ASSESSMENT OF THE KNOWLEDGE AND USE OF BRIQUETTES FOR CLIMATE CHANGE OPTION AMONG RICE PROCESSORS IN ANAMBRA STATE, NIGERIA

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ABSTRACT: *The study on the assessment of the knowledge and use of briquettes for climate change option among rice processors in Anambra State, Nigeria investigated the level of rice processor's knowledge and perception on the use of briquettes, perceived advantages of renewable energy, as well as the socio-economic characteristic influence on the processor's perception and the perceived challenges to the production of briquettes. Data were collected from 974 randomly selected rice processors and analyzed with descriptive statistics and Tobit regression model. The study shows that the majority (62.2%) of the processors are female with mean age, processing experience and a monthly output of 43 years, 15 years and 4.5 tons respectively. Also, the processors were fairly knowledgeable on the use of briquettes but perceived renewable energy as economically viable, and climate-smart among others. The socioeconomic variables influencing their perception were Age, marital-status, enterprise size, experience, monthly income, and rice residues. Finally, the likely challenges that will constrain briquettes production include; high initial cost, high maintenance cost etc. furthermore, policymakers must swing into action to sensitize* ***processors on the need to adopt renewable energy for environmental sustainability.***

Keywords: *Biomass, briquettes, rice husk residues, density, utilization, sustainability, renewable energy*

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1 **INTRODUCTION**

The world is averagely experiencing a series of unpleasant situations originating from climate change variability. To a layman, the climate is the "average weather condition over a long time". This definition is tentative and easy to understand. Recently, climate change has been on the global spotlight due to its peculiarities challenging the existence of man. The African Development Bank Group (ADBG) (2013) suggested that climate change is "any change in climate observed over a long period". The global concern on climate change is raising more eyebrow on those changes anthropogenic in nature, especially the issues concerned with deforestation, urbanization, industrialization, among others. Mayami (2011); Newzealand

and Herald (2011) in Bonaventure *et al.* (2017) suggested that climate change causes variation in the weather pattern in African and other parts of the world like in the case of Hurricane Katrina in New Orlean, U.S.A in 2005; Fukushima floods nuclear disaster in Japan in 2011; the flood in China, India, Pakistan and Bangladesh and excessive rainfall in Chad, Niger, and Nigeria, drought in some part of U.S.A in 2012. Even the recent wildfire in Australia is not excluded from the list.

As earlier stated, climate change could be as a result of the anthropogenic (human) activities or natural process. Corroborating with Ozor and Nnaji (2011); Onu *et al*. (2012), the main causes of climate change were human activities which include increased urbanization and industrialization especially in developed nations which led to the introduction of large quantities of greenhouse gases (GHGs) like Carbon IV oxide (CO_2), Methane (CH_4), and Nitrous oxide (N_2O) into the atmosphere, thereby reducing the safety and health of human habitation due to its toxicity. A prolonged effect of these emission alters the ozone layer. Thus, the Intergovernmental Panel on Climate Change (IPCC) (2007) suggested that GHGs are the major causes of global warming which has increased life risk. Apart from the emission of GHGs by companies, agricultural activities like in the application of inorganic fertilizer, bush burning, among others equally contribute to the emission of GHGs. It is equally worthy to note that the natural causes of climate change are but not limited to volcano, earthquake to mention a few. Both the natural and anthropogenic process has in recent time contributed to the rising sea level, irregularities in rainfall pattern, flooding, wildfire outbreak, extreme weather condition, heat stress, and pest and diseases outbreak among others. The effects of climate change vary from region to region depending on the prevailing climate of the region. Therefore, measures should be adopted to mitigate the impact of climate change in this changing world (Mohammed *et al*., 2011).

These changes in climate are increasingly making it difficult for the rural poor especially in Sub-Saharan Africa to engage in meaningful agricultural activities for food security and economy of the rural people (Eromose *et al*., 2017). Africa contributing less of the GHGs emission has remained the highest receiver of the impact of climate change which includes; poor soil fertility, low agricultural productivity, food shortage and scarcity, environmental conflict with nature, desert encroachment that has seen an increase in the clash between herders and farmers in West Africa among others. It, therefore, calls for serious attention since the basic economic activities of Africa is rooted in agriculture. Responding to the climate action, there is a need to shift attention to a green alternative such as biomass (plant origin) for renewability and clean environment. Interest in sustainable fuel sources is gathering public attention, therefore, Obi *et al*. (2013) noted that the production of biomass and biofuel is a growing industry.

The price of liquid fuel grows at a steeper rate than the price of solid fuel, thus, Patil (2019) asserted that the substitution of furnace oil to solid briquette is one of the alternative renewable energy sources. Due to lower acid gas and greenhouse emission, biomass energy is an important renewable energy alternative compared to fossil fuel (Chou *et al.,* 2009; Grover and Mishra, 1996; Tripathi *et al*, 1998). The entire value chain process of biomass production enhances local economic capacity (Osama, 2019). Therefore, encouraging a remarkable shift from fossil fuel to renewable energy sources will boost the rural economy (Sen *et al*., 2016). These renewable energy technologies present a viable option of meeting the growing energy demand, especially in remote and rural areas (Patil *et al.* 2012). Also, Osama (2019) noted that biomass increases the rural farmer's purchasing power through succour in form of money generated through participation in the biomass value chain, it is worthy to note that biomass turns the cost of waste management into revenue opportunity to farmers.

The utilization of this biomass in its original form is often restricted due to its undesirable characteristics such as high moisture content, irregular shape and size, low bulk density among others which make it very difficult to handle, transport and store (Sen *et al.,* 2016; Oladeji, 2010). Thus, one of the alternative ways to overcome these limitations is to densify biomass materials into a briquette (Balatinecz, 1983). Chaney (2010) opined that densification is the process of converting low bulk density biomass into high density and energy concentrated fuel briquettes, therefore the factors that determine the briquette characteristics is the particles size, density of the materials, carbonization temperature, and the pressure force when printing the briquette.

Briquette is a solidified fuel in different shapes and sizes (Patil, 2019). Researchers noted that briquettes can be produced from biomass residues such as maize cob (Wilaipon, 2007), rice husk (Yahaya & Ibrahim, 2012), coconut husk (Olorunnisola, 2007) among others. Several works have been carried out on the production of fuel briquettes for both domestic cooking and industrial applications, but the major driving force behind this research is the need to ascertain small scale rice processor's knowledge on the use of briquettes as an effective means of managing agro wastes to address the environmental consequences and health risk associated with the use of firewood for rice parboiling and other use at the processing centres. This paper was therefore conceptualized as a waste to wealth study which advocates the conversion of rice husk ordinarily set ablaze by the processors to briquettes. Sen *et al.* (2019) suggested that briquettes are replicable, appropriate, cost-effective, locally available, easy to make, environment friendly and culturally fitting.

In Anambra State, Nigeria; mainly at rice-producing and processing areas, a whole lot of environmental pollutions are being carried out daily ranging from burning of rice husk, GHGs emission to the felling of trees for firewood which is not safe for environmental sustainability. An interview with some of the processors revealed that a minimum of 5.56 USD (at ₦388 per dollar) worth of firewood is used to parboil one drum of paddy (740 kg). Despite that firewood fetching creates casual employment to the women and youths, its environmental dangers cannot be quantified. Thus, suggesting the need to set up a briquette outfit that will create more permanent employment and reduce the cost of wood incurred in rice parboiling and processing (Sen *et al.*, 2019). Thus, the need to ascertain the processor's knowledge and readiness to adopt the use of briquettes for rice processing activities is very important before any investment is championed.

Objectives

The main focus of the study was to assess the selected small scale rice processor's knowledge and use of briquettes for climate change option and environmental sustainability in Anambra State, Nigeria. Specifically, the objectives were to:

i. ascertain the knowledge and perception of the selected rice processors on the use of briquettes,

ii. identify the perceived advantages of briquettes as renewable energy,

iii. determine the socioeconomic characteristic influence on the processor's perception on the use of briquettes, and

iv. find out the processors perceived challenges to the production of briquettes in the area.

2 RESEARCH METHODOLOGY

Study Area

Anambra state is located in the Southeastern part of Nigeria and comprises of 21 Local Government Areas (Aguata, Awka North, Awka South, Anambra East, Anambra West, Anaocha, Ayamelum, Dunukofia, Ekwusigo, Idemili North, Idemili South, Ihiala, Njikoka, Nnewi North, Nnewi South, Ogbaru, Onitsha North, Onitsha South, Orumba North, Orumba South and Oyi). The State is sub-divided into four agricultural zones (Onitsha, Anambra, Awka and Aguata) to aid planning and rural development (Obianefo *et al.*, 2020). The State is bounded with Delta State to the West, Imo State and Rivers State to the South, Enugu State to the East, and Kogi State to the North. The indigenous ethnic groups in Anambra state comprises of 98% Igbo and 2% Igala mainly living in the North-western part of the State. Anambra State is situated between Latitudes 5°32^{I} and 6°45^{I} N and Longitude 6°43^{I} and 7°22^{I} E respectively. The State has an estimated land area of 4,865sqkm. The last official census reported that 4177828 people are living in Anambra State (NPC, 2006).

Sampling Procedure and Method of Data Collection

A combination of sampling technique (purposive and random) was adopted for the study. Two local government areas were purposively selected from each agricultural zone (Anambra zone; Ayamelum and Anambra East, Awka zone; Awka North and Ekwusigo, Onitsha zone; Ogbaru and Ihiala, Aguata zone; Orumba North and Orumba North) due to the predominance of small scale rice processors in the area. The researcher conducted a pilot survey by first administering 40 questionnaires (5 in each LGA) to rice processors which recorded a 90% return rate. A binomial method (σ = npq) was used to calculate the standard deviation of the study mean, where; σ is the standard deviation, n is the number of the pilot questionnaire distributed, p is the questionnaire rate of return (0.9) and q is the rate of questionnaire not returned (0.1).

$\sigma = 40 * 0.9 * 0.1 = 3.6$.

Also, a mean method of sample size determination was used at 90% confident interval to estimate the sample size from an infinite population as stated;

$$\mathrm{n_i} = \frac{Z^2 * \sigma}{e^2}$$

Where:

n_i is the study sample size, Z^2 is the Z score at 90% confidence interval, e^2 is the margin of error and σ is the standard deviation of the pilot study.

$$\mathrm{n_i} = \frac{1.645^2 * 3.6}{0.1^2} = 974$$

Furthermore, a cross-section of 122 small scale rice processors was randomly sampled from 7 LGAs (Ayamelum, Anambra East, Awka North, Ekwusigo, Ogbaru, Ihiala and Orumba North) and 120 from Orumba North LGA in September 2019 through the help of 5 research assistants who spent one month in the field.

Method of Data Analysis

A descriptive statistics and Tobit regression model was used to actualize the study objectives. Objective one, two, and four were achieved with descriptive statistics, while objective three was achieved with a Tobit regression. The perception part of objective one was achieved with a mean threshold from 5 points Likert scale. The models are stated as follows:

A). The descriptive statistics was defined by:

$$\overline{\mathrm{X}} = \sum \frac{\mathrm{FX}}{\mathrm{n}} \ldots \ldots Eqn. 1$$

Where; $\overline{\mathrm{X}}$ = mean, X = variable outcome, n = sample size, and F = frequency.

B). The mean threshold from 5 points Likert scale is defined by;

$$\overline{X} = \frac{1+2+3+4+5}{5} = 3.0$$

Where:

$\overline{X}$ = Mean threshold used for decision making ($\geq$ 3.0 = agreed, < 3.0 = disagree), 5 = strongly agreed, 4 = agreed, 3 = somewhat agreed, 2 = disagreed, and 1 = strongly disagreed.

C). The Tobit regression is defined by:

$$P^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots \beta_6 X_6 + e$$

$$P^* = \overline{X} \text{ if } P^* > LL$$

Where:

P* = the mean threshold of perception, $\beta_1 - \beta_6$ = parameter of estimate, X_1 = gender (dummy; 1 = male, 2 = female), X_2 = Age (years), X_3 = processing experience (years), X_3 = Marital status (1 = single, 2 = married, 3 = separated, 4 = divorced, 5 = widowed), X_4 = Level of education (years), X_5 = Household size (No), X_6 = enterprise size (tons), X_7 = experience (years), X_8 = Monthly income (₦), X_9 = rice residues (ton), e = error term beyond the control of the farmers, and LL = 3.0 (lower limit of censored perception).

3 DATA PRESENTATION AND ANALYSIS

Table 1: Socioeconomic characteristics of small and medium scale rice processors

Sn.	Variable	Frequency	Percentage	Mean
1	**Gender**			
	Male	368	37.8	
	Female	606	62.2	
2	**Age**			
	$\leq$ 18	-	0	
	19 – 28	47	4.8	
	29 – 38	237	24.3	**42.71**
	39 – 48	493	50.6	
	49 & above	197	20.2	
	Marital status			
	Single	65	6.7	
	Married	834	85.6	
	Divorced	29	3.0	
	Separated	28	2.9	
	Widowed	18	1.8	
	Education attainment			
	Primary	133	13.7	
	Secondary	674	69.2	
	Tertiary	167	17.1	
7	**Household size**			
	$\leq$ 5	472	48.5	
	6 – 10	502	51.5	**5.92**
	11 & above	-	0	

Enterprise size			
≤ 3	389	39.9	
4 – 6	481	49.4	**4.15**
7 – 10	104	10.7	
11 & above	-	0	
Experience			
≤ 10	473	48.6	
11 – 20	339	34.8	**14.68**
21 – 30	64	6.6	
31 – 40	81	8.3	
41 & above	17	1.7	
Monthly income (₦)			
≤ 50,000	103	10.6	
50,001 – 100,000	297	30.5	
100,001 – 150,000	241	24.7	**138470.23**
150,001 – 200,000	159	16.3	
200,001 & above	174	17.9	
Husk residues (tons)			
≤ 10	40	4.1	
11 – 20	841	86.3	**18.04**
21 – 30	63	6.5	
31 & above	30	3.1	

Source: Field Survey Data, September 2019.

Gender: The study revealed that the majority (62.2%) of the selected rice processors were female while the rest (37.8%) were male. **Age:** the study shows that the majority (50.6%) of the selected rice processors are within the age of 39 – 48 years, while the remaining 24.3%, 20.2% and 4.8% are within the age of 29 – 38 years, 49 years & above, and 19 – 28 years respectively. The average age was approximately 43 years. **Marital status:** the study shows that the majority (85.6%) of the processors are married while the remaining 6.7%, 3.0%, 2.9% and 1.8% are single, divorced, separated and windowed respectively. **Educational attainment:** the findings show that the majority (69.2%) of the processor's educational attainment was secondary, while the remaining 17.1% and 13.7% processor's attainment were tertiary and primary respectively. **Household size:** the study shows that the majority (51.5%) of the processors have a household size between 6 – 10 persons, while the rest 48.5% have a household size of ≤ 5 persons. None of the processors had a household size of 11 persons & above, also the average household size was approximately 6 persons. **Enterprise size:** the study shows that the greater proportion (49.4%) of the processor's enterprise size was 4 – 6 tons per month, while the remaining 39.9% and 10.7% have an enterprise-size of ≤ 3 tons and 7 – 10 tons per month respectively. None of the processors had an enterprise-size of 11 tons & above. The mean enterprise size was 4.15 tons per month. **Processing experience:** the study revealed that the greater proportion (48.6%) of the processors had processing experience of ≤ 10 years, while the remaining 34.8%, 8.3%, 6.6% and 1.7% had processing experience of 11 – 20 years, 31 – 40 years, 21 – 30 years and 41 years & above respectively. The average processing experience was approximately 15 years. **Monthly income:** the study shows that the greater (30.5%) proportion of the processors has a monthly income of ₦50,001 – ₦100,000, while the remaining 24.7%, 17.9%, 16.3%, and 10.6% has a monthly income of ₦100,001 – ₦150,000, ₦200,001 & above, ₦150,001 – ₦200,000 and ≤ ₦50,000 respectively. The average monthly income was ₦138,470.23 (356.88 USD at ₦388 per dollar). Also, the study revealed that the majority (86.3%) of the processors has a husk residue of 11 – 20 tons, while the remaining 6.5%, 4.1% and 3.1% have a rice husk residues of 21 – 30 tons, ≤ 10 tons and 31 tons & above respectively. The mean husk residue was 18.04 tons.

Table 2: Knowledge of renewable energy of selected small and medium scale processors

Sn.	**Variable**	**Frequency**		**Percentage**	
		Yes	**No**		
1	Do you know what renewable energy is?	464	510	47.62	52.38
2	**Which Renewable energy technology do know?**				
	Solar electricity generator	139		14.27	
	Solar water pump	904		92.81	
	Solar heat	139		14.27	
	Wind turbine	0		-	
	Biogas	301		30.90	
3	Is your source of renewable energy efficient?	0	974	100.0	
4	Would you like to use renewable technology?	974	0	100.0	
5	**The renewable energy preferred**				
	Solar electricity generator	904		92.86	
	Solar water pump	464		47.62	
	Solar heater	70		7.14	
	Wind turbine	-		-	
	Biogas	394		40.48	
6	**Source of energy**			-	
	Firewood	139		14.29	
	Petrol or diesel generator	904		92.86	
	Electricity	70		7.14	
	Solar system	-		-	
	Wind turbine	-		-	
	Biogas	-			
	Coal	-			

Source: Field Survey Data, September 2019. *Multiple responses

The study attempted to ascertain the processor's knowledge of renewable energy technology on rice briquettes. Study responses were recorded in the study. The findings revealed that the majority (52.38%) of the processors are not knowledgeable about renewable energy technology on rice husk briquettes, while the rest 47.62% are knowledgeable. Also, the majority (92.81%) of the processors knows about solar water pump, while the remaining 30.90%, 14.27 and 14.27% knows about biogas, solar electricity generator and solar heat respectively. None of the respondents is knowledgeable about wind turbine in the area. Equally, all (100.0%) the processors admitted that their sources of renewable energy are not efficient. They (100.0%) equally accepted to use renewable energy technology if available in their location. Furthermore, the study shows that the majority (92.86%) of the processors preferred solar electricity generator, while the remaining

47.62%, 40.48% and 7.14% preferred solar water pump, biogas and solar heater respectively. None of the respondents preferred wind turbine renewable energy technology. Lastly, the majority (92.86%) of the processors confirmed petrol or diesel generator as their main source of energy, while the remaining 14.29% and 7.14% reported firewood and electricity respectively. None of the respondent accepted solar system, wind turbine and biogas as their main source of energy.

Table 3: Processors perception of conventional energy and renewable energy

Sn.	Variable	mean	Std. Dev.	Decision
	Conventional energy	4.32	0.47	Agree
1	The conventional energy supply is very expensive	3.99	0.18	Agree
2	The conventional energy supply is not reliable	4.09	0.28	Agree
3	The conventional energy supply is inefficient	4.04	0.20	Agree
4	The conventional energy supply is not sustainable	4.14	0.41	Agree
5	The conventional energy supply is not environmentally friendly	4.25	0.64	Agree
	Renewable energy	4.06	0.49	Agree
6	Renewable energy is economically viable	3.74	0.68	Agree
7	Renewable energy technology is climate-smart	3.99	0.19	Agree
8	Renewable technology will create job	3.99	0.15	Agree
9	Renewable energy technology is reliable	4.08	0.27	Agree
10	Renewable technology is efficient	4.25	0.46	Agree
11	Renewable energy technology is sustainable	4.06	0.28	Agree
12	Renewable energy technology will improve farmers income and livelihood	3.97	0.32	Agree
13	Using renewable energy technology will improve farm productivity	3.53	0.93	Agree
14	Using renewable energy technology will improve crop production	2.32	0.80	Agree
15	Using a solar water pump will lead to overuse of groundwater by farmers	2.71	1.05	Agree
16	The initial cost of renewable energy technology is high	4.29	0.69	Agree
17	Renewable energy can be used to provide electricity in rural areas	3.96	0.42	Agree
18	solar system technology is suitable in my area	4.08	0.27	Agree
19	Generating electricity from biogas using crop residues/waste is sustainable	4.00	0.11	Agree
20	Generating electricity from biogas using crop residues/waste is reliable and efficient	4.02	0.15	Agree
	Cluster mean	**3.90**	**0.43**	**Agree**

Source: Field Survey Data, September 2019.

The rice processor's perception of renewable and conventional energy technology was captured and measured with 5 points Likert scale. The analysis produced the mean threshold for the study used for a decision-making process, a mean threshold greater than equal to 3.0 was reported as agree, while a mean threshold less than 3.0 was reported as disagree. Based on the 6 items of conventional energy technology identified, 6 of them had a mean threshold of 3.0 which means that their perception on conventional energy was; the conventional energy supply is very expensive, the conventional energy supply is not reliable, the conventional energy supply is inefficient, the conventional energy supply is not sustainable and the conventional energy supply is not environmental friendly.

More so, the mean threshold of the 14 items of processors perception on renewable energy technology was 3.0 which implies that the respondents perception were renewable energy is economically viable, renewable energy technology is climate-smart, renewable technology will create job, renewable energy technology is reliable, renewable technology is efficient, renewable energy technology is sustainable, renewable energy technology will improve farmers income and livelihood, using renewable energy technology will improve farm productivity, using renewable energy technology will improve crop production, using solar water pump will lead to overuse of groundwater by farmers, initial cost of renewable energy technology is high, renewable energy can be used to provide electricity in rural areas, solar system technology is suitable in my area, generating electricity from biogas using crop residues/waste is sustainable, generating electricity from biogas using crop residues/waste is reliable and efficient.

Table 4: Perceived advantages of renewable energy technology

Sn.	Advantage	Frequency	percentage
1	Reduced cost	765	78.57
2	Energy security	858	88.10
3	A source of income from selling excess	23	2.38
4	Environmental responsibility	301	30.95
5	Reducing electricity bill	70	7.14
6	Job creation	673	69.05

Source: Field Survey Data, September 2019. (*) Multiple responses

This study shows that the majority (88.10%) of the processors perceived energy security as the advantages of using renewable energy, while the remaining 78.57%, 69.05%, 30.95%, 7.14% and 2.38% perceived the advantages of using renewable energy technology as reduced cost of energy, job creation, environmental responsibility, reducing electricity bill and a source of income from selling excess respectively.

Table 5: Socioeconomic characteristic influence on the processor's perception

Perception	Coef.	Std. Err.	t-value
Sex	-0.045352	0.0381561	1.19
Age	-0.0052378	0.0024355	2.15**
Marital status	0.0555376	0.0309693	1.79*
Level of education	0.031185	0.285968	0.11
Household size	-0.038982	0.115761	0.34
Enterprise size	0.0172478	0.0104581	1.65*
Processing experience	-0.0032651	0.0019005	-1.72*
Monthly income	8.33e-07	2.77e-07	3.01***
Rice husk residues	0.023674	0.010058	2.35**
Intercept	3.908816	0.1489029	26.25
Diagnostic tools			
Log-likelihood	36.668024		
Likelihood ratio (LR)	19.11***		
Prob. > Chi^2	0.0243		

Pseudo R^2	0.3523

Source: Field Survey Data, September 2019. (*) Significant at 10%, (**) Significant at 5%, (***) Significant at 1%

The socioeconomic characteristics influence on processor's perception on the use of briquettes of used a Tobit regression model, the diagnostic check had a log-likelihood of 36.668024 and likelihood ratio (LR) of 19.11*** significant at 0.0243 Chi^2 probability. The Pseudo R^2 which means the same as the coefficient of multiple determinants was 0.3523. Note that the coefficient of sex, level of education and household size were not significant at either 10%, 5% or 1% level of probability. While the coefficient of age was negative and significant at 5% level of probability. The coefficient of age was positive and significant at 10% level of probability. The coefficient of enterprise size was positive and significant at 10% level of probability. The coefficient of processing experience was negative and significant at 10% level of probability. The coefficient of monthly income was positive and significant at 1% level of probability, and the coefficient of rice husk residues was positive and significant at 5% level of probability.

Table 6: Processors perceived challenges to the production of briquettes in the area

Sn.	Challenges	Frequency	Percentage (%)
1	High initial cost	325	33.33
2	High maintenance cost	835	85.71
3	Poor return on investment	162	16.67
4	Briquette is not efficient or reliable	603	61.90
5	Lack of technical know-how	371	38.10

Source: Field Survey Data, September 2019. * Multiple responses

The study allowed for multiple responses which reported that the majority (85.71%) of the processors suggested high maintenance cost as the perceived challenges to the production and use of briquettes, while the remaining 61.90%, 38.10%, 33.33% and 16.67% reported that briquette is not efficient or reliable, lack of technical know-how, high initial cost and poor returns on investment respectively.

4 DISCUSSIONS

The study has revealed that rice processing is dominated by female processors in the study area, the female is more involved in rice processing in the study area, the finding was expected hence most of the activities at the processing centres like; fetching of firewood, parboiling and drying, de-stoning, measuring, among others are mostly performed by women while activities like machine operation and maintenance are mainly masculine activities. Interesting, the average age and processing experience were 43 and 15 years respectively, this implies that the processors are still active and have gained enough experience to know the best way to increase their processing capacity. Since most of the processors attended a secondary school which means that they are fairly literate and can adopt the use of modern rice processing technology? The mean household size of 6 people is large enough to supply cheap family labour to maximize the Centre's profit. Also, the mean monthly output of 4.15 tons and a monthly income of 356.88 USD is an indication that the processors are truly operating on a small scale. Furthermore, the mean rice husk residues of 18.04 tons is an indication that the processors will supply enough biomass for the production of briquettes is invested in.

Since the study reported that the majority of the processors are knowledgeable about renewable energy technology, it corroborates the findings on their level of education. Despite petrol or diesel generator been the major source of energy at the processing centres, the study equally reported that the processors preferred solar electricity generation which will ensure a constant supply of power at the centres. Furthermore, the cluster mean of 3.90 on the processor's perception of renewable energy technology is an indication that the decision was reached based on majority responses. This implies that the processors have a good perception of renewable energy technology. This findings on processor's perception corroborate the suggestions of Patil *et al*., 2012.

It is important to bring to the public notice that the processors report on the advantages (reduced cost, energy security, a source of income from selling excess, environmental responsibility, reducing electricity bill and job creation) of renewable energy was in agreement with the findings of Osama, 2019; Sen *et al.,* (2019) on the influence of binders on physical properties of fuel briquettes produced from cassava rhizome waste.

The findings on the processor's age imply that a unit increase in age will reduce the predictive value of perception on the use of briquettes by 0.52%. This finding is in line with *a priori* expectation as older processors tends to take a lesser risk in trying a new technology than younger ones. The findings on the processor's marital status imply that a unit increase in the number of married processors will increase the predictive value of perception on the use of rice briquettes by 5.55%. This is in line with the *a priori* expectation as processors with partners have more tendency to be aware of briquettes as renewable energy. The findings on enterprise size imply that a unit increase in the processing output of the processors by a unit will increase the predictive value of perception on the use of rice briquettes 1.72%. The findings on processing experience imply that a unit increase in the number of processors that are less experienced in rice processing activities will reduce the predictive value of perception on the use of the rice briquettes by 0.33%. Furthermore, the findings on monthly income imply that a unit increase in the processor's monthly income earned will increase the predictive value of perception on the use of rice briquettes by 8.33 units. This corroborates with the *a priori* expectations as an increase in the financial capacity of the processors surely tends to increase their access to information on the use of rice briquettes. Finally, the findings on rice husk residues imply that a unit increase in the volume of rice residues will increase the predictive value of perception on the use of rice briquettes by 0.24%. This was expected since the processors may tend to find an alternative solution to useful disposal of rice husk residues as they accumulate in the area. Therefore, it has been established that; *age, marital status, enterprise size, processing experience, monthly income and rice husk residues* were the socioeconomic variables influencing processor's perception on the use of rice briquettes in the area.

Haven sensitively discussed all the study objectives, effort should be made by the policymakers to handle the challenges (high initial cost, high maintenance cost, poor return on investment, the briquette is not efficient or reliable and lack of technical know-how) reported by the processors if a meaningful investment is expected to tackle the issues of environmental sustainability posed by the emission of greenhouse gas and felling of firewood leading to deforestation.

5. CONCLUSION

This study on the knowledge and use of rice briquettes for climate change option at this present time the world is clamouring for green alternative (renewable energy) is a welcome idea. Most activities of man are conflicting with the natural environment which informed the need to look inward for measures that will help to address the situation. Not just for a way-out but the measures should be economically beneficial to the general public. This study, therefore, adopted a waste to wealth as well as environmental sanitation approach. At rice processing areas in Anambra State, a huge amount of money is spent on firewood used for parboiling, as well as on diesel used to power the machines due to the epileptic supply of conventional energy in the area. Also, when the heaps of rice husk accumulate, processors often set them ablaze to reduce the quantity, hence, not only polluting the environment but emitting carbon IV oxide to the atmosphere which is dangerous to human health. Sadly, those trees that are continuously being fell for firewood gradually reduce the trees that were meant to absorb the emitted carbon.

Justifying the need for affordable and sustainable energy and job creation, this study established the processor's knowledge and perception of converting rice husk to briquettes to replace firewood for both domestic and industrial uses. More importantly, when a briquet centre is established in Anambra State, apart from creating employment to the women and youths that will manage the centres, it will equally reduce cost and in turn, increase the profit of the users. Furthermore, it is very important to educate the processors as well as the general public on the need for environmental responsibilities for sustainable energy alternatives. It therefore necessary to make the following recommendation;

1. Rice processors should be trained on the technology of briquettes production and usage.

2. Briquette machines should be locally fabricated for affordability and availability of spare parts

3. Processors should be sensitized on the need to invest in briquettes production and usage as a way of environmental responsibility.

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