3). The age of oil processors that dominated the industry is 31 - 40 years while 20 – 30 years is the least. The age bracket and frequency is different from previous studies (Soyebo et al., 2005; Ohimain et al., 2012a; Ekine and Onu, 2008; Ajayi and Solomon, 2010). Akangbeet *al.* (2011) indicate that (46.9%) of the palm oil extractors were 60years and above, while 16.9% fall within the agile youthful age bracket of between 20-40 years. The variation in the percentage frequency could be attributed to the number of individuals involved in oil palm processing. The age range is an indication that oil palm business is meant for mostly married people who are still in their active working age hence they are matured and responsible (Ekine and Onu, 2008; Akangbe *et al.*, 2011).

The gender of the labor force comprised of 72.7 and 27.3% men and women respectively. The report is comparable to other studies (Soyebo et al., 2005; Ohimain et al., 2012a; Ekine and Onu, 2008; Ajayi and Solomon, 2010). Gender affects the productivity of the oil palm enterprise. Akangbe et al. (2011) reported that women ~~are~~ *were* involved in all the processing activities in their studies in Oyo state, Nigeria. The result of this finding indicates that women are less found in the industry. Perhaps there are some processing activities that women hardly undertake (Ohimain et al., 2012a), this may be the reason why oil palm processing enterprise is dominated by males in the Niger Delta Nigeria.

Educational qualifications such as holders of first degree, diploma, secondary school certificates, standard six certificates and no standard six certificates are respectively presented as 13, 35, 30,

22 and 0% of the labor force. Like age, educational qualification frequency is different from previous studies (Ohimain et al., 2012a; Ekine and Onu, 2008; Ajayi and Solomon, 2010). Akangbe *et al.* (2011) presented that 55.0% of oil palm extractors had no formal education and only 21.3% had at least the basic primary school education, while 11.2% had post primary education. Olagunju (2008) study revealed that 50%, 44%, 1% and 4% had primary, secondary, tertiary, and no education respectively. Educational level of processor affects the overall quantity and quality of palm oil produced. Education plays an important role in palm oil processing operations since it will facilitate the adoption of innovations that will improve palm oil processing (Olagunju, 2008).

The years of experience indicates that processors have been in the enterprise in the range of <10, 11 – 20, 21 – 30 and >30 years are 45, 33, 16 and 6% respectively. The years of experience are different from previous studies (Soyebo et al., 2005; Ajayi and Solomon, 2010). Akangbe *et al.* (2011) presented that 30, 52.5 and 17.5% have experience for 1-25, 26 – 50 and 51-75 years. The experience of oil palm processor influence the general output of the product as well as price, employment. The level of experience of processors in this study is higher than 10 years.

4 Conclusion

The unemployment that has rocked the country over the years can be accredited to the comparatively low employment opportunities with an increasing population growth. The petroleum product that the country has relied on for decades is diminishing in supply. Therefore for the country to break the viscous of unemployment and poverty, agriculture is the surest way forward. The semi-mechanized oil palm processing mills present high opportunities if properly exploited. In this study, the influence of socioeconomics on oil palm processing was investigated and it revealed that male dominated the mill with > 70% of the staff. These translated to males undertaken most of the processing activities in the mill. About 78% of the processor educational qualification $\geq$ WASC, of these 16.7% have first degree. About 89% of the staff is 30 years, of these 70% is between 30 and 50years. The number of staff involved in the processing was ~~fund~~ found to be high. The processors are capable of producing 9.1 liters of palm oil/personnel. Therefore the sector is capable of impacting positively to the teaming skilled and unskilled unemployed youths in the country. These could also help improve in a number of operational aspects, leading to higher demand and better prices of CPO.

References

1. Adebayo, A. (1999). Youth Unemployment and National Directorate of Employment self and Employment Programmes. Nigerian Journal of Economics and Social Studies 41 (1): 81-102.
2. Adeleke, A. (2012). Improving poverty alleviation programmes in Nigeria through small and medium scale agricultural development projects. European Journal of Business and Management, 4(11): 109 – 120.
3. Ahmed, S.A. (2001). Agriculture and Food Security in Nigeria. Paper presented for a forum with Mr. President on Agriculture and Food Security Council Chambers Presidential Villa, Abuja, Nigeria.

4. Ajayi, M.T. and Solomon, O. (2010). Influence of extension contact and farmers' socio-economic characteristics on adoption of oil palm technologies in Aniocha North Local Government, Delta State. *JAGST* 12(2): 35-46.
5. Akangbe, J. A., Adesiji, G. B., Fakayode, S. B. and Aderibigbe, Y. O. (2011). Towards Palm Oil Self-sufficiency in Nigeria: Constraints and Training needs Nexus of Palm Oil Extractors. *J. Hum. Ecol.* 33(2): 139-145.
6. Alexander, H. S., Ezugwu, D. C., Titillayo, A. O. and Ajiboye, D. I. (2012). Unemployment in the Nigerian democratic setting: Challenges and the way forward. *International Journal of Economic Development Research and Investment*, 3(2): 70 – 79.
7. Awogbenle, A. C. and Iwuamadi, K. C. (2010). Youth unemployment: Entrepreneurship development programme as an intervention mechanism. *African Journal of business management*, 4 (6), 831-835.
8. Chavalparit, O., Rulkens, W.H., Mol, A.P.J. and Khaodhair, S. (2006). Options for environmental sustainability of the crude palm oil industry in Thailand through enhancement of industrial ecosystem. *Environmental, Development and Sustainability* 8: 271-287.
9. Dimelu, M.U. and Anyaiwe, V. (2011). Priorities of Smallholder Oil Palm Producers in Ika Local Government Area of Delta State: Implication for Agricultural Extension Service in Nigeria. *World Journal of Agricultural Sciences* 7 (2): 117-123.
10. Egbuna, E.N. (2001). Food Production: An Africa Challenge. *Central Bank of Nigeria Economic Financial Review* 39(1):13.
11. Ekine, D.L. and Onu, M.E. (2008). Economics of small-scale palm oil processing in Ikwerre and Etche Local Government Areas of Rivers State, Nigeria. *Journal of Agriculture and Social Research* 8(2): 150-158.
12. Ezealaji, N.L.O. (2011). Economics of palm oil storage and marketing in Imo State, Nigeria. *African Journal of Marketing Management* 3(10):253-260.
13. Fanimu, D. and Okere, R. (2012). Nigerians bemoan rate of unemployment, seek action. *Guardian* Tuesday, 07 August 2012.
14. Food and Agricultural Organization (2005). *FAO corporate Document Repository; agriculture and consumer protection of small scale palm oil processing in Africa.* <http://www.d/fao/docrep/005/74355e.pp>.
15. Foundation for Partnership Initiatives in the Niger Delta (PIND) (2011). *A report on Palm Oil Value Chain Analysis in the Niger Delta, 2011.*
16. Izah, S.C. and Ohimain, E.I. (2013). Microbiological quality of crude palm oil produced by smallholder processors in the Niger Delta, Nigeria. *Journal of Microbiology and Biotechnology Research*, 3 (2): 30 - 36.

17. Kadurumba, C. and Ume, S.I. (2011). Determinant of Profit Efficiency among Small Scale Traditional Palm Oil Processors in Nigeria. *International Journal of Agriculture and Rural Development* 14(2): 716-721.
18. Mahlia, T.M.I., Abdulmum, M.Z., Alamsyah, T.M.I. and Mukhlishien, D. (2001). An alternative energy source from palm wastes industry for Malaysia and Indonesia. *Energy Conversion and Management* 42: 2109 - 2118.
19. Ngando, E.G.F., Mpondo, M.E.A., Dikotto, E.E.L. and Koon, P. (2011). Assessment of the quality of crude palm oil from smallholders in Cameroon. *Journal of Stored Products and Postharvest Research* 2(3): 52-58.
20. Ohimain, E. I. (2010). Emerging bio-ethanol projects in Nigeria: Their opportunities and challenges. *Energy Policy* 38: 7161-7168.
21. Ohimain, E.I., Izah, S.C. (2013a). Energy self-sufficiency of smallholder oil palm processing in Nigeria. *Renewable Energy*. In press.
22. Ohimain, E.I., Izah, S.C. (2013b). Gaseous emissions from a semi-mechanized oil palm processing mill in Bayelsa state, Nigeria. *Continental Journal of Water, Air and Soil Pollution*, 4 (1): 15 – 25.
23. Ohimain, E.I., Izah, S.C.(2013c). Water minimization and optimization by small-scale palm oil mill in Niger Delta, Nigeria. *Journal of Water Research*, 135: 190 – 198
24. Ohimain, E.I., Izah, S.C. and Obieze, F.A.U. (2013a). Material-mass balance of smallholder oil palm processing in the Niger Delta, Nigeria. *Advance Journal of Food Science and Technology*, 5(3): 289-294.
25. Ohimain, E.I., Izah, S.C., Abah, S.O. (2013b). Air quality impacts of smallholder oil palm processing in Nigeria. *Journal of Environmental Protection*, 4: 83-98
26. Ohimain, E.I., Oyediji, A.A. and Izah, S.C. (2012a). Employment effects of smallholder oil palm processing plants in Elele, Rivers State, Nigeria. *International Journal of Applied Research and Technology* 1(6): 83 - 93.
27. Ohimain, E.I., Daokoru-Olukole, C., Izah S.C. and Alaka, E.E. (2012b). Assessment of the quality of crude palm oil produced by smallholder processors in Rivers State, Nigeria. *Nigerian Journal of Agriculture, Food and Environment* 8(2): 28 - 34.
28. Ohimain, E.I., Seiyaboh, E.I., Izah, S.C., Oghenegueke, V.E., Perewarebo, T.G. (2012c) Some selected physico-chemical and heavy metal properties of palm oil mill effluents. *Greener Journal of Physical Sciences*, 2(4): 131 - 137.
29. Ohimain, E.I., Daokoru-Olukole, C., Izah, S.C., Eke, R.A., Okonkwo, A.C. (2012d). Microbiology of palm oil mill effluents. *Journal of Microbiology and Biotechnology Research*, 2(6):852 – 857.
30. Okechalu, J.N., Dashen, M.M., Lar, P.M., Okechalu, B. and Gushop, T. (2011). Microbiological quality and chemical characteristics of palm oil sold within Jos Metropolis, Plateau State, Nigeria. *Journal of Microbiology and Biotechnology Research* 1(2): 107-112.

31. Oladipo, J.A (2008). Agrio-Industry as Strategy for Rural Development: An Impact Assessment of Nigeria Oil-Palm Industry. *European Journal of Social Sciences* 7(1): 75-87.
32. Olagunju, F. I. (2008). Economics of Palm Oil Processing in Southwestern Nigeria. *International Journal of Agricultural Economics and Rural Development* 1 (2): 69-77
33. Orewa, S.I., Adekaren, B., Ilechie, C.O. and Obulechei, S. (2009). An Analysis of the Profitability of Using the NIFOR Small Scale Palm Oil Processing Equipment (SSPE). *American-Eurasian Journal of Agronomy* 2(3): 192-200.
34. Rupani, P.F., Singh, R.P., Ibrahim, H. and Esa, N. (2010). Review of Current Palm Oil Mill Effluent (POME) Treatment Methods: Vermicomposting as a Sustainable Practice. *World Applied Sciences Journal* 11 (1): 70-81.
35. Shadare, O.A. (2012). Graduate Unemployment in Nigeria: Causes, Effects and Remedies. *British Journal of Arts and Social Sciences*, 5(2): 142 – 154.
36. Sheil, D.; Casson, A.; Meijaard, E.; van Noordwijk, M.; Gaskell, J.; Sunderland-Groves, J.; Wertz, K. and Kanninen, M. (2009). The impacts and opportunities of oil palm in Southeast Asia: What do we know and what do we need to know? Occasional paper no. 51. CIFOR, Bogor, Indonesia.
37. Singh, R.P., Embrandiri A., Ibrahim, M.H., Esa, N. (2011). Management of biomass residues generated from oil mill: vermicomposting a sustainable option. *Resour. Conserv. Recy.*, 55: 423-434.
38. Singh, R.P., Ibrahim, M.H., Norizan, E., Iliyana, M.S. (2010). Composting of waste from palm oil mill: a sustainable waste management practice. *Rev. Environ. Sci. Biotechnol.* 9: 331-344.
39. Soyebbo, K.O., Farinde, A.J. and Dionco-Adetayo, E.D. (2005). Constraints of oil palm production in Ife central local government area of Osun State, Nigeria. *J. Soc. Sci.* 10(1): 55-59.
40. Sridhar, M.K.C., AdeOluwa, O.O. (2009). Palm Oil Industry Residue. *Biotechnology for agro-industrial residues utilisation*. Nigam, P.S and Pandey, A. (eds.). Springer Science. Pp 341 – 355.
41. Sumathi, S., Chai, S.P., Mohamed, A.R. (2008). Utilization of oil palm as a source of renewable energy in Malaysia. *Renewable and Sustainable Energy Reviews*, 12: 2404 – 2421.
42. Ugbah, M.M. and Nwawe, C.N. (2008). Trends in oil palm production in Nigeria. *Journal of Food, Agriculture and Environment*, 6(1): 119-122.
43. Ugwu, D.S. (2009). Problems and prospects of commercial small and medium scale cocoa and oil palm production in Cross River State, Nigeria. *Journal of Applied Sciences Research*, 5(7): 827-832.
44. World Bank (2013). Over 10 million Nigerian adults are illiterate. *Punch, newspaper*, Tuesday June 4, 2013. Pp. 32.

- 436 45. WWF-India, (2013). Palm oil market and sustainability in India.
437 www.wwfindia.org/?7080/India-supports-Sustainable-Palm-Oil. Accessed October 4th,
438 2013.
439

440
441
442
443