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From Crisis to Co-creation: Analyzing the Effect and Economic Rejuvenation Strategies in Palm Oil Processing in Irele Local Government Area

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ABSTRACT

The study examined effect and economic rejuvenation strategies in palm oil processing during and post COVID-19 in Irele Local Government Area, Ondo State. Multistage sampling technique was employed in the selection of 215 respondents for the study. Data were collected using structured questionnaire and responses were collated and analyzed using descriptive statistics and regression analysis. Findings revealed that threshing of bunch was the most tedious activities experienced during palm oil processing and that COVID-19 affected the operational activities of palm oil processing as the lockdown hindered major operational activities of palm oil, as well as caused a total pause of operational activities of palm oil processing. In addition, the gross margin during COVID-19 in 2020 was ₦435,000.00 and the post COVID-19 gross margin in 2023 was ₦565,000.00. Regression result indicated that household size ($p< 0.001$), processing experience ($p< 0.001$), labour ($p< 0.05$) and threshing cost ($p< 0.001$) have positive coefficients and are statistically significant factors that contributed to profit in palm oil processing. The study therefore recommended that farmers should be encouraged to form co-operative societies to solve the problems of inadequate information and cultivation knowledge as well as give the avenue for earnest government intervention measures in case of any outbreak or crises.

INTRODUCTION

Palm oil, in addition to cocoa, rubber, groundnut was among the important cash crop and mainstay of Nigerian economy especially in pre-oil era. It is one of the major sources of livelihood in most rural areas and semi urban areas of Southern Nigeria. Male and female; young and old were involved in its production. Palm oil processing technique could either be through the traditional production technique or modern method. Although, the use of the machine is faster and easier, most palm oil processors still adopt the traditional processing technique as a means of production because this technique appears to be more affordable and cost-effective. The enterprise is very viable in spite of the numerous constraints such as high cost of harvesting, long-duration during production, lack of storage facility, unavailability of labour, deterioration of produce, unavailability of market among others. Another major reason for decline in palm oil processing in recent times could be attributed to the Coronavirus disease (COVID-19) as the advent of the COVID-19 pandemic (an infectious disease caused by the SARS-CoV-2 virus.

In the wake of the unprecedented COVID-19 pandemic, the global landscape underwent a seismic shift, profoundly affecting industries across the spectrum. Among the sectors navigating the intricate challenges posed by this crisis, the palm oil processing industry emerged as a vital yet

vulnerable player in the economic fabric of the Nation. As the pandemic unfolded, its disruptive impact rippled through supply chains, markets, and communities, prompting a need for comprehensive analysis and strategic interventions to navigate the tumultuous journey from crisis to co-creation. Most people infected with the virus will experience mild to moderate respiratory illness and recover without requiring special treatment. However, some will become seriously ill and require medical attention. Older people and those with underlying medical conditions like cardiovascular disease, diabetes, chronic respiratory disease, or cancer are more likely to develop serious illness, (World Health Organization (WHO) 2019; 2020). Anyone can get sick with COVID-19 and become seriously ill or die at any age. COVID-19 pandemic dealt a huge blow on all activities in the world, including in the area of agriculture, most especially palm oil processors. Nigeria was adversely affected by the COVID-19 pandemic. Due to the persistent increase and spread of the COVID-19 virus in the Nigeria, the Federal Government eventually announced a nationwide lockdown on March 30, 2020, taking immediate effect in three States of the Federation: Lagos, Ogun, and Abuja.

The effect of the COVID-19 lockdown on the price of farm product cannot be over-emphasized as the farm market gate price went down *because of the market shutdowns, and reduced movements, especially interstate, by traders. For the same reasons, prices of food items in regional markets increased substantially. So, processors were making reduced profits by selling in local markets while urban consumers were paying higher prices because of low supplies in the regional markets.* The pandemic also causes movement restriction intra and inter States within the country which impacted the shortage of workers to harvest the perishable palm fruit resulting in decrease in output. The agricultural sector has become critical since then. In the plantation sector, the impact of COVID-19 caused the border closure that prevented foreign labour from entering the country (Adnan & Nordin, 2020). The new legislation of Standard Operating Procedure (SOP) regarding COVID-19 affected the operation activity in palm oil production. It should therefore be noted that, World Bank reported that economic expansion will experience a decline after COVID 19, that is by the end of 2024, people in about one out of every four developing countries and about 40% of low-income countries will still be poorer than they were on the eve of the COVID pandemic in 2019. In advanced economies, meanwhile, growth is set to slow to 1.2% this year from 1.5% in 2023 (Adnan & Nordin, 2020).

Nigeria was considered the world leader in the palm oil market in the 1950s and 1960s when agricultural products like palm oil and cocoa were the key commodities generating foreign exchange for the country. However, this is not the case, as the sector suffers neglect. Within the last 10 years, Nigeria's palm oil production has increased particularly between 2009 and 2022, production increased significantly, data published by the United State Department of Agriculture showed. The highest growth was registered in 2010 by roughly 14 per cent over the 850,000 metric tonnes in the preceding year but the impact is yet to be felt in the country's local consumption demand and global market ranking order (Biodun *et al.,* 2021). In the 1950s, Nigeria generated about 43 per cent of the world's total production. The production satisfied local demand, and the excess was exported. Available data however shows that Nigeria has become a net importer of palm oil. In 2022, the production of palm oil in Nigeria reached 1.4 million metric tons. Between 2009 and 2022, the production quantity generally increased, registering the highest growth in 2010, when it grew by roughly 14 percent. From 2014 onwards, the output from palm oil production followed a rising trend United States Department of Agriculture, USDA, (2018). Production continued the trend from 2014 (940,000 MT) onwards. In 2015, production rose to 955, 000 MT and further to 990,000 MT in 2016, 1.03 million MT in 2017, and 1.13 million and 1.14 million MT in 2018 and 2019, respectively. According to the data, in 2021 and 2022, Nigeria's palm oil production averaged 1.4 million metric tonnes and 1.3 million MT in 2020 (USDA, 2018).

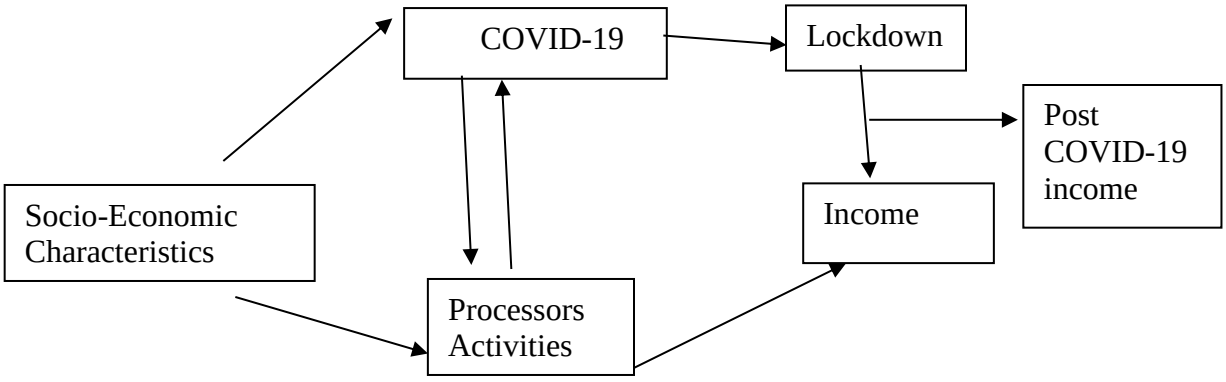
Despite the improvement in production, Nigeria has fallen from its position as world leader to the fifth largest producer, a spot it has stood for more than five years now. The nation now trails Columbia (1.8 million MT), Thailand (3.3 million MT), Malaysia (19.2 million MT) and Indonesia

(45.5 million MT) in production. Based on this data, Nigeria now contributes less than two per cent (1.4 million metric tonnes) to the global production of approximately 74.08 million MT. However, as Nigeria aims to regain its position as the world's largest oil palm producer and processor of palm oil, which was previously lost to Malaysia over three decades ago, successive governments have implemented various efforts to enhance oil palm production and productivity. These initiatives aim to improve processing methods as well (Achmad *et al.,* 2021).

Ondo State is one of the major palm oil producing area in Nigeria. The global palm oil sector is feeling the effects of the COVID-19 pandemic, as demand drops across the world, trade is disrupted and production is hampered in Nigeria and other parts of the world. Although the short-term prospects of the sector are bad, experts suggest it is still too early to say whether the viral epidemic will hurt efforts to expand the sustainable palm oil market in the medium-to-long term. While this research aims to investigate the effect of the COVID-19 crisis on the palm oil processing industry and explore potential economic rejuvenation strategies, there is a scarcity of in-depth studies focusing on the resilience and adaptation strategies employed by the palm oil processing sector in Ondo State in general and Irele Local Government Area in particular. Understanding how businesses in this sector coped with the crisis and adapted their operations could provide valuable insights into building resilience in the face of future disruptions in addition to the fact that World Bank envisaged slowest economic expansion after COVID-19 (WHO, 2020).

Although there have been several studies on palm oil processing in Nigeria, few of which are as follows. Ahmed and Rahman (2021) carried out an overview of palm oil production processors in Nigeria, while Owutuamor *et al.* (2019) studied value addition in oil palm processors in Anyama district Ogbia Local Government Area, Bayelsa State. Also Edem (2015) studied the Palm Oil Marketing and Distribution Pattern in Imo State, Nigeria. The present study however intends to examine the effect and economic rejuvenation strategies in palm oil processing during and post-COVID-19 in Irele Local Government Area.

Palm oil appears as one of the most promising productive alternatives for the Nigerian agricultural sector and long term industrialization. But given the present output level of oil palm products, it is clear that Nigeria is supplying below the quantity demanded and it necessitates the importation of the products. The cost of production plays an important role to ensure the product still can be operated to gain profits and fulfill the demand. The cost of production for smallholders is lower and they operate on a small scale rather than plantations that are operating on a large scale. Based on a previous study (Ahmed and Rahman (2021), Owutuamor *et al.,* (2019) and Edem (2015)), smallholders employ family labor for some activities and this happens due to reducing the cost of production. When the price of palm oil decreases, plantations face challenges. Simultaneously, if the cost of production inputs increases, overall production costs rise. Unfortunately, due to the lower quality of oil palm, companies may experience minimal profits



Source: Authors Concept

Operation Unit

Fruit fermentation	**loosening fruit base from spikelets and to allow ripening processes to abate**
Bunch chopping	facilitating manual removal of fruit
Fruit sorting	removal and sorting fruit from spikelets
Fruit boiling	sterilize and stop enzymatic spoilage, coagulate protein and expose microscopic oil cells
Fruit digestion	rupture oil-bearing cells to allow oil flow during extraction while separating fibre from nuts
Mash pressing	releasing fluid palm oil using applied pressure on ruptured cellular contents
Oil purification	boiling mixture of oil and water to remove water-soluble gums and resins in the oil, dry decanted oil by further heating
Fibre-nut separation	separating de-oiled fibre from palm nuts
Second Pressing	recovering residual oil for use as soap stock
Nut drying	sun drying nuts for later cracking

Using descriptive statistics like frequency distribution and percentages, the socioeconomic characteristics of palm oil processors were examined. The Gross Margin (GM) and Net Farm Income (NFI) was used to estimates costs and returns while the factors that affect the profit for palm oil processors were determined using Ordinary Least Square (OLS) regression. The product of the prevalent wage rate and total man-days of family labor was used to assign values to family labor. To arrive at the net farm value, the values of the fixed items (such as drums (metals), axes, cooking pots, jerry cans and funnels) of the cost were depreciated and added to the rent on land.

Likert scale was used for ranking respondents' responses to challenges faced in the course of processing palm oil the study area. A likert scale is a type of rating scale used to measure attitudes or perceptions of individual regarding a particular topic or issue, (Likert, 1931 and adapted by Adeleke *et al.,* 2017). However Likert scale can be used to collect data on "how strongly or how frequently" respondent believe that challenges have affected palm oil processing. In order to gather information, Likert-type questions with a five-point rating scale were utilized (Adeleke *et al.,* 2017). The questions ranged from: Strongly Agreed, Agreed, Undecided, Disagreed, and Strongly Disagreed on the scale of 5 to 1 respectively.

METHODOLOGY

This study was carried out in Irele Local Government Area (LGA), Ondo State, Nigeria. Some of the towns and villages that make up Irele LGA include Igbinsan, Ajagba, Akotogbo, Omi, Labala, Iyansan, legbongbon, and Gbogi. The estimated population of Irele LGA is 194,761 inhabitants with the vast majority of the dwellers of the LGA being members of the Yoruba ethnic group. Irele LGA occupies a total area of 963 square kilometres and has an annual average temperature of 28^0C. The average humidity level of the LGA is 66 percent while the total precipitation level of the area is estimated to be around 1,560 mm of rainfall per annum. Farming is a critical aspect of the economy of Irele LGA. Apart from Oil-Palm, a number of food crops and vegetables such as yam and pepper are also grown in the area. Trade also flourishes in the LGA as the area plays host to a number of markets where a variety of commodities are bought and sold. Other important economic activities in Irele LGA include blacksmithing and hunting.

Multistage sampling technique was employed in the selection of respondents for the study. The first stage involved purposive selection of Irele LGA of Ondo State. This is because of high density of palm oil processors compared to other LGA in the State. In the second stage, a random sampling of ten (10) communities from the selected Local Government Areas that are primarily into palm oil processors. At the third and final stage, there was random and representative sampling of twenty

two (22) oil palm processors from each of the selected communities. This means that the total sample size of 220 respondents. Five responses were discarded due to incomplete information.

Model Specification

Gross Margin Analysis

Cost and Return equation implicitly indicates the model taken into consideration for cost and return per annum and per respondent estimation.

$GM = TR - TVC$
Where:
$TR = Total\ Revenue\ in\ ₦aira/annum$
$TC = Total\ Costs\ in\ ₦aira/annum$
$GM = Gross\ Margin\ ₦aira/annum$
$TR = Total\ Revenue\ in\ ₦aira/annum$
$TVC = Total\ Variable\ Costs/annum$

$$NFI = \sum_{i=1}^{n} P_{yi}Y_i - \sum_{j=1}^{m} P_{xj}X_j - \sum_{k=1}^{k} F_k$$

$NFI = Net\ Farm\ Income$
$Y_i = Gross\ Output\ (litres)$
$P_y = Unit\ Price\ of\ Product\ Y_i\ in\ ₦aira$
$X_j = Quantity\ of\ variable\ input\ (where\ j = 1,2,3,4,5 \ldots \ldots . n)$
$P_{xj} = Price\ per\ unit\ of\ variable\ input\ in\ ₦aira$
$F_k = Cost\ of\ fixed\ inputs\ K\ (where\ K = 1, 2, 3, k\ fixed\ inputs)$

Regression (OLS) Analysis

The implicit model as used in this study is stated thus

$Y_i = (X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12})$

$Y_1 =$ Income
$X_1 =$ age (years)
$X_2 =$ sex (male $= 0$, female $= 1$)
$X_3 =$ marital status (Single, married, widowed or divorced)
$X_4 =$ religion (Christian, Islam or Others)
$X_5 =$ household size
$X_6 =$ education
$X_7 = experience\ in\ years$
$X_8 = labour\ cost$
$X_9 = digest\ cost$
$X_{10} = threshing\ cost$
$X_{11} =$ pressing amount
$X_{12} = grinding\ cost$

RESULTS AND DISCUSSION

The result in Table 1 revealed that 76.28% of the palm oil processors were female while 23.72 % are male. This result indicated that majority of the oil palm processor were female. This may likely be due to the fact that palm oil processing is a detailed assignment. This result is against the study of Chiemela, *et al.* (2021) in their work on economics of palm oil production in Nsukka Local Government Area, Enugu State, Nigeria, which showed that more than 50% of palm oil farmers were male. The mean age was 42 years which showed that the processors are in their active years. This implies that the processors of this age are likely to be dynamic and resistance to fatigue in the tedious work involved in their palm oil processing. The finding is similar to that of a study by Salawu and Rufai (2017) which indicated that majority of the palm oil processors in their study were middle-aged. The results further indicated that majority (81.40%) of the oil palm processors are married with an average of 4 members in their household. Although large family size can sometimes be an asset to the farmers in terms of work force/labour, often time it is faced with the challenges of social and welfare facilities such as feeding, education, sheltering, health care and other living expenses for such a large number of dependents, This is supported by Agwu (2016) who stated that palm oil processors have a household size ranging from 5 to 9 persons. Most of the respondents are educated with an average of 13 years in school. This implies that oil palm processors in the study area are highly educated and as such, may be knowledgeable enough to understand the workings of the industry. However, high literacy level is expected to have positive effects on oil palm processing as shown by (Nwandu *et al.*, 2021). As seen in Table 1, the respondents had an on the average 11 years of palm oil processing experience. This implies that majority of the respondents are very conversant with the activities and challenges prevailing in the industry. Experience in palm oil production could however improve processing and hence the greater tendency to be technically efficient as indicated by Onyenweaku and Nwosu (2015), that positive correlation subsists between experience and efficiency in business. In addition, the result in the Table shows that 21.40% of the respondents use family for labour, 72.56% uses hired labour while 4.19% uses age grade and 1.84% of the respondents uses communal labour as their source of labour for palm oil production. This implies that majority of the respondents in the study area uses hired or paid labour as their source of labour. However, family labour is used to complement hired labour available in order to meet the labour supply needed in palm oil production. This is findings is in line with the findings of Odefadehan (2017). Finally, 41.86% of the respondents choose oil clarification as the tedious activity while 58.14% of the processors show that bunch threshing is the most tedious activities in the processing of palm oil. Moreover, the local processors do not own oil palm plantations of their own, so the palm trees are scattered all around, thereby, making it tedious, challenging and tasking to gather harvested oil palm fruit bunches in one place. This is similar to observations raised by Nwalieji and Ojike (2018).

Table 1: Socioeconomic Characteristics of the Respondents

Sex	**F**	**%**	**Experience (years)**	**F**	**%**
Male	164	76.28	< 10	05	2.33
Female	51	23.72	11-20	133	61.86
Age (Years)	**F**	**%**	21-30	60	27.91
21-40	120	55.81	31-40	17	7.90
41-60	83	38.61	Mean	11	
61-80	12	5.58	**Operation Process**	**F**	**%**
Mean	42		Manual Process	157	73.02
Religion	**F**	**%**	Machine Process	58	26.98
Christianity	155	72.09			
Islamic	41	19.07	Digesting	215	100
Traditional	19	8.84	Threshing	215	100
Marital Status	**F**	**%**			
Single	26	12.09	Oil Clarification	90	41.86
Married	175	81.40	Bunch threshing	125	58.14
Divorced	5	2.33	**Education (Years)**	**F**	**%**
Widowed/Widower	7	3.26	<6	24	11.16
Separated	2	0.92	7 – 12	44	20.47
Household Size	**F**	**%**	> 12	147	68.37
10	211	98.14	Total	215	100
11-20	4	1.86			
Mean					
Education					
No Formal Education	6	2.79			
Primary Education	9	4.19			
Secondary Education	29	13.49			
OND/NCE	79	36.74			
HND/University	92	42.79			

Source: Field Survey, 2023

Effects of COVID-19 on Income of Palm Oil Processors

The result of the effects of COVID-19 on income of palm oil processors is presented in Table 2. The result in the Table showed that the respondents recorded a Total Revenue (TR) of ₦870,00.00 during COVID-19 and ₦1,035,000.00 after COVID-19. In addition, the result indicated a Gross Margin (GM) of ₦435,000.00 with a profit of ₦ 420,000.00 during COVID-19 and a GM of ₦ 550,000.00 with a profit of ₦550,000.00 after COVID-19. This result revealed that the profit after COVID-19 is more than during the COVID-19 and this shows a mean significant difference of ₦60,039.30. This indicates that COVID-19 had great consequences on the income though, the cost of production was a bit on the rise during COVID-19. This result signifies economic rejuvenation strategies in palm oil processing in the study area, from crisis to co-creation. This result confirms the findings of Ma'soad and Khairuddin (2022) which established that credit improves the gross margins of the smallholder farmers.

Table 2: Profitability of Palm Oil Processors

Variables		**During COVID-19 (₦)**		**Post COVID-19 (₦)**	**p-value**
Total Revenue (TR)	750L@29000.00	870,000.00	1125L@23000.00	1,035,000.00	
Bunch Threshing		57,000.00		65,000.00	
Digesting		123000/00		135,000.00	
Pulp Pressing		230000.00		235,000.00	
Others		25000.00		35000.00	
Total variable cost		**435,000.00**		**470,000.00**	
Fixed cost (Drum (metal), big bowls, Jerry can, pots)	**Depreciated @ five years**	**15,000.00**		**15,000.00**	
Total cost		450,000.00		485,000.00	
Gross Margin		435,000.00		550000.00	
Profit		**420,000.00**		**550,000.00**	
t-test difference (Mean)		93551.4 (46716.27)		153590.7(93156.56)	0.0991*

*NB. *L= Litre; *₦29000.00/23000.00 is the Price for 25Litre*

** Represents 10% significant level; Figures in Parenthesis is the Standard Error*

Factors that Determines the Profit to Palm Oil Processing

The result in Table 3 findings on the factors affecting the profit to oil palm processing demonstrate that that household size ($p< 0.001$), processing experience ($p< 0.001$), labour ($p< 0.05$) and threshing cost ($p< 0.001$) have positive coefficients and are statistically significant. The implication of this is that the more of this variable will leads to increase in the profit of palm oil processors in the study area.

This suggests that household size was significantly positive (1%). This suggests that a 2.35 litre increase in oil palm production will result from a unit increase in family size. This suggests that an increase in household size will lead to an increased labor availability, which will increase output as a result of an increase in labor. Another significant variable was the threshing cost. The production of oil palm will therefore increase by 0.3 litre for every unit increase in cost of threshing. This was reported by the respondents that threshing makes processing more convenient. This result agrees with the findings of Nwaobiala and Ogbonna (2014). The household head age, was negatively significant, which suggests that aging reduces production as a result of loss of strength. The cost of pressing is also negatively significantly to the profit of oil palm processing. A higher cost of pressing will lead to increase in the cost of production and lead to reduction in the profit from the enterprise. Quantity of labor has a positive coefficient and significant. Quantity of labor is expected to have a positive impact on the production in the long run; since production is expected to increase with more labor. Experience is also significant and it has positive coefficient, which is in agreement with *a priori* expectations; meaning that, an increase in the year of experience will impact the production positively. This result can be attributed to the major dependent of oil palm processing on other variables. This agrees with work of Ma'soad and Khairuddin (2022) on the effect of pandemic COVID-19 towards operational activities in oil Palm production and that of Amafade and Ovharhe Oil on palm production value addition in Nigeria.

Table 3: Regression Summary Table

Variables	Coefficients	Std Err	p-value	mfx
Age	-28.05	7.66	0.001***	0.000
Sex	-0.14	2.11	0.948	0.948
Household size	2.35	0.75	0.004***	0.002
Education	-0.23	0.19	0.264	0.257
Experience	0.38	0.13	0.006***	0.003
Labour cost	0.0018	0.0074	0.024**	0.016
Digest cost	-0.00077	0.0022	0.730	0.727
Threshing cost	0.0030	0.0032	0.056**	0.047
Pressing cost	-0.0014	0.0011	0.224	0.212
Grinding cost	-0.000019	0.0011	0.086*	0.086
Constant	54.39	8.40	0.000	
Prob > F	0.0000			
R-Squared	0.9025			
Adjusted R-Squared	0.8650			
Root MSE	4.9096			

Note: ***, **, * Represents 1%, 5% and 10% Significant Levels respectively

Constraint Militating against Palm Oil Processing

The result in Table 4 shows the constraints faced by the respondents. The Table shows that 46.98% of the respondents agreed that the lockdown due to COVID-19 hindered Operational activities of palm oil, also, 28.84% strongly agreed and 55.35% agreed that COVID-19 caused a total pause of operational activities of palm oil processing. Furthermore, 44.19% strongly agreed and 14.88% agreed that workers health condition was affected by COVID-19. Also, only 7.45% of the respondent agreed that pandemic led to the high cost of commodities and finally, only 6.5% of the respondent agreed that due to COVID-19 Pandemic new legislation of standard Operating Procedure were formulated.

Table 16: Distribution of the Effects of COVID 19 on the Operational Activities of Palm Oil Processing

Items	SA	A	U	D	SD
Lockdown due to COVID-19 hindered Operational Activities of Palm Oil	95 (44.19)	101 (46.98)	2 (0.93)	17 (7.19)	
COVID-19 cause a total pause of operational activities of palm oil processing	62 (28.84)	119 (55.35)	3 (1.40)	20 (9.30)	11 (5.12)
Workers Health Condition	95 (44.19)	32(14.88)	3(1.40)	77 (35.81)	8 (3.72)
Pandemic led to the high cost of Commodities	152 (70.70)	47 (21.86)	13 (6.05)	3 (1.40)	
Due to COVID-19 Pandemic new legislation of standard Operating Procedure	90 (41.86)	83 (38.60)	28 (13.02)	14 (6.51)	

Source: Field Survey, 2023
SA = Strongly Agree, A= Agree, U = Undecided, D = Disagree, SD = Strongly Disagree

CONCLUSION

From the findings of this study, it was revealed that threshing of bunch was the most tedious activities experienced during palm oil processing. The study however concluded that COVID-19 affected the operational activities of palm oil processing as the lockdown due to COVID-19 hindered major operational activities of palm oil, as well as caused a total pause of operational activities of palm oil processing. Furthermore, palm oil workers health conditions were affected by COVID-19. The study therefore recommended that processors should form cooperative societies. These groups can address information gaps, enhance cultivation knowledge, and provide a platform for government intervention during outbreaks or crises. In addition, the necessary stakeholders should provide training and capacity-building programs for palm oil processors to enhance their skills and adapt to changing circumstances.

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