Analysis of Marketing of *Moringa oleifera* Lam and its' effect to Environment in South East, Nigeria.

Análisis de comercialización de *Moringa oleifera* Lam y su efecto sobre el medio ambiente en el sudeste de Nigeria.

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ABSTRACT

Analysis of *Moringa oleifera* Lam product marketing and its' effect to environment in South East, Nigeria was studied. Specifically, the objectives of the study were to describe the socio-economic characteristic of moringa *oleifera* product marketers, identify the various forms in which moringa *oleifera* were marketed, determine the marketing margin and marketing efficiency of moringa *oleiferia*, analyze the determinant factors to *Moringa oleifera* marketers'marketing efficiency, identify the effects of moringa *oleifera* marketing to the environment, identify the technologies used to cushion the effects of moringa marketing to the environment, determine the effect of the marketers' socio-economic characteristics on their technology adoption decision and identify the constraints to marketing of *Moringa oleifera* products in the study area. A multistage random sampling procedure was used to select120 moringa *oleifera* products marketers in the study area. Primary and secondary data were used to elicit information from the respondents. The objectives of the study were addressed using percentage responses, marketing margin and marketing efficiency models, multiple regression analysis and factor analysis. The results show that the majority of the marketers were males, youthful, had large household size, married, educated and members of cooperatives. The most important form of moringa *oleifera* products consumed in the study

area was leaf, followed seed and leaf powder. Furthermore, the marketers' marketing margin and marketing efficiency results showed to be positive and highly significant respectively. Among the functional forms tried, the linear form was chosen as the lead equation based on econometric and statistical reasons. The coefficients of age, education and membership of cooperatives had a direct relationship with marketing efficiency. The effects of moringa *oleifera* marketing to the environment were noise, odour, flies, littering of the environment with moringa residues, rodents and mosquitoes. The technologies used to guide against environmental degradation by moringa *oleifera* marketing were use of nose and mouth protective gadgets, good ventilation, proper disposal of wastes, proper maintenance of processing plant and use of hearing protective device (HPD) The determinant factors to the adoption of technology by marketers against environmental dilapidation were household size, educational level, access to credit and membership of organization. Important constraints to moringa *oleifera* marketing in the study area were low returns, competition, no financial support, inadequate funding, inadequate raw materials, high cost of transportation and poor communication. These variables fell between factors loading of 0.30 and above at 10 % overlapping variance as contained in factor analysis result. Policies options aimed at enhancing marketers' access to education programmes as relates to environmental pollution as result of their marketing activities through adult education, seminars and workshops especially be encouraged. In addition, there is need to encourage marketers to form cooperatives in order to reduce their transaction cost of marketing. Furthermore, processor of moringa *oleifera* leaves into powdered form should wear protective devices such as ear and eye masks to avoid possible pollution from its dust.

Keywords:Analysis, *Moringa oleifera* Lam, Marketing, Effect, Environment South East, Nigeria.

RESUMEN

Se estudió el análisis del marketing de productos de Moringa oleifera Lam y su efecto sobre el medio ambiente en el sudeste de Nigeria. Específicamente, los objetivos del estudio fueron describir las características socioeconómicas de los comercializadores de productos de moringa, identificar las diversas formas en que se comercializa la moringa, determinar el margen de comercialización y la eficiencia de comercialización de la moringa oleiferia, analizar los factores determinantes para la comercialización de Moringa oleifera , identifique los efectos del marketing de moringa en el medio ambiente, identifique las tecnologías utilizadas para amortiguar los efectos del marketing de moringa en el medio ambiente, determine el efecto de las características socioeconómicas de los comercializadores en su decisión de adopción de tecnología e identifique la restricción para el marketing de Moringa

productos de oleifera en el área de estudio. Se utilizó un procedimiento de muestreo aleatorio de varias etapas para seleccionar 120 comercializadores de productos de moringa en el área de estudio. Los datos primarios y secundarios se utilizaron para obtener información de los encuestados. Los objetivos del estudio se abordaron utilizando respuestas porcentuales, margen de comercialización y modelos de eficiencia de comercialización, análisis de regresión múltiple y análisis factorial. Los resultados muestran que la mayoría de los vendedores eran hombres, jóvenes, de gran tamaño, casados, educados y miembros de cooperativas. La forma más importante de productos de moringa consumidos en el área de estudio fue la hoja, seguida de semillas y polvo de hojas. Además, el margen de comercialización y los resultados de eficiencia de comercialización mostraron ser positivos y altos, respectivamente. Entre las formas funcionales estimadas, la forma lineal fue elegida como la ecuación principal basada en razones econométricas y estadísticas. Los coeficientes de edad, educación y membresía de las cooperativas tenían una relación directa con la eficiencia del marketing. Los efectos del marketing de moringa en el medio ambiente fueron ruido, olor, moscas, basura del medio ambiente con residuos de moringa, roedores y mosquitos. Las tecnologías utilizadas para guiar contra la degradación ambiental por el marketing de moringa fueron el uso de dispositivos de protección para la nariz y la boca, buena ventilación, adecuada eliminación de desechos, mantenimiento adecuado de la planta de procesamiento y uso de dispositivos de protección auditiva (HPD) Los factores determinantes para la adopción de tecnología por parte de los especialistas en marketing contra el deterioro ambiental fueron el tamaño del hogar, el nivel educativo, el acceso al crédito y la membresía de la organización. Las restricciones importantes contra el marketing de moringa en el área de estudio fueron los bajos retornos, la competencia, la falta de apoyo financiero, la financiación inadecuada, las materias primas inadecuadas, el alto costo del transporte y la mala comunicación. Estas variables cayeron entre la carga factorial de 0.30 y superior con una variación superpuesta del 10% como se encuentra en el resultado del análisis factorial. Las opciones de políticas destinadas a mejorar el acceso de los vendedores a la educación gratuita y asequible, alentar a los vendedores a formar cooperativas a fin de reducir el costo de transacción del marketing y reducir los efectos del marketing en el medio ambiente, el procesador de hojas de moringa en forma de polvo debe usar dispositivos de protección y para El acceso de los especialistas en marketing a programas educativos sobre contaminaciones y posibles consecuencias.

Palabras clave: Análisis, Moringa oleifera Lam, Comercialización, efecto, Medio ambiente Sureste, Nigeria

INTRODUCTION

Moringa oleifera Lam (Moringaceae) is a small or medium-sized tree with creamy – white, sweetly scented flowers and light –green, tripinnately compound foliage (fahey etal. 2005). It *originated* from South Asia, in the Himalayan foothills but now found in many tropics and sub-tropics of the world (Fahey et al. 2005;Foidl and Richtie 2013). It is a medicinal plant with high nutritional value in terms of high protein, vitamins, beta-carotene and amino acids, hence could be useful as a food supplement for both human and animals (Ferrao et al. 1997, Hashim et al 2013]. As a medicinal plant, moringa acts as cardiac and circulatory stimulants, possess antitumor, antipyretic, antiepileptic, anti-inflammatory, anti-ulcer, anti-spasmodic, diuretic, anti-hypertensive, cholesterol lowering, anti-oxidant, ant-diabetic, hepatic-protective and inhibitor against bacteria and fungi (Nickolaus 2001 and Johnson 2008). Other uses of the crop as opined by Nickolaus 2001 and Makkar and Becker (2004)are for treatments of diabetes, asthma, bronchitis, tuberculosis, dysentery, epilepsy, diarrhea, cure for malaria, stomach problems, diabetes, water treatment, hypertension, retained placenta, asthma, colds, to induce vomiting and to promote wound healing.

In recent time, with increase population growth leading to its increased industrial demand (in form of herbal health care formulations; herbal based cosmetic products and herbal nutritional supplements), traditional health care practitioners uses and increase in consumption at the household level, lead to enhanced trade of moringa and other medicinal plants and extracts by many developing countries of the world (WHO 2006). Despite the importance of medicinal plants, moringa inclusive, the trade is highly intricate, unorganized and diverse. These could be attributed to the fact that most medicinal plants materials are sold unprocessed , the harvesting of the plant are basically by untrained people and nomadic, inappropriate storing of medicinal plants (Andrew-shepherd 2007) ,weak market links and poor bargaining power among marketers and adulteration with fake plants in order to hike their profits (Wikipedia 2010 and Grosvenor 2016). Although, Moringa *oleifera* tree is widespread throughout the tropics, it is commonly found around farms and fences in many compounds, thus making information emanating from crop very scarce. This scenario has dwarfed significantly research on marketing of moringa product in Nigeria particularly and many other developing countries in general (Jefferson2013).

However, in the recent time, there have been public outcries in many developing countries on the environmental degradation and the associated health risk emanating from moringa and other related vegetables marketing. These environmental dilapidations' consequences could be inform of odour as result of decay of remains of the un marketed plant parts (Lee 2009), noise, dust and smoke from moringa processing plant (Rosen and Olin 2013), littering of environment, flies, mosquito and rodent breeding from the dumped

moringa debris (Lee 2009). These environmental filthiness are more severe in localities where there is lax in implementation of environmental sanitation by the agencies concerned, hence posing lots of health risks to people and the roads in such vicinity, made very impassable by debris of the crop(Environmental Protection Agency (EPA) 2012). Studies (Lee 2009; Rosen et al 2013 and Ume *et al* 2018) on health hazards associated with filthy environment are well documented. For instance, on noise, Field(1998) reported that it could result in induced-hearing loss and an increased incidence of coronary artery disease. In animals, Jefferson (2013)reported that noise can escalate the risk of death by altering predator or prey detection and avoidance; inhibit reproduction and navigation. Literature on hazards as relates to dusts, revealed that this substance which could be inform of ultra - fine particles is capable of causing heart disease, lung cancer, asthma and cardiac conditions (Rosen and Olin 2013).

This study is analyzed from appraisal of the efficiency of moringa marketing in order that the products get to the final consumer in good conditions as well to reveal some environmental decays associated with moringa marketing and possible technologies in abating the menaces in the study area. This study tries to bridge this knowledge gap, since to the best knowledge of the researcher no know published work on the subject area. However, the study are justified in different ways; Firstly, through determination of the marketing efficiency, it will aid policy makers and program planners in making policy options aimed at providing goods to consumer in the required form, at the required time and place, and with the lowest possible marketing costs consistent with the interests of the producer. Moreover, the study could serve as a baseline for evaluating efficient moringa *oleifera* marketing practice at least environmental hazards especially now the climate change effects are threat to mankind's existence.

Specifically, the objectives are to: 1) describe the socio-economic characteristic of moringa *oleifera* product marketers 2) Identify the various forms in which moringa *oleifera* can be marketed.3) determine the marketing margin and marketing efficiency of *Moringa oleifera* marketers. 4) Analyze the determinant factors to *Moringa oleifera* marketing eficiency.5) identify the effects of moringa *oleifera* marketing to the environment. 6) identify the technologies used to cushion the effects of moringa *oleifera* marketing on the environment. 7) determine the effect of the marketers' socio-economic characteristics on their technology adoption decision and 8) identify the constraints to marketing of moriga *oleifera* products in the study area.

MATERIALS AND METHODS

The South East Nigeria is the study area and it lies between latitude $5^0 9'$ and $7^0 75'$N of Equator and longitude $6^0 85'$ and $8^0 46'$ East of Greenwich Meridian. It has a total land mass of 10,952.400 ha with population of 16,381.729 people (Umeet al 2016). The zone is made up of five states viz: Abia, Anambra, Ebonyi, Enugu and Imo States. It is bordered in the North by Benue and Kogi States, in the West by Delta and Rivers States, in the South by Akwa Ibom State and in the East by Cross River State. Multi-stage random sampling technique was used to select states, Local Government Area LGA), towns, market and marketers. In the first stage 1, three states were randomly selected from five states. In the second stage, five Local Government Areas (LGAs) were randomly selected from each states. These brought to a total of fifteen LGAs. In the third stage, four towns were selected from each LGA, making a total of sixty towns. In the fourth stage, two major markets were purposively selected from each town. This brought to a total of one hundred and twenty marketers. In the fifth stage, from the lists of wholesalers and retailers provided by their associations in their respective markets, one marketer each from the wholesalers and retailers was randomly selected. This brought to total of one hundred and twenty marketers (Sixty for wholesaler and retailers respectively) for detailed study. A structured questionnaire was used to elicit information on primary data, while secondary data was collected through seminars, workshops, project theses and related periodicals.

Objectives 1, 2, 5 and 6 were analyzed using percentage responses. Objective iii was analyzed using marketing margin and marketing efficiency model analyses. Objective iv was analyzed using multiple regression analysis and objective vii was captured using Logit model. Finally, objective viii was analyzed using factor analysis.

Model specification: Wholesaler marketing margin = <u>wholesaler selling price – Purchasing price</u>

Selling price………………………………………………….(1)

Retailer marketing margin = <u>Retailer selling price – Purchasing price</u>

Sellingprice ……………………………………………………(2)

Marketing Efficiency: The marketing efficiency was obtained by dividing the net profit margin of the specific agency by each agency's marketing cost and multiplies by 100.

Producer marketing efficiency = <u>producer price – cost of production</u>   x 100

Productioncost……………………………………………….(3)

Wholesaler efficiency = <u>wholesaler price – marketing cost</u> x 100

$$\text{Marketingcost} \dots\dots\dots\dots\dots\dots\dots(4)$$

Retailer efficiency = $\underline{\text{retailer price – marketing cost}}$ x 100

$$\text{Marketing cost} \dots\dots\dots\dots\dots\dots\dots\dots\dots(5)$$

Multiple regression analysis is represented as $Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + \dots + b_8x_8 + b_nx_n \dots\dots\dots\dots\dots\dots\dots\dots(6)$

Where;

Y= marketing efficiency (%)

X_1 = Age (years), X_2 = Marital status (Dummy), X_3 = Educational level (Year), X_4 = Household size (N), X_5 = transportation cost (N), X_6 =Marketing experience (years), X_7 = Credit (N̶)̶,̶X_8 = membership of cooperative (Dummy)

e_i = error term

Four functional forms (linear, semi-log and Cobb-Douglas) of production function were tried and explicitly represented as:

Linear function:
$$Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + e\dots\dots\dots\dots\dots\dots\dots(7)$$

Double log function (Cobb Douglas):
$$\ln(y) = \ln b_0 + b_1\ln x_1 + b_2\ln x_2 + b_3\ln x_3 + b_4\ln x_4 + b_5\ln x_5 + e\dots\dots\dots\dots\dots (8)$$

Semi double log function:
$$Y = \ln b_0 + b_1\ln x_1 + b_2\ln x_2 + b_3\ln x_3 + b_4\ln x_4 + b_5\ln x_5 + e\dots\dots\dots\dots\dots (9)$$

Exponential function:
$$\ln Y \quad = \quad b_0 \quad + \quad b_1x_1 \quad + \quad b_2x_2 \quad + \quad b_3x_3 \quad + \quad b_4x_4 \quad + \quad b_5x_5 \quad + e\dots\dots\dots\dots\dots\dots\dots(10)$$

The choice of the best functional form was based on the econometric and statistical criteria.Here, Logit model was used to identify factors that determine the adoption or non-adoption decision of farmers to use improved technologies to alleviate environmental pollution. Thus, the probability (P_i) that a marketer will adapt to the improved technology is a function of an index Z_i which is also the inverse of the standard logistic cumulative function of Pi

That is, $P_i\ (Y=1) = F-1(Pi)$ $\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(11)$

Then, $Z_i = F-1(Pi)$

The index is a set (Xi, that is socioeconomic characteristics of the farmers, while b_i are regression coefficients which indicate the probability effect of farmers' attributes) and is a linear function

of the attributes, that is,

$$Z = m_0 + m_1X_1 + m_2X_2 + m_nX_n. \tag{12}$$

The probability of adopting improved environmental technology is given by

$$P_t\ (Y-1) = \frac{1}{1+ A^{3t}} \quad \text{...(13)}$$

While the probability of not adopting the improved technology could be represented as

$$P_t\ (Y=1) = \frac{1}{1+ 6^{2t}} \text{...(14) and}$$

$$6^{2t} = \frac{F1(Y=1)}{1- F(F=1)} \quad \text{.. (15)}$$

The dependent variable, (Yi, which is farmer's decision to adopt or not to adopt) takes the value 1 if the marketer adopts and 0 if he does not. However, since the dependent variable is binary, maximum likelihood estimation is ideal, thus making ordinary least squares estimation unsuitable. The equation 12 can be estimated using the average value of Zi as:

$$Zt = In\ \frac{P_1}{1} - P_t = m_0 + m_1+x_1+m_2+x_2+m_3x_3+m_4x_4+m_5x_5+m_6x_6+m_7x_7 \text{...(16)}$$

where

Y= Adoption of Technology (Adoption, 0; otherwise, 0).X_1 = Age (years), X_2= Household size (in number), X_3 = Educational Level (in years), X_4= Access to credit (Yes = 1 and 0 otherwise), X_5 = Farming experience (Years), X_6 = Membership of marketing organization (Yes =1 or 0 otherwise) u = error term.

Factor Analysis: Factor analysis was employed to identify the constraints experienced by moringa product marketers, principal component factor analysis with varimax –rotation and factor loading of 0.3 was used. The constraints observed by farmers were grouped into three factors using varimax rotation and factor loading of 0.30. The principal component factor analysis model is stated thus

$$C_1 = a_{11} f_1 + a_{12} f_2 + \text{--} an_1 f_n \text{.................. (17)}$$

$$C_2 = a_{21} f_2 + a_{22} f_2 + \text{---} a^2 nf \text{.................(18)}$$

$$C_3 = a_{31} f_3 + a_{32} f_2 + \text{---------------------------------------} a^3 nf_n \text{................(19)}$$

$$C_n = a_{n1} f_1 + a_{n2} f_2 + \text{------------------------------------} a_{nn} f_n \text{.......................(20)}$$

Where

$C_1 = c_n$ = observed variable /constraints in marketing of moringapdts

$a_1 = a_n$ = factor loading or correlating coefficients

$f_1 = f_n$ = unobserved underlying challenging factors facing moringa marketers

RESULTS AND DISCUSSION

Table 1 shows that male marketers (83.33%) dominated wholesaler moringa marketing, while 45% also of same gender for retailers in the study area. The males' domination could be attributed to financial advantage men have over women, which could give them leverage in performing marketing functions (Ume et al 2016).

The finding of Bannermah (2001) disagreed with this assertion. He opined that .females dominated as they are able to do haggling of price that is associated with marketing than the male counterpart. Furthermore, 33.33% and 41.67% of the wholesalers and retailers fell within age range of 36-45 years respectively, while the least (6.67%) of wholesalers and retailers respectively fell within age range of 16- 25 years respectively. This result shows that the marketers in the study area were youthful, strong and active to contain the stresses and strains associated with marketing (Ramachandran, 1998) More so, Table 1 revealed that the majority of the wholesalers (58.35%) and retailers (60%) were married, 41.67% of wholesalers and 40% of retailers were single respectively. Married people are likely to have many household members, which entails more mouths to feed. This invariable affects the amount of money in the business and the possibly expected profit (Ndubaku 2012).

Table I moreover, shows that the majority of the wholesalers (66.7%) and retailers (58.35%)had household size of 6-10 persons respectively, while the least, 6.66% and 15% for wholesalers and retailers respectively fell within the house hold size of 11 - 15 and 1-5 persons. Studies show that poor households engage their members into hired labour in performing marketing functions in order to generate income for improvement of family

welfare (Adewanyi 2003 and Ume et al 2016). However, Foster (2006) emphasized that the impact of household size to agricultural marketing depends on the magnitude, age structure and available marketing labour among members. Besides, 6.67% of the wholesalers and retailers respectively had no formal education, while 93.33% of the marketers (Wholesalers and retailers respectively) were educated. Education provides marketers with knowledge and skills to enhance marketing activities, thereby ensuring efficiency in market performances, consequently improved livelihood (Essien et al 2014) As well, 66.67% and 63.33% of the wholesalers and retailers respectively were members of organizations (such as age grade, cooperative societies and other social club respectively), while 33.33% and 36.67% of wholesalers and retailers respectively were not member of any organization. Members of organization have access to information on improved marketing innovations through interactions, credit for payment of labour, capacity building and training (Ndubaku 2012).

Table 1: Distribution of Marketers According to Socioeconomic Characteristics

Retailer		Wholesaler		
Factors	Frequency	Percentage	Frequency	Percentage
Gender				
Male	50	83.33	45	45.00
Female	10	16.67	15	25.00
Age				
16 – 25	4	6.67	4	6.67
26 – 35	5	8.33	10	16.67
36 – 45	20	33.33	25	41.67
46 – 55	15	25.00	10	16.67
56 – 66	10	16.67	6	10.00
Above 67	6	10.00	5	8.33
Household Size				
1 – 5	6	10.00	17	28.33
6 – 10	40	66.67	35	58.35
11 – 15	4	6.67	9	15.00
Marital Status				
Married	35	58.35	36	60
Single	25	41.67	24	40.00
Divorced	-	-	-	-
Widow	-	-	-	-
Educational Level				
No formal	4	6.67	4	6.67
Primary	16	36.67	6	I0.00
Secondary	30	50	28	46. 67
Tertiary	10	16.67	12	20.00
Membership of Organisation				
Yes	40	66.67	38	63.33
No	20	33.33	22	36.67

Source, Field Survey, 2017

Table 2 shows the various forms in which Moringa products were marketed. The results show that the most important form in which the Moringa products were marketed was through the leaves and represented by 92.8% of the sampled consumers.

Table 2: Distribution of Respondents According to the Form in which Moringa Products are marketed in the Study Area

Forms	Frequency	Percentage	Rank
Leaf powder	73	60.83	3rd
Seed	81	67.50	2nd
Bark	60	50	4th
Leaves	110	92.8	1st
Pod	59	47.19	5th

Source; Field Survey; 2017.

*Multiple Responses

The leaves of moringa is easy to grow and rich in proteins, calcium, iron, ß-carotene (converted to vitamin A in the human body), vitamin C and vitamin E (Ramachandran1998). Producing moringa leaves according to (Ume et al 2016) is also means of generating agricultural income, developing the food processing industry, nutritionally rich vegetable for families and finding new businesses. In addition, *Moringa oleifera* leaves have a high dry matter content (20-25%) compared to most other plant food sources (10%). This makes it even more beneficial as a fresh vegetable since 100 grams of fresh leaves will bring twice as much nutritive material as 100 grams of most other vegetables (Ramachandran 1998).Furthermore, the seed form (67.50%) was ranked the second. The moringa oil (extract from the seed) is similar to olive oil is rich in oleric acid and is used in body and hair care as a moisturizer and skin conditioner (Bannermah 2001 and Simonyan et al 2010). Also, leaf powder form was third in the order and represented by 60.83% of the total respondents. Furthermore, (Ramachandram 1998) reported that most of moringa producers produce leaf powder and market it without being qualms of the quality standards which could result to digestive illnesses. These standards cannot be overlooked as the major consumers of moringa leaf powder are the vulnerable populations such as pregnant women, children, the elderly or HIV positive people poses ethical problems (Adewanyi 2003). Dried and milled moringa leaves are easily stored and added to meals (Foster, 2006). The root of moringa (50%) can be used as substitute for horseradish in countries like India and Pakistan (Ramachandran 1998).The pod form of moringa marketing was the least and reported by

47.19% of the sampled consumers in the study area. Studies show that pod of moringa is cooked as a vegetable in fresh or canned form (Ramachandran1998).

Table 3 shows the regression estimates of the determinants of marketing efficiency among moringa products marketers in the study area.

Table 3.Regression Estimates of the Determinants of Marketing Efficiency Among Moringa Products Marketers in the Study Area

Variable	Linear +	Exponential	Cobb-Douglas	Semi log
Constant	-45.000(-6.16***)	1.0075 (4.13***)	-7.878(4-0.93***)	7.8780(30.93***)
Age	0.3885 (3.51**)	0.0125(3.39**)	0.0125(3.39**)	32.4836 (3.94***)
Marital Status	-3.2402 (-1.18)	-0.0840 (-0.91)	-0.1824 (-1.59)	-6.2024(-1.48)
Education	5.9652(3.23**)	0.1770(2.87**)	0.7185 (3.98***)	25.1719(3.82***)
Householdsize (x_4)	1.6234(4.13***)	0.0445(3.40**)	0.3497(3.46**)	13.974(3.79***)
Transportation cost (x_5)	0.00002(0.74)	(4.13***)(0.73)	0.0028(0.19)	0.1818 (0.33)
Marketing experience(x_6)	0.6437 (4.58***)	0.0264 (5.63***)	0.4579(4.14***)	11.4183(2.83**)
Credit (x_7)	0.0092(0.080)	0.00014(14.71***)	0.6621 (10.55***)	47.0170(20.54***)
Organisation(x_8)	7.3972(3.03**)	0.2525(3.10**)	0.3504(3.61***)	11.9147(3.36**)
R^2	0.9323	0.8498	0.7914	0.8611
R	0.9273	0.8388	0.7761	0.8509
F	187.53	77.10	51.70	84.46

Source: computed from STATA   4A

** and **** is significant at 5% and 1% level respectively. Figure in parentheses are t-value

+ = lead equation

The linear functional form was chosen as the lead equation because of a high R^2 and highest number of significant variables. The coefficient of age was positive and significant at 5% level of probability. This implies that at as an individual start advancing in age, the more the increase in is his/her marketing efficiency. This is against a priori expectations and this could be probably because the older marketers seem to be more credible and trustworthy than the younger counterparts (Matimisebi 2010). The coefficient of education was positive and significant at 5% alpha level. This implies that any increase in educational level will lead to a corresponding increase in marketing efficiency. According to Foster (2006) and Onyeweaku and Effiong (2000) higher level of education determines the quantity of skills, allocative abilities, and efficiency and how well marketers are informed of the innovation and technologies around them for attainment of high profitability. The coefficients of household size was positive and highly significant at 1% level .This implies that any increase in household size will lead to corresponding increase in marketing efficiency. According to

Ndubaku (2012) reported that large household could ensure labour availability in order reduce the cost of marketing.

The coefficient of marketing experience was positive and highly significant at 1% alpha level. This implies that any increase in marketing experience will lead to a corresponding increase in marketing efficiency. This may be because the more the number of years of experience attained, the wider the knowledge acquired on marketing strategies to be adopted in order to earn a higher income and to surpass competitive opposition (Essien et al 2014). Also, Matimisebi (2010) noted that experience in agribusiness enhances output performance. The coefficient of membership of cooperatives was positive in line with a *priori* expectation and significant at 5% level. This implies that farmers who belong to cooperatives are more market efficient than their counterparts who do not belong. Cooperatives afford her member marketers the opportunity of sharing information on modern technologies and purchasing inputs in bulk (Ejechi et al 2010). This follows the finding of Anuebunwa(2004).

The marketing margin is the difference between the retail and farm gate prices as indicated in Table 4. The sale prices of moringa by different market intermediaries in South East Nigeria was summarized and presented in Table 5.

Table 4 Sales Average Price of Moringa by Different Market Intermediaries ₦/10 kg

Market Agency	Leaf Powder	Seed	Leaves	Bark	Total
Producers	7,200	7770	5580	5,370.5	25920.5
Wholesalers	15,760	12,100	8669.5	8,464.5	44994
Retailers	14160	9,387	6704	6562	36813
Total	37120	29,257	20953.5	20397	107727.5

Source; Field Survey; 2017.

N/B kg = Kilogram.₦ = Nigeria currency with Dollar exchange rate of ₦365 per Dollar

The result of sales price of moringa by different intermediaries per 10kg weight shows that wholesalers made highest average sales price of ₦ 15,760 per 10kg weight for the leaf powder, while the least, (₦ 5,370.5) was for the producers in moringa bark business. The total average sales price of moringa leaf powder per 10kg bag was highest (₦37,120, while bark business was the least (₦20,397). It is important to note that, all the marketing agencies received high sales price per 10kg in the late season (November – March) compared to early seasons (April – October). This could be because of the scarcity of moringa products in that period, resulting in high selling prices of the commodity. Nevertheless, the early season coincides with the period of plenty of harvest of moringa and attracts low price.

Marketing costs are the costs incurred by various market intermediaries from the time when commodity lives the farm until it reaches the consumers is presented in Table 6. These costs add utilities to the product to be marketed in terms of form, time, place and possession (Anuebunwa 2004) .The operating cost of producer, wholesaler and retailers were presented in Table 6, 7 and 8 respectively. Table 7 showed the average operating cost items of producers per 10kg in Naira. The operating costs of producers were seed, planting, fertilizer application, harvesting, transportation, bagging, loading and offloading, rent and processing costs

Table 5: Average Operating Costs of Producer per 10kg in Naira (₦)

Operating cost	Leaf Powder	Seed	Leaves	Back
Seed	400	400	400	400
Planting	100	100	100	100
Fertilizer application	220	220	220	220
Weeding	310	310	310	310
Harvesting	80	90	80	150
Transportation	80	100	140	148
Bagging	100	100	80	128
Loading and Off Loading	50	50	70	100
Rent	60	60	60	60
Cost of Processing	300	145	30	40
Total	1700	1575	1490	1656

Source; Field Survey, 2017.

The operating costs of producers per 10kg in Naira varied among moringa products as indicated in Table 6. The late season of the products had the highest average operating cost.The result also revealed that the total average cost of leaf powder was the highest (₦1,700), followed by back (₦=1,656) and the least was leaves (₦=1,490). Among the operating costs considered, seed input (₦400)was the highest of all operating inputs used in the production. This could be attested to the fact that the same planting material is among the most acceptable edible part of the plant in the study area (Tanko 2004).The least of the operating costs was cost of loading and off loading (which accounted for ₦50 and ₦50 for leaf power and seed respectively), while ₦30 and ₦40 were for leaves and back respectively. The very low values for processing in leaves and back as shown in Table 6 could be linked to the fact that there is very meagre processing required of the product in the study area. Table 6 reveals that the average operating costs of wholesalers per 10kg of moringa.

Table 6: Average Operating Cost of Wholesaler Per 10kg bag in Naira (₦)

Wholesale cost	Leaf Powder	Seed	LEAVES	Back
Purchase of 10kg	4760	1200	669.5	464.5
Food and lodging	400	400	400	400
Transportation and cost of capital	1320	1320	1450	1456
Loading and offloading	20.00	50	80	100
Storage Cost	30	30	120	125
Rent	50	50	80	80
Total	6580	3050	2799.5	2625.5

Source; Field Survey, 2017.

Leaf powder had the highest total average operating cost (₦6,580), followed by seed (₦3,050) and the least was bark (₦2,625.5). Perhaps, the possible reason for high average operating cost for leaf powder could be due to the high demand for leaf powder by consumers, hence the wholesalers have to travel to various locations to purchase the quantity they needed. Furthermore, during the late season(November – March), which is usually occasioned with scarcity of the product, the wholesalers and their agents' incur high transportation costs in vending for the products among markets and farm gates in order to procure the needed quantity (Tanko 2004).The average operating cost of retailers per 10kg in Naira as revealed in Table 7.

Table 7: Average Operating Cost of Retailers per 10kg bag in Naira (₦)

Retailer cost	Leaf Powder	Seed	LEAVES	Back
Purchase of 10kg	4160	1387	704	562
Food and lodging	300	300	300	300
Transportation and cost of capital	500	500	500	500
Loading and offloading	50	50	70	100
Storage Cost	20	30	100	120
Rent	45	45	45	45
Total	5075	2312	1719	1627

Source; Field Survey, 2017

The retail costs considered were cost of transportation, cost of feeding and lodging, storage cost and rent. These costs varied among the seasons and moringa products. On the average, operating costs of retailer per 10kg of types of moringa products were ₦5,075, ₦2,312, ₦1,719 and ₦1,627 for leaf powder, seed, leaves and back respectively. The differentials in the values of the total operating costs could be related to varied labour input demanded among the seasons by the retailers

The average of the total operating costs for the marketing agents as contain in Table 8 shows that leaf powder(₦13,355) was the highest, with the wholesalers having the highest contributions(₦ 6580), while the least was producer(₦1,700).

Table 8: Net Operating Costs of Producers, Wholesalers and Retailers in Naira(₦)

Market Agency	Leaf Powder	Seed	Leaves	Back	Total
Producer	1700	1575	1490	1656	6421
Wholesaler	6580	3050	2799.5	2625.5	15055
Retailer	5075	2312	1719	1627	10733
Total	13355	6937	6008.5	5908.5	32209

Source, Field Survey, 2017

The high operating costs of leaf powder could be attributed to perhaps the high processing techniques which involved substantial costs compares to other products. The least of the average operating cost among the moringa products was that of the back, ₦5908.5. Furthermore, marketers that did business in all the studied moringa products as contained in Table9, shows that wholesalers had the highest cost, ₦15,055, with leaf powder business being the highest(N6580), while the least was that of leaves, ₦2626.5. The high average costs incurred by the wholesalers could be related not only to the bulk purchases of commodities that is common to this intermediary but cost of vending of the moringa products during the periods of scarcity, usually November – March. In addition, the least of marketers that did transaction in the moringa products was the producers. The producers apart from costs of agricultural inputs such as labour, planting material and fertilizer used in cultivation of the crop, they incurvirtually no substantial marketing function such as transportation cost as most often they sell their products at farm gate (Ume and Okoronkwo 2016). The net profit margin of the market intermediaries is presented in Table 9.Net profit margin is the difference between sales prices and operating cost after the cost of capital has been deducted (Lee 2009).

Table 9 shows that the marketing agencies enjoyed moderate high net profits in all the products of moringa businesses. The average net profits for the marketing agents shows

that leaf powder(₦16,144.5) was the highest, with the wholesalers making the highest net profits of ₦ 9180, while the least was producer(₦5,500). The high net profit of leaf powder could be ascribed to among others the high consumer acceptability of the product use in most of family food menu (Ume etal 2016). The least of the net profit among the moringa products was the leaves, (₦15,945) with the producers marketers being the least (₦4, 090) This could be because of poor preservation nature of the leaves, in effect, the marketers dispose immediately after harvest, which usually coincide with the season of plenty and low price (Ume and Okoronkwo 2016).

Table 9: Net Profit of Moringa Producers, Wholesalers and Retailers in ₦

Market Agency	Leaf Powder	Seed	Leaves	Back	Total
Producer	5500	6195	4090	5370.5	21155.5
Wholesaler	9180	9050	5870	5839	29939
Retailer	9085	7075	4985	4935	26080
Total	23,765	22,320	15,945	16144.5	77174.5

Source, Field Survey, 2017

Marketing efficiency as shown in Table 10 is net profit margin divided by marketing cost and multiplies by 100% (Vallero 2014). The net profit margin of the intermediaries in all seasons is shown in Table 9 and was divided by net marketing cost in Table 8.

Table 10 Marketing Efficiency in MoringaProducts in South East Nigeria in Kilogram (Kg)

Market Agency	Leaf Powder	Seed	Leaves	Back	Total
Producer	30.9	25.4	36.4	30.8	30.3
Wholesaler	71.6	33.7	47.9	44.9	50.2
Retailer	55.8	32.6	34.4	32.9	41.1
Total	56.1	31.07	37.6	36.5	41.7

Source, Field Survey, 2017

Analysis of marketing efficiency of the intermediaries as contained in Table 12 shows that moringa market intermediaries in the study area had generally low marketing efficiencies. Nevertheless, high marketing efficiency of 71.6% was recorded by wholesalers in the leaf powder, while the least, 30.8% was reported under the producers in the sales of back. High efficiency in marketing according to Environmental Protection Agency (EPA 2003) indicates that marketing agencies is efficient in performing marketing activities, hence, resulting to high profit. This result did not concur with (Vallero 2014), who had very high

marketing efficiency (100% and above) in his study. He opined that very high marketing efficiency (100% and above) implies that none of the marketing intermediaries did much to increase value-added in their marketing business accept the transportation of the produce to the designated customers. Nevertheless, low marketing efficiency implies that the concerned marketing agencies did much to increase value-added on their products through apart from transportation but storage and processing before the product gets to the retailers/final consumers (Powers et al 2011).

Table 11; Distribution of the Respondents According to Effects of Moringa Marketing on the Environment.

Variable	Frequency	Percentage
Odour	80	66.7
Noise	96	80
Flies	75	62.5
Mosquito	67	55.8
Rodents	81	67.5
Smoke	70	58.3
Dust	67	55.8
Littering of environment	64	53.3

Source; Field Survey; 2017.

Table 11 shows that 66.7% of the respondents complained about odour as result of decay of moringa wastes. The unpleasant odour resulting from ammonia (NH_3), volatile organic compounds (VOCs) and hydrogen sulphide (H_2S) can be a source of annoyance to the environs (Visser et al. 2011) .Furthermore, 80% of the respondents complained about noise. Noise, generated from the of machines used in moringa processing could induce hypertension, high stress levels, tinnitus, hearing loss, sleep disturbances, and other harmfulEnvironmental Protection Agency EPA (2012). Nevertheless, the annoyance of the noise to the people depends on the size of the plant and the frequency of the plant operations (US EPA 2007). Moreover, littering of environment with moringa parts such leaves, stalk, peels and shell by the marketers especially the marketing and processing environs was complained by 53.3% of the respondents. The menace is capable of causing economic costs to the government agencies concerned in attempts in clearing them, especially when the wastes are enormous (Committee of Environment of Nigeria CEN 2003). In addition, 62.5% of the respondents complained about flies. These flies generated from decomposed moringa wastes are vectors of diseases such as cholera, dysentery, typhoid, filarial, and dengue fever, (Depczynski et al. 2005)

Also, 55.8% of the respondents complained about mosquitoes, which breed in the decomposed moringa wastes during the wet condition. This scenario is capable of causing malaria to habitants of the environs (Nwaneri et al. 2016). Furthermore, 67.8% of the respondents reported on incessant breed of rodents such as rat, which could cause annoyance to people living around the area. This finding was in line with (Depczynski et al. 2005), who opined that such wastes disposal area is capable of creating a big nuisance by attracting birds, rats, and pigs—vectors of various diseases. Furthermore, 58.3% encountered problem of smokes from the processing plant especially where the activity is done in processing house that is not well ventilated. In this condition, workers are often inhaling such gas like carbon monoxide from partial combustion of hydrocarbon, resulting in dizziness, suffocation, breathlessness and death at extreme condition (Nwaneri et al. 2016). Finally, 55.8 % of the sampled population complain about dust from processing of moringa into powdering form with use of machines. Dust can lead to respiratory infections, heart diseases, strokes, asthma and cardiac conditions (Ume and Okoronkwo 2016).Table 12 shows that 90% of the respondents disposed their wastes, just like other agricultural crops for composting and as bio fuel production through fermentation under controlled conditions.

Table 12 Distribution of Respondents According to use of Technologies to Curtail the Effect of moringa Marketing on the Environment

Technology	Frequency	Percentage
Use of nose and mouth protective gadgets	88	66.7
Adequate Ventilation	95	79.2
Maintenance of processing plant	100	83.3
Proper waste disposal	108	90.0
Use of Hearing Protective Device (HPD)	75	62.5

Source; Field Survey; 2017.

*Multiple Responses

Moringa waste (include the rotten, peels, shells, and scraped portions of moringa or slurries, is a biodegradable material generated from post-harvest losses due to lack of storage capacity, processing and packaging of moringa according to customers' stipulations (Committee of Environment of Nigeria 2003). More so, 83.3% of the sampled population opined that maintenance of processing plant was necessary in alleviating the pollutions associated with use of machines in processing of moringa leaves into powdering form. These maintenances could be inform of regular servicing of the machines using appropriate oil grade and changing of oil at desired time, the exhaust pipe of the processing plant should be

extended outside the house and fitted with silencer in order to reduce noise pollution and use of adulterated fuels should be avoided (Tanko and Opara 2010). In addition, 66.7% of the respondents used mouth and nose gadgets as device to overcome problems of air pollution. This gadget is of different types and use to guide against odour and dust (Enete etal. 2010). As 79.2% of the respondent used adequate ventilation in the processing house with the house suited North – East orientation. This will make the house airy and devoid of building up of dust, smokes and odour, which be injurious to health (Ume etal. 2018). Besides, the use of hearing protective device (HPD) was reported by 62.5% of the respondents as means of checkmating against noise pollution. Hearing protection is available in types and sizes, ranging from yellow plugs inserted into the ear to customized osteoplastic. Each type of hearing protection has specific qualities. For instance, customized osteoplastic hearing protection fits perfectly and can last for years. It is commonly used by motorcyclists and musicians. While, the yellow plugs are cheap but has demerits of irritating the ear, if inserted into the ear with dirty fingers, the risk of external ear infections could result and it is use once only (Grosvenor 2006). Other types of HPD are ear muff, wax ball, silicon plug and universal plug. It is paramount to state that despite the important of these gadgets, most people in developing countries, Nigeria inclusive do not use them while operating in such perilous situation.The effect of the marketers' socio-economic characteristics on their technology adaption decision using logistic model were discussed in Table 13.

The coefficient of age was negative to the technology adoption and significant at 1% probability level. This could be because as the marketer becomes older, they are less energetic and risk averse to adoption of technology. In contrary, Adewanyi (2003) reported that old age is often associated with long years of marketing/ processing experience, hence could comprehend vividly the implications of his/her actions to the environment, and could positively influence his/ her adoption decision process. The coefficient of household size was positive and statistically significant at 10% probability level. This implied that as household size increases, adoption of technologies on moringa also increases. The household size importance lies on availability of labour in accomplishing moringa technologies such as proper disposal of moringa wastes in order to forestall the potential environmental hazard (Bendarangake 2006, Wikipedia 2010). In contrary, (Powers etal. 2011) opined in situation where the household size is of dependent population (children and old age), they will be mainly consumers and rarely engage in processing and marketing exercises.

As expectation, the coefficient of access to credit use was positive and significant at 5% alpha level. The sign of the coefficient could be associated with the significances of credit use in assisting marketers in purchasing necessary inputs which could aid in adoption of technologies in order to curtail maximally environmental effects as result of moringa processing and marketing. The negative sign identity of the coefficient as reported by Akande

(1993) and Arene (2002) could be linked to the diversion of agricultural credit to non – farm marketing uses. In line with a *priori* expectation, the coefficient of level of education was positive and significant at 1% alpha level. According to Ndubaku (2012) the level of educational attainment by the marketer could not only increase his/her marketing efficiency but also enhanced his/her ability to understand and evaluate new processing and marketing technologies aimed at abating maximally their actions against the environmental abuse. The coefficient of the membership of organization had direct relationship with the dependent at 90% confidence interval. Cooperative as reported by Amusa et al. (2015) enables her members to have access to information on improved moringa marketing innovations to environmental management, material inputs of the technology, credit for payment of labour and purchasing of inputs, capacity building and training on environmental sustainability in the course of their marketing.

Table 13: Determinant Factors to Technology Adoption Using Logit Model

Variable	Coefficient	z – value
Intercept	-1.678	(-4330)***
Age	-0.287	(- 2.350)**
Household size	0.365	(1.097)*
Educational Level	1.023	(3.800)***
Membership of Organisation	2.009	(1.990)*
Marketing Experience	2.378	0.420
Access to Credit	2.008	(2.001)**
LR – Chi Square (7)	= 5.12	
Prob> Chi Square	= 0.6389	
Pseudo R^2	= 0.0052	
Log likelihood	= -381.02998	

*, ** and *** implies significance at 10%, 5% and 1% respectively

Source; Field Survey; 2017

The results in Table 14 shows varimax rotated factors militating against moringa products marketing in the study area.

Table 14: Varimax-Rotated Factors Against Moringa Product Marketing in the Study Area.

Constraining variables	Factor 1	Factor 2	Factor 3
Low returns	-0.016	0.463*	0.184
Price fluctuations	0.135	0.023	0.327
Competition	0.552*	0.076	-0.183
Inadequate funding	0.302*	-0.233	0.297
No financial Support	0.216	0.148	0.560*
High tax rate	0.168	-0.129	0.240
High cost of Transportation	0.019	-0.301*	0.142
No experience	-0.438	-0.352	0.404
Poor communication	0.391*	-0.352	-0.093

Source: computed from SAS 2017.

Three factors were extracted based on the response of the respondents, Factor 1= economic/institutional factor, Factor 2 = infrastructural factor and Factor 3 = socio-financial factor (Ume et al. 2016). Only variable with factor loading of 0.30 and above at 10% overlapping variance were used in naming the factors.This is line with the finding (Ume, et al. 2018) who are of the opinion that varibles with factor loading of less than 0.30 and variables that loaded more than one factor were discarded. Variables that loaded more than one factor like price fluctuations and no experience were discovered..In naming the factors Ume, et al (2018) stated that each factor is given a denomination based on the set of variables or characteristics it is composed of. Constraints under the economic /institutional factor include competition (0.552), inadequate funding (0.302) and poor communication (0.391). This agrees with Ume, et al. (2018) who reported that lack of fund is one of the major challenges experienced by farmers. Inadequate fund constitute s a major challenges in the farm investment.Variables that loaded under factor 2 (infrastructural factor) include; low returns (0.463), inadequate raw materials (0.497) and high cost of transportation (0.301) . This means that any factor with variable loading of 0.3 and above are the important factor to be considered as serious factor militating against moringa products marketing in the study area.

As conclusion and recommendations, most of the respondents were youthful, males, had moderate household sizes and well experienced. .Also, the marketers had high marketing margin and low efficiency. Furthermore, the important factors influencing marketing efficiency of moringa products were age, education, household size, marketing experience, and membership of cooperative societies. The effects of moringa marketing on the environment were noise, odour, flies, littering of the environment with moringa residues, rodents and mosquitoes. The technologies used to guide against environmental degradation by moringa marketing were use of nose and mouth protective gadgets, good ventilation,

proper disposal of wastes, proper maintenance of processing plant and use of hearing protective device (HPD). The determinant factors to the adoption of technology by marketers against environmental dilapidation were household size, educational level, access to credit, membership of organization. The factors affecting marketing of moringa were poor access to fund, high tax rate, and poor communication. 1) Based on the findings, the following policies options were proffered; Provision of free and affordable education through adult education, workshops and seminar to enable marketers' access and process information that will enhance marketing of moringa products in the study area. 2) Encouraging experienced marketers to remain in business by granting them access to soft loans/credit at minimum interest rates to enhance quantity of moringa products marketed. 3) Encouraging marketers to form and belong to cooperatives. This will enhance bulk purchases, thereby minimizing transaction cost of marketing thereby enhancing marketing efficiency. 4) Institutional and infrastructural policies to militate against the constraints militating against moringa marketing. 5) Government should assist marketers by providing both processing and storage facilities which will make the products to be made available throughout the seasons. 6) Intensified researches are needed in moringa products as to know more about the various forms it can be processed for easy marketing and consumption.7) There is need to ensure by appropriate government agency that marketers have access to credit from microfinance bank and commercial banks at reduce interest rate and affordable collaterals. This will enable the marketers to procure the necessary inputs to be used to guide against environmental degradation in the course of carrying out their marketing business. 8) There is need to enforce on workers in processing houses to wear protective devices while performing their functions by appropriate government agencies. This will help to curtail maximally environmental effects associated with their operations such as hearing losses, respiratory problems and among others on them. 9) The Environmental Protection Agencies should provide refuse dumping facilities for ease of refuse disposal. This will guide against indiscriminate disposal of wastes at every nook and crannies of the marketing points by the marketers. 10) There is need for levies to be imposed on defaulters of indiscriminate refuse dumping. 11) There is need for the marketers to organize environmental sanitation/cleaning of their marketing places and processing units on at least once in every month. 12) The need or marketers forming cooperative is very paramount. This will help to equip marketers with information on how best to avoid environmental degradation in the course of discharging their businesses through interactions and provision of inputs at affordable prices. 13) There is need for marketers to be exposed to educational programmes like seminars and workshops with subject matters focusing on environmental pollution and preservations.

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