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The Socioeconomic attributes and Risk behaviour of Small–Scale Oil Palm Processors (Millers) in Akwa Ibom State, Nigeria

Sunday B. AKPAN[1✉], Veronica S. NKANTA[2] , Udoro J. UDO[3]
[1,3]Department of Agricultural Economics and Extension, Akwa Ibom State University, Obio-Akpa Campus, Akwa Ibom State, Nigeria, [2]Department of Agricultural Economics and Extension, University of Uyo, Akwa Ibom State, Nigeria
[1]https://orcid.org/0000-0002-0458-028X: [2]https://orcid.org/0000-0001-7035-7978: [3]https://orcid.org/0000-0002-6915-2788
✉: sundayakpan@aksu.edu.ng

ABSTRACT
This study examines the socioeconomic and risk behaviour of small–scale oil palm processors in Akwa Ibom State, the southern region of Nigeria. The multi-stage sampling technique was used to collect cross-sectional data from one hundred and twenty-five (125) micro-oil palm processors. The results revealed that the majority of the processors were married and males were the dominant sex. The average years of processing experience, age, membership in social organization and educational attainment stood at 11.43 years, 48.23 years, 2.78 years and 12.15 years respectively. The processors' average household size and annual income were 5 members and ₦319, 658.33 (at 1$ = ₦380.26 in 2020) respectively. The risk factors identified among the micro-oil palm processors include insufficient raw materials, poor public electricity, high cost of tools and machines and increased operation hazards. The result showed that oil palm processors in the region are risk-takers. The empirical results revealed that processors' age, educational attainment, membership in social organization, household size, processing experience and processors' income were significant factors influencing the risk behaviour of oil palm processors. To enhance the well-being of micro-oil palm processors in the region, emphasis should be devoted to the development of education attainment and social capital formation among others.

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INTRODUCTION
Oil palm (*Elaeis guineensis*) is an economic crop that found its root in the tropical rainforest region of West Africa (Reddy et al. 2019; Okolo et al. 2019). From the archived, Nigeria was the leading producing nation of oil palm in the 1960s, contributing about 43% of the World production (FAO, 2022). Currently, the country is the 5th largest producer with 2.00% (i.e. 1.141 million metric tons) of the global output of 72.973 million MT (USDA, 2022 and FAO, 2022). Malaysia and Indonesia produced approximately 84% of the World's palm oil with Indonesia accounting for 58.00% (representing about 42.50 million MT) (USDA, 2022). In Africa, Nigeria is known to produce the bulk of palm oil and is also the highest consumer. The country's large population has continued to be an important driver of demand for oil palm and its derivatives. In recent times, the domestic consumption of oil palm products has exceeded supply in most parts of the West Africa region thus making the region a net importer of oil palm products (Akpan, 2019 and USDA, 2022). Despite the continuous marginal increase in annual production, Nigeria is a net importer of palm oil and its derivatives (Ohimain and Izah, 2014; USDA, 2019). For instance, the country produced 1220 metric tons of palm oil in 2019 while the domestic consumption stood at 1390 metric tons resulting in a 12.23% deficit in domestic production which was augmented through importation (Akpan, 2019 and FAO, 2022 and USDA, 2022).

It is reported that more than 80% of the oil palm fruit production in Nigeria originates from the dispersed several smallholder farmers while established plantations accounted for the remaining 20% (Ojo *et al.,* 2017 and USDA, 2020). To boost domestic production in the country, the federal government has implemented trade policies and launched a series of intervention programmes to increase the credit scope of oil palm farmers and encourage large scale production and processing (CBN, 2020). The processing of oil palm fruits for edible and palm kernel oils as well as other derivatives is an old occupation and is crucial to the economies of many rural households in southern Nigeria where the bulk of the

oil palm is produced (Patrick et al., 2013; Udoh and Essien 2015, Bassey 2016, and Okolo *et al.,* 2019; Alabi *et al.,* 2020). According to Osei-Amponsah et al. (2018), oil palm fruit processing involves several steps: harvesting the bunches, bunches slicing or threshing, fruit separation from the bunches, boiling of the fruits, digestion or separation of the fruit from fibres, oil extraction, clarification/separating oil from impurities and storage. Most of these steps are done manually in developing countries compared to highly mechanized processing steps in developed countries (Oyeronke and Adedotun 2019). Palm oil is the most popular derivative of oil palm fruit processing (Boyce, 2017 and Anyaoha *et al.,* 2018) and is an essential ingredient in the dietary requirement of most Nigerians. It is also a source of raw materials for many agro-allied and pharmaceutical enterprises. The food processing, cosmetic and hygiene as well as biofuel industries are responsible for 72%, 18% and 10% of industrial consumption respectively (Voora *et al.,* 2019). The predominant technique of production for most processors in Nigeria is semi-labour intensive and is often characterized by the inefficient utilization of farm resources (Hassan et al., 2016; Biodun et al., 2020). However, Izah (2016) and Ebere et al., (2018) noted that the smallholders and mostly semi-mechanized palm oil processors in Nigeria account for about 70-80% of the total domestic palm oil production.

In the south-south region of Nigeria, there are many wild oil palm trees spread throughout the region. An oil palm tree has a great economic value to the indigenes of the area and is mostly cultivated or maintained for its commercial benefits. The south-south region produces about 42% of the country's palm oil, while the south-east and southwest produce 25% and 27% respectively (USDA, 2022). Since the oil palm crop production requires an expanse of land and the prevalence issue of high population density in the southern region of the country, limited land has been one of the constraints facing the enterprise. In the region, about 60-80% of palm oil processing is carried out using the semi-capital technique (a mixture of the traditional and limited capital/machines) (Akpan and John, 2020). The bulk of the oil palm processing enterprises is (micro) small scale with producing capacity in the range of half a ton or 500kg to 2.5 tons of fresh fruits per hour (Akpan and Akpan, 2020). Despite the enormous potential in oil palm production, especially its rich long value chains; oil palm processors have not been able to translate these diverse opportunities to better welfare and improved income (Patrick *et al.,* 2013 Akpan et al., 2020a). This is evident in increasing rural poverty among farming households in the region and the country at large (Akpan *et al.,* 2016 and Akpan et al., 2020b), frequent shortages of palm oil and high price volatility (Gourichon, 2013 and Alabi *et al.* 2020); as well as an increasing number of moribund micro oil palm processing enterprises across the producing regions in the country (Enwelu *et al.,* 2013). Observations from various studies indicate that the once flourishing sub-sector in the country is gradually becoming desolate due to multifaceted issues ranging from farmers' specific to economic, production risks, political and environmental detractors among others (Patrick *et al.,* 2013 and Akpan *et al.,* 2019). For instance, in the southern region of the country, agricultural labour in the rural areas is highly constrained by increasing youth migration to urban areas, and oil palm production and processing depend so much on human labour (Akpan *et al.,* 2017). Also, insufficient credit, poor infrastructures in the rural communities and unhealthy rivalries from imports, land use alternatives and population growth have not given the oil palm processors an easy ride to production in the region (Udoh *et al.,* 2011; Akpan, 2019; Akpan and Ebong 2021). Amidst these uncertainty and risky situations highlighted and among others, oil palm processors still plan their ways through these hash situations to produce the oil palm fruits and their derivatives though in decreasing returns to scale (Akpan, 2019).

Perhaps, the oil palm processors in the producing region have developed ways to adapt to these uncertainties and risky environments in which they operate (Izah and Ohimain 2016). Hence, it is presumably right, that the wrinkling performance of the oil palm sub-sector in the region and Akwa Ibom State, in particular, has a lot to do with processors' socioeconomic behavioural response to the risky environment and other related factors including poverty (Ojo *et al.,* 2017 and Akpan, 2019). Following these assertions, there is an overwhelming need to investigate the oil palm processors' social and economic behaviours and analyze their risk coping strategies to understand better, the path to sustainable production and improved farmers' or processors' well beings.

In line with the above thought, few studies have studied the social and economic attributes of the small scale oil palm processors' in Nigeria. For instance, Soyebo (2005); Akinnirant *et al.,* (2013); Patrick *et al.,* (2013); Emokaro and Ugbekile (2014); Adebo *et al.,* (2015); Adesiji *et al.,* (2016); Nwalieji and Ojike (2018) and Akpan *et al.,* (2019) have identified that oil palm processors were majorly males, possess the average household size of 7 members, moderately educated, are married and of middle age and well experienced in oil palm processing. The reports also submitted an average processing income range of ₦1, 000, 000.00-₦1, 006, 852.00 per annum and an average monthly gross margin range of about ₦69,600-₦100, 000.00. Besides, Gunn (2014) identified: the high cost of palm oil processing, insufficient access to credit facilities; lack of government supports, poor extension system;

unstable price of oil palm, poor road network, and obsolete processing technologies as the main constraints against the use of improved technology by the oil palm processors.

In a few related literature on sources of risks to farmers, Ezeh and Olukosi (1991); Salimonu and Falusi (2009); Udoh and Essien (2015), Okolo et al., (2015) and Onu et al., (2021) documented irregularity in input supply, volatility in market prices, pest, government policies, diseases, inaccessibility to credit facilities and the use of obsolete processing equipment, poor water supply, poor equipment, inadequate land, lack of information on modern oil palm processing and changes in weather conditions as the major risk sources in crop production and processing in Nigeria. Similarly, literature on the risk behaviour of farmers has been documented by Nmadu *et al.,* (2012) and Akhtar *et al.,* (2017). In summary, they identified processors' sex, education, distance from farm to the main market, off-farm income, age, farming experience, access to extension agents, marital status, household size, family income, credit, membership of cooperative, off-farm income, access to information, mode of land acquisition and total investment capital as significant variables that determined risk behaviour of small-scale farmers. Likewise, Biodun et al., (2020); Alabi *et al.* (2020) and Islam *et al.,* (2021) found high transport cost, output price fluctuations, insufficient raw materials and credit, crude processing methods, poor quality of the output and poor infrastructures as major risk factors for crop processors.

From the literature reviewed, the oil palm enterprise in the country has not been given due attention in terms of the risk attitude of the processors despite its rich value chains and providing sources of livelihood to many rural households. The study was specifically designed to fill this lacuna and equally update the available information on the socioeconomic characteristics of the processors, hence providing additional resources for policymakers in the region and country at large. Hence, the study examines the social and economic attributes of the small-scale oil palm processors and also identifies the risk coping strategies adopted by them in the prevailing harsh and risky production environment as well as identifying factors that influence their risk attitude/risk index.

RESEARCH METHODOLOGY

Study Area

The study was carried out in Akwa Ibom State located in the southern region of Nigeria. The State is divided into six agricultural zones namely: Uyo, Oron, Ikot Ekpene, Eket, Abak and Etinan. Three zones were selected based on the volume of oil palm fruit production. The zones used were: Ikot Ekpene, Abak and Eket agricultural zones.

Study Population

The sample population consists of all the oil palm processors (millers) in Ikot Ekpene, Abak and Eket agricultural zones in Akwa Ibom State. According to the ADP representatives in the zones, there are about 800 well-established oil palm processors in the zones.

Sample Size Selection

The study used Cochran's (1963) formula to derive a representative sample size from a finite population of oil palm processors in the study area. The equation is specified as thus:

$$S_n = \frac{z^2 P(1-P)}{D^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where S_n is the required sample size; Z is the 95% confidence interval (1.96); P is the estimated proportion of micro oil palm processors in the total population of oil palm processors in the study area (about 91%); D is the absolute error or precision at 5% type 1 error. The sample size is derived as shown in equation 2

$$. S_n = \frac{(1.96)^2 0.91(1-0.91)}{(0.05)^2} = 126 \ldots\ldots\ldots (2)$$

Type of Data, Sampling Procedure and Sample Size

Primary data were elicited from the micro oil palm processors in selected zones. A well designed structured questionnaire was administered to the oil palm processors to collect the required data. A two-stage sampling technique was adopted to choose the required sample size used in the study. The first stage involved the use of purposive sampling to select three local government areas in each zone. This led to the selection of nine (9) local government areas. The second stage involved the random selection of fourteen (14) small-scale oil palm processors in each of the selected local government areas. A total of one hundred and twenty-six (126) micro oil palm processors representing more than 15.00% of the target population were selected in the zone for the study. However, one hundred and twenty-five (125) oil palm processors' responses were used for the analysis.

Defining Risks and construction of the risk index in the study

In this study, risks were perceived as those factors that prevent the micro oil palm millers from achieving the optimum or sustainable income/production required to maintain the enterprise. It is also assumed that the effect of risks on the oil palm millers' income or production can be estimated, unlike the uncertainties. Different types of risks were considered in computing the risk index of an oil palm miller in the study area. The type of risks considered were; production, marketing, environmental, financial, and human resource risks.

The risk index is the measure of farmers'/processors attitudes to risk. To construct the risk index, several questions cut across all the types of risks considered in this study were drafted. The sum of positive responses of the oil palm processors was weighted with the total number of questions asked to generate the risk index used in the study. Mathematically, the index estimated is presented as thus:

$$\boldsymbol{RI} = \frac{\sum \textbf{summation of the number of positive response(s) of the oil palm miller}}{\sum \textbf{total questions asked}} \ldots\ldots (3)$$

The risk index (RI) ranges from zero to unity. When the RI approaches zero, it means that the oil palm miller is risk-averse or has taken sufficient efforts to deal with the risks. In other words, such respondent has developed alternatives to eliminate the negative impacts of several risk factors in the business. Also, an index of 0.5 connotes moderate ability to address these risks (risk-neutral), while a risk index approaching unity implies risk tolerance (risk-taker) oil palm miller. The risk tolerance or risk-taker investor can bear or tolerate several risk factors amidst production and other components of the value chain.

The model specification

The descriptive tests were used to examine the socio-economic characteristics of the micro oil palm millers, while a nominal scale was used to rank the risk factors in order of their prevalence. Besides, multiple linear regression based on Ordinary Least Squares estimation was used to identify the causal relationships between the risk index and the social and economic characteristics of the oil palm millers in the study area.

Explicitly, the risk index model used is specified as thus:

$$RI_i = Y_i = \beta_0 + \beta_1 AGE + \beta_2 SOC + \beta_3 EDU + \beta_4 EXP + \beta_5 HHS + \beta_6 CRE + \beta_7 EXT + \beta_8 PIC + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where,

RI = Risk index of oil palm miller as defined in equation 1

AGE = age of the oil palm miller owner (years)

SOC = oil palm miller membership in social organization (years)

EDU = educational qualification of oil palm miller (years)

EXP = experience of the oil palm miller/processor (year)

HHS = household size of the oil palm miller/processor (number)

CRE = access to credit facility by oil palm miller (dummy; 1 for access and 0 for non-access)

EXT = access to agricultural extension services by the oil palm miller (dummy; 1 for access and 0 for non-access)

PIC = income from oil palm processing business (naira)

RESULTS and DISCUSSION

Socioeconomic characteristics of oil palm processors

The summary of the socio-economic features of the micro oil palm processors is shown in Table 1. The finding revealed that the majority of the oil palm processors (96.80%) were males, while a minority (3.20%) were female. The result of the sex composition of the processors is likely linked to the fact that the male processors are more able to withstand the rigorous demands of agro-processing compared to their female counterparts. The finding corroborates Soyebo (2005), Akinnirant *et al.,* (2013), Patrick *et al.,* (2013), Emokaro and Ugbekile (2014), Adebo *et al.,* (2015) and Nwalieji and Ojike (2018).

Also, the majority (35.20%) of the processors were in the age range of 41-50 years, while 21.60% and 26.40% of the processors were in the age range of 31-40 and 51-60 respectively. However, the youthful (20-30 years) and the aged (greater than 60 years) populations constituted 8.00% and 8.80% of the sample population respectively, while the average age of 48.23 years was obtained for all the processors. Following this finding, there is an overwhelming need to encourage youth involvement in oil palm processing in the study area. Concerning the age distribution of the processors, it means that majority of the oil palm processors are fast ageing and there is an overwhelming need to encourage youth involvement in the oil palm processing businesses. The involvement of the youths in the business would ensure sustainability and the adoption of updated technologies. A similar finding has been reported by Soyebo (2005), Akinnirant *et al.,* (2013), Patrick *et al.,* (2013), Adebo *et al.,* (2015), Nwalieji and Ojike (2018) and Akpan *et al.,* (2019).

Besides, the result reveals that the majority (96.80%) of the processors were married while only 3.20% were single. The marital status of the processors suggests that oil palm processing is a sustainable livelihood activity for several families. This means that many families in rural areas depend on the oil palm processing business for their improved well-being. Soyebo (2005), Akinnirant *et al.,* (2013), Patrick *et al.,* (2013), Emokaro and Ugbekile (2014), Adebo *et al.,* (2015), Adesiji *et al.,* (2016), Nwalieji and Ojike (2018) and Akpan *et al.,* (2019) have reported a similar result.

Moreover, the distribution of the processing experience of the processors indicates that 60.00% of the processors have experience of 1-10 years, 30.40% belong to 11-20 years of processing experience while

9.60% settled in 21-30 years experienced cadre. An average of 11.43 years of processing experience was realized for all the processors. In line with the above result, the average processing experience of 11.43 years shows the level of sustainability of the business in the region. A similar structure in processing experience has been found by Soyebo (2005), Akinnirant *et al.,* (2013), Patrick *et al.,* (2013), Nwalieji and Ojike (2018) and Akpan *et al.,* (2019).

Table 1. Socioeconomic characteristics of micro oil palm Processors

Characteristic	Frequency	Percentage	Mean
Marital Status of processors (number)			
Single	4	3.20	
Married	121	96.80	Dummy
Total	**125**	**100.00**	
Processing Experience (Years)			
1-10	75	60.00	
11-20	38	30.40	11.43
21-30	12	9.60	
Total	**125**	**100.00**	
Educational Qualifications (years)			
No Education	2	1.60	
Primary	21	16.80	
Secondary	50	40.00	12.15
Tertiary	52	41.60	
Total	**125**	**100.00**	
Membership in Social Organization (years)			
0	73	58.40	
1-10	46	36.80	
11-20	6	4.80	2.78
Total	**125**	**100.00**	
Family Size of processors (number)			
1-5	85	68.00	
6-10	38	30.40	5.00
Greater than 10	2	1.60	
Total	**125**	**100.00**	
The processed income per year (Naira)			
Less than 100,000	33	26.40	
100,001-300,000	29	23.20	
300,001-500,000	25	20.00	
500,001-700,000	17	13.60	319,658.33
700,001-1,000,000	15	12.00	
Greater than 1,000,000	6	4.80	
Total	**125**	**100.00**	
Sex composition of processors (number)			
Male	121	96.80	Dummy
Female	4	3.20	
Total	**125**	**100.00**	
Age Distribution of processors (Years)			
20-30	10	8.00	
31– 40	27	21.60	
41– 50	44	35.20	48.23
51-60	33	26.40	
>60	11	8.80	
Total	**125**	**100.00**	

The analysis of the educational qualification of the micro oil palm processors shows that the majority of the processors (41.60%) went through tertiary institutions and 40.00% obtained secondary education, while 16.80% of the processors had primary education.

Only 1.60% of the processors had no formal education. An average of 12.15 years of formal education was revealed among the processors. Also, the educational qualification of the processors suggests that the oil palm processors have the potential for innovation adoption, market participation and access to several information sources. Akinnirant *et al.,* (2013), Patrick *et al.,* (2013), Nwalieji and Ojike (2018) and Akpan *et al.,* (2019) had similar results.

The findings further reveal that the majority (58.40%) of small-scale oil palm processors do not belong to any social group. About 36.80% and 4.80% of the processors have enjoyed social capital for the period of 1-10 years and 11-20 years respectively.

Source: Computed by authors, data from field survey, 2020. Average annual exchange rate (1$ = ₦380.26 in 2020)

This implies that oil palm processors in the study area have a low level of social interaction or social capital. This assertion is substantiated by an average of 2.78 years of social interaction found among them. In addition, the low degree of social capital creation among the processors means that somehow they might not have adequate information to update their current levels of production. The prevalence of low capital formation among the oil palm processors could be attributed to the increasing job diversification, the unorganized market for oil palm products and sometimes societal mistrust as well as cultural and religious barriers. The finding corroborates Akpan *et al.,* (2019).

As well, the structure of the family labour was analyzed and is important within the framework of small scale production. An average household size of 5 members was found for the processors. However, the breakdown of the family size of the processors shows that 68.00%, 30.40% and 1.60% of the processors have a family size in the range of 1-5, 6-10 and greater than 10 members respectively. Furthermore, the structure of the household size reveals the significance of household labour in the oil palm processing business. The method of processing is mainly labour intensive and hire labour is becoming scarce following the alternative/competitive use from other farm activities and the issue of rural-urban migration. Emokaro and Ugbekile (2014), Adesiji *et al.,* (2016), Nwalieji and Ojike (2018) and Akpan *et al.,* (2019) submitted similar results.

The study also reveals that the majority (26.40%) of the processors make less than ₦100, 000 annual income. About 23.20% of the processors earned annual income in the range of ₦100, 001 to ₦300, 000; while 20.00% of the processors realized annual income in the category of ₦300, 001-₦500, 000. Only 13.60% and 12.00% of the processors generated annual income in the range of ₦500, 001 to ₦700, 000 and ₦700, 001 to ₦1, 000,000.00 respectively. The finding reveals that only 4.80% of the processors earned more than ₦1, 000,000.00 per annum. However, an average annual income of ₦319, 658.33 was discovered among the processors in the study area. The size of the annual income generated from the oil palm processing business in the study area justified the small scale nature of the business. The finding is within the range submitted by Adebo *et al.,* (2015), Adesiji *et al.,* (2016) and Akpan *et al.,* (2019).

RISK FACTORS FACED BY OIL PALM PROCESSORS

Risk factors in oil palm processing are considered inducers or promoters of risks. These are challenges or constraints an oil palm processor must unravel before the attainment of efficient production and sustained profitability. These risk factors confronting the oil palm processors were analyzed and the results are presented in Table 2. From the finding, all processors attested to the fact that an insufficient quantity of oil palm fruit is the number one challenge hindering the efficient processing of oil palm fruit or attainment of full capacity utilization rate. The problem of insufficient quantity of oil palm fruit stems from the seasonality in production; unhealthy rivalry among buyers and the increasing alternative of oil palm land use. The resultant effect is the shortage experienced in the supply and this sometimes leads to an increase in the price of the oil palm fruits. The price fluctuation is, however worst during the lean season compared to the on-season.

The findings also reveal the poor public supply of electricity and the high cost of billing as among the major risks hindering the improved performance of the oil palm processing business in the study area. Also, the erratic supply of public electricity has pushed the majority of the processors to depend on other sources of power which are expensive and hence increase the production cost and reduce the profit margin. Sufficient power is needed to carry out efficiently the activities of palm fruit processing and hence constitutes a significant part of the production cost.

Another important risk factor encountered by the oil palm processor in the region is the issue of the high cost of tools, machines and equipment used in the processing business. The acquisition of these necessary tools, equipment and machines help to relieve the stress and drudgery involved in the oil palm processing business. Most of the processors are resource-poor and thus do not have a sufficient resource base to acquire the necessary capital needed to achieve high efficiency in the business. This challenge was obvious among the processors as the majority of them owned and operates obsolete machines, tools and equipment as well as made use of the traditional method of production.

Table 2: Perceived Risks in the oil palm milling (oil palm processors) in Akwa Ibom State

S/N	Risk factors faced by the oil palm processor	Percentage response	Ranking
1	Insufficient raw materials (oil palm fruits)	100.00	1st
2	Poor public electricity/high cost of billing	95.00	2nd
3	High cost of tools, machines and equipment	93.33	3rd
4	Increase operation hazards	93.33	3rd
5	Theft/pilfering	88.33	4th
6	Poor road network	85.00	5th
7	High transportation cost	80.00	6th
8	Price inconsistency of raw materials	75.00	7th
9	Lack of adequate skills to operate machines	43.33	8th
10	Higher wages for hired labour	25.00	9th
11	Lack of purchasing power/insufficient demand	21.67	10th
12	No organized market for processed products	16.67	11th

Source: Computed by author, data from field survey, 2019. Multiple choices were allowed.

The processors, in addition, revealed the prevalence of the operation hazards as a serious risk factor affecting the efficient operation of oil palm processing. The issue of increase in operational hazard has to do with the inferior technique of production used and almost zero training and research among the processors. All the activities involved in oil palm fruit processing are without operational hazards. From harvesting to transporting the fruits to the processing site, there are hazards associated with all the stages of processing. The hazards range from mild to severe and could sometimes lead to death. For instance, during harvesting and thrashing of the bunch among other activities; processors opined that they suffered a daily injury in the business of oil palm processing. Minimizing the frequency of these hazards is critical to attaining higher capacity utilization and efficiency of resources used,

Another serious risk factor identified was pilfering or theft. This is a serious drawback factor to many processors in the study area as the menace of theft is predominantly reported by the processors because most of the processing units are located in isolated areas but closer to the source of raw materials. Most of the processors do not have sufficient financial backup to obtain adequate security for their raw materials, machines and other factors of production, as such they are exposed to pilfering at all levels of production.

The risks of the poor road network and high transportation costs were also selected by the processors as among the impediments to attaining higher capacity utilization. The poor farm road could delay the conveying of oil palm fruits to the processing site. Oil palm processing is a time-bound activity and the quality of oil palm produced is the function of the number of hours a processor subject the fresh fruits to processing.

In the other perspective, the bulkiness of the oil palm fruit leads to the high cost of transportation and this is one of the major components of production cost. A processor that purchases fruits far away from his processing site would likely incur a higher cost of transit.

The price inconsistency of the raw materials (especially the palm fruit) in the market is one of the major risk factors whirling around the oil palm processors in the study area. The inconsistency in price occurs following some imperfections in the oil palm fruit market in the region. For instance, bunch sizes depend on the species of the oil palm tree, taxes, the transportation cost and price bargaining including competition created by the rich merchants from the neighbouring States among others. The minor risk factors or challenges the processors identified include; Lack of adequate skill to operate the machines, high wages for hired labour, lack of purchasing power or insufficient demand, and the unorganized market for processed products. The findings are in agreement with the reports of Ezeh and Olukosi (1991), Salimonu and Falusi (2009), Gunn (2014) and Akpan *et al.,* (2019).

Risk index distribution among oil palm processors

The summary of risk behaviour or attitude of the oil palm processors is presented in Table 3. The mean risk index is 0.64118, implying that many of the oil palm processors bear or operate in risky situations rather than averting them. Hence, on average the oil palm processors in the study area are risk-takers. Only 15.20% of the oil palm processors have lower risk indices in the range of 0.40 - 0.50. This means that this set of processors has a lower capacity to operate in the risky environment or has taken measures to mitigate the various forms of risks confronting them.

Contrary, about 84.80% of the oil palm processors can be described as risk-takers because their risk index exceeds 0.500 units, though the result shows different degrees of risk-taking. This category of oil palm processors can adapt or integrate risky situations into

the operation of oil palm processing. To exhibit this character of risk-taking does not portray efficient management but rather represents additional cost to the total cost of production because each risk factor has a cost. However, the minimum and maximum risk factors reported among the oil palm processors were 0.412 and 0.941 respectively, while 19.67% of the variability in the risk index was observed. The distribution of the risk factors skews positively denoting increasing tendencies of risks among micro oil palm processors.

Table 3: The risk index distribution among oil palm processors

Category	**Frequency**	**Percentage**
0.400-0.500	19	15.20
0.501-0.600	40	32.00
0.601-0.700	23	18.40
0.701-0.800	31	24.80
0.801-0.900	10	8.00
0.901-1.000	2	1.60
Total	**125**	**100.00**
Minimum	0.41176	
Maximum	0.94118	
Mean	0.64118	
Standard deviation	0.12616	
Coefficient of variability	0.19677	
Skewness	0.22432	

Sources: Computed by authors.

Determinants of risk behaviour of small-scale oil palm processors

The causal relationship between the risk indices and socioeconomic characteristics of the micro oil palm millers/processors was investigated using the multiple linear regression model based on the OLS estimation technique and the estimates are presented in Table 4. The R-squared value (0.6451) revealed that about 64.51% of the total variability in the risk indices is associated with the specified explanatory variables. The F-statistic (4.709) is significant at 1% probability level. This indicates that the estimated R-squared is significant and by implication the estimated model has the goodness of fit. The multicollinearity factor (a prominent problem common among cross-sectional data) was tested with the variance inflation factor (VIF) and tolerance ratio. The result showed no significant presence of multicollinearity. This further confirmed the reliability of the estimates of the multiple regression model. Furthermore, the estimated RESET test, heteroscedasticity and normality of the error term tests indicated structural rigidity of the estimated model, absence of heteroscedasticity and justification of the use of Ordinary Least Squares estimation methods respectively. This implies that the estimates are consistent and unbiased

Table 4: Ordinary Least Squares estimates of the risk index of oil palm processors in Akwa Ibom State

Variable	Coefficient	Robust Std. error	t-test	Prob.	VIF	Tolerance factor
Constant	0.7064	0.0868	8.135***	0.0000	–	–
AGE	−0.0018	0.0008	−2.250**	0.0310	1.414	0.7072
SOC	−0.0036	0.0015	−2.390**	0.0213	1.255	0.7968
EDU	−0.0066	0.0038	−1.729*	0.0838	1.301	0.7686
EXP	−0.0056	0.0032	−1.751*	0.0816	1.415	0.7067
HHS	0.0005	0.0002	2.500**	0.0192	1.564	0.6394
CRE	0.0266	0.0350	0.760	0.4473	1.513	0.6609
EXT	−0.0141	0.0338	−0.417	0.6770	1.159	0.8628
PIC	−6.68e-09	3.36e-09	−1.989*	0.0467	1.515	0.6601
Diagnostic tests						
R-Squared		0.6451	White test (P-value)		0.16757	
F-Cal (8, 117)		4.7086***	RESET test (P-value)		0.15779	
Normality test (P-value)		0.82492	Adjusted R-Squared		0.43980	

Source: Computed by authors, asterisk, *, ** and *** represent significant probability at 10%, 5% and 1% respectively.

The empirical results showed that oil palm processors/millers' age has a negative relationship with the risk index factor of oil palm milling. The result implies that a unit increase in the processor's age would lead to about 0.0018 unit reduction in the risk index. This means that older processors are more risk-averse compared to younger ones. In other words, the older processors will likely adopt alternative ways to avert risky situations rather than tolerate them. Similar results have been submitted by Akhtar *et al.,* (2017) and Islam *et al.,* (2021).

The result also showed that increase in social activities or being a member of a social organization has a negative correlation with the risk index of oil palm millers in the study area. This means that being an active member of an oil palm processors' association will reduce the risky situations common to the business. For instance, a year increase in membership of a related social group or oil palm processors' social group will reduce the risk index by 0.0036 units. The result satisfies priori expectation because social capital accumulation resulting from being a member of a social organization help in information sharing thereby helping to avert some common risks inherent in the business. Related results by Akhtar *et al.,* (2017) and Nmadu *et al.,* (2012) substantiate this finding.

The coefficient of education is negative and significant at a 10% probability level. This means that years of formal education of an oil palm processor is a significant negative determinant of risk index or attitude. Precisely, a year increase in the formal education of the processor would lead to a 0.0066 unit reduction in the risk index of oil palm milling. An increase in education would likely increase the oil palm processors' risk coping ability. It will also increase the scope of information available to the processor on oil palm processing risks and equally improve the quality of human resources as well as managerial ability in the business. When these attributes are obtained following improvement in formal education, the oil palm processors will be risk-averse. The finding corroborates Nmadu *et al.,* (2012).

The oil palm processors' experience has a significant (at a 10% probability level) negative relationship with the risk index. A year increase in processing experience will lead to a 0.0056 unit decrease in the risk index. The plausible reasons for the result include the fact that an increase in processing experience bred mitigation strategies in the short run and allowed the processor to adapt to risk reduction plans in the long run. The finding aligns with the Nmadu *et al.,* (2012) report.

Similarly, the processing income of an oil palm processor has a significant (at 10% probability) negative relationship with the risk index. This means that the more income accruing to the processor, the more likely production and other forms of risks will be averted in oil palm milling. The result is in agreement with a priori expectation as an increase in income will provide alternative means of solving risky situations at any point in the value chain of oil palm production. Akhtar *et al.,* (2017) found a similar result.

Contrary to the above results, an increase in the household size has a triggering effect on the risk index of oil palm processors in the study area. By implication, a unit increase in the processors' household size induces about 0.0005 (at 5% probability) unit increase in the risk index of oil palm processors in the study area. An increase in household size increases the household expenditure thereby depriving farm households of sufficient financial ability to tackle risky situations on the farm. The finding agrees with the report of Nmadu *et al.,* (2012)

SUMMARY and CONCLUSION

The study examined the socioeconomic characteristic and risk factors confronting the micro-oil palm processors in Akwa Ibom State, Nigeria. The results revealed that oil palm processors were fast ageing, hence the need to encourage youths into oil palm processing is obvious in the State. Also, there is low social capital formation among oil palm processors which has contributed to the slow innovation adoption among the micro-processors. Besides, results showed that the majority of the processors were males, married and have attended tertiary and secondary schools. The average years of processing experience, age, membership in social organization and educational attainment stood at 11.43 years, 48.23 years, 2.78 years and 12.15 years respectively. The processors' average household size and annual income was 5 members and ₦319, 658.33 respectively. The risk factors identified among the oil palm processors include insufficient raw materials (oil palm fruits), poor public electricity/high cost of billing, high cost of tools, machines and equipment, increase operation hazard, theft, poor road network and high transportation cost among others. Findings revealed that oil palm processors in the region are risk-takers. The empirical findings showed that the processors' age, social capital, processing experience and income, as well as formal education, are negative determinants of the risk index/attitude of the oil palm processors: while the household size was identified as a positive determinant.

In conclusion, it is glaring that harnessing resources to fast track development in oil palm processing will contribute immensely to the improvement in human capacity available in the sub-unit and reduce poverty among Nigerians. However, the sub-unit needs urgent interventions to reduce the risky situations associated with its value chain. The study has identified a myriad

of factors that should be considered by the policymakers for meaningful and sustainable interventions in the sub-unit. Therefore, based on the findings, it is strongly recommended that government and all stakeholders in the agricultural sector in the region should develop policies that will improve the socioeconomic characteristics of the oil palm processors and reduce the risk factors in the business to achieve better efficiency the business. Also, the adult education programme in the State should be strengthened for efficient delivery.

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