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Poisson Count Model to Explain Gender Dynamics of Farmer Adoption of Climate Smart Agricultural Practice

Rebecca OWUSU[1]

Abstract

Climate smart agricultural practices are important interventions for addressing effects of climate change in agricultural production. In this paper, a Poisson count regression model is employed to examine multiple factors that drive both men and women farmers' adoption of climate smart agricultural practices. Using a sample of 105 maize farmers, the econometric modelling revealed that men farmers' adoption of climate smart agricultural practices is affected by years of education and climate related shock. Also, men and women farmers' adoption of climate smart agricultural practices is influenced by farm size. Given that women farmers in developing countries are not permitted to own large farms, it is recommended that government considers land reforms that would enable women farmers have more access to large farms to improve their adoption of climate smart agricultural practices.

***Keywords**: Climate change, Gender, Adoption, Maize farmers*

***JEL Classification**: Q15, Q54*

İklim Akıllı Tarım Uygulamalarına Çiftçi Uyumunun Cinsiyet Dinamiklerinin Poisson Sayma Modeli İle Açıklaması

Özet

İklim akıllı tarım uygulamaları, iklim değişikliğinin tarımsal üretim üzerindeki etkilerini ele almak için önemli araçlardandır. Bu çalışmada, hem erkek hem de kadın çiftçilerin iklim akıllı tarım uygulamalarını benimsemesini sağlayan birçok faktörü incelemek için Poisson sayma regresyon modeli kullanılmıştır. 105 mısır çiftçisi örneğini kullanan ekonometrik modelleme, erkek çiftçilerin iklim akıllı tarım uygulamalarını benimsemelerinin eğitim düzeylerinden ve iklim kaynaklı şoktan etkilendiğini ortaya koymaktadır. Ayrıca, akıllı tarım uygulamalarını benimseyen kadın ve erkek çiftçiler çiftlik büyüklüğünden etkilenmektedir. Gelişmekte olan ülkelerdeki kadın çiftçilerin büyük çiftliklere sahip olmalarına izin verilmediği göz önüne alındığında, hükümetin kadın çiftçilerin iklim akıllı tarım uygulamalarını benimsemelerini geliştirmek için büyük çiftliklere daha fazla erişimlerini sağlayacak arazi reformlarını göz önünde bulundurmaları önerilmektedir.

***Anahtar Kelimeler**: İklim değişikliği, Cinsiyet, Benimseme, Mısır çiftçileri*

***JEL Sınıflandırması**: Q15, Q54*

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1. Introduction

Agriculture is one of the major sectors contributing to the economic development of Ghana. The sector contributes about 20% to gross domestic product, employs about 55% of the population and generates 30-40% of foreign exchange earnings (Fosu-Mensah et al., 2012). Despite the enormous contributions of the agricultural sector to Ghana's economic development, it is bedevilled with challenges such as inefficient market systems, low productivity and climate change. Climate change according to the Intergovernmental Panel on Climate Change (IPCC) is a change in state that can be identified by changes in the mean and (or) the variability of its properties and that which persists for an extended period, typically a decade or longer (IPCC, 2014). The effect of climate change on the agricultural sector is widely acknowledged (Lipper et al.. 2014). Studies have shown that climate change will create heat and water stress that will result in yield reductions, decreased livelihood stocks, reduced food accessibility and consumption (Vermeulen et al., 2010).

Given the importance of the agricultural sector and the impact of climate change on the sector (Adger et al., 2003; Deressa et al., 2009a), adaptation to climate change has become a major policy concern to farmers, policy makers and researchers. Over the years, farmers have adopted measures to deal with the effects of climate change including climate smart agricultural practices. Climate smart agricultural practices (CSA) are practices that sustainably increases productivity, resilience, reduce greenhouse gases and enhance achievement of national food security and development goals (Food and Agriculture Organisation [FAO] 2010; Wassie and Pauline, 2018). The CSA practices were introduced by the Food and Agriculture Organisation in 2010.

Since the introduction of CSA practices, several studies have explored farmers' adoption behaviour. For instance, Fosu-Mensah et al. (2012) examined farmers' perception and adaptation to climate change in Ghana and found that farmers believe climate change has negative effects on their production, and have accordingly adopted measures such as crop cultivation, changes in crop species and planting dates, to deal with its negative effect. Also, Deressa et al. (2009a) study on farmers' choice of adaptation to climate change in the Nile Basin of Ethiopia using choice experiment found that farmers adopted agronomic practices such as crop varieties, irrigation and change in planting dates to deal with the effects of climate change. The study further identified level of education, gender, age, access to extension service, credit and wealth of household head as key drivers of farmers' adaptation choice. Other studies on farmers' adaptation to climate change include Below et al. (2012), Bryan et al. (2009), Hassan and Nhemachena (2008), Mertz et al. (2009), Reidsma et al. (2010).

Quite distinct from the aforementioned studies are the research that have been conducted in the area of gender and climate change (Andersen et al., 2017; Bryan et al., 2018; Di Falco and Veronesi, 2013; Jost et al., 2016; Külcür et al., 2019; Perez et al., 2015). The fact that women are more vulnerable to climate change effect is well established in the literature (Alston, 2014; Arora-Jonsson, 2011). For

instance, Ahmed et al. (2016) using qualitative assessment of climate change adaptation in semi-arid regions of Ghana revealed that alternative groups adopt different adaptation measures which are influenced by climate and non-climate stressors. The specific groups considered under the study were males and females. Codjoe et al. (2012) study on gender and occupational perspectives and adaptation to climate extremes in the Afram plains of Ghana revealed that males and females preferred different climate change adaptation strategies during floods and droughts.

Previous studies have examined some of these differences in perceptions and practices, howbeit with some confusion in the definition of gender. Some studies by gender make use of males and females (Ahmed et al. (2016; Codjoe et al. 2012), while others use men and women (Partey et al. 2009; Murage et al. 2015; Adzawla et al. 2019). There is therefore a confusion in the literature in the use of men and women to represent gender, *vis-à-vis males* and females. This paper follows previous studies that have accurately referred to men and women with reference to gender (Partey et al., 2009; Murage et al., 2015; Adzawla et al., 2019). Gender dynamics, therefore, imply differences in the men and women perceptions of climate change, and adoption of climate smart agricultural practices and its determinants. It suffices to note that males and females refer to sex, which is defined as the biological differences between males and females and not gender that is a social construct and relates to the continuum of complex psychosocial self-perceptions, attitudes, and expectations people have about members of both sexes (Tseng, 2008; Quisumbing, 2014). It is important to note that one cannot be referring to males and females when talking about gender because they are not the same as men and women.

In addition, many studies examining farmers adoption of climate smart agricultural practices in Ghana assume that adoption of the practices is binary and therefore model using probit or logit regression models (Akudugu et al., 2012). The drawback of these approaches is that they ignore simultaneous adoption behaviour of farmers (Mwungu et al., 2018). Failure to incorporate simultaneous adoption implies that the methods also ignore unobserved variation that might influence adoption of multiple technologies (Lin et al., 2005; Mwungu et al., 2018). This study addresses the limitations by using a Poisson count regression model to examine men and women farmers' adoption of climate smart agricultural practices. The Poisson model has the advantage of accounting for the number of climate smart agricultural practices adopted by farmers, which makes the study quite distinct. Specifically, this is the first empirical application of the Poisson model in examining gender dynamics of climate smart agricultural practices adoption in Ghana.

The empirical data for the analyses come from an inter household survey conducted in the Eastern region of Ghana among maize farmers. Maize is considered because it is a major food security crop, mostly consumed by all age groups in Ghana. The crop is cultivated by small-scale resource poor farmers under rain-fed conditions and therefore highly vulnerable to climate change effects. This study is therefore relevant in identifying the gender specific factors that would improve farmers' adoption of climate smart agricultural practices. The results show that men and

women farmers are aware of most of the CSA practices. The adoption drivers of the CSA practices, however, vary cross the gender groups. For instance, the Poisson count regression estimation revealed that men farmers' adoption of CSA practices is influenced by years of education and previous experience with climate related shock such as erratic rainfall. However, the women farmers' adoption of CSA practices is mainly influenced by larger farm sizes and higher yields.

The rest of the paper is organised as follows. The next section discusses the literature review followed by the methods employed in the study including a description of the data used in the application. This is followed by a discussion of the results and finally, the paper concludes with policy recommendations.

2. Literature Review

The effects of climate change on agriculture and livelihoods is widely acknowledged in the climate change and development literature (Akudugu et al., 2012; Lipper et al., 2014; Schlenker and Lobell, 2010). For instance, Akudugu et al. (2012) study on implications of climate change on food security and rural livelihood: experiences from Northern Ghana revealed that floods and droughts have become a major issue in the area with consequential effect on food security and livelihoods. Besides the general effect of climate change, it has been established in the literature that women are more vulnerable to climate change effects (Beuchelt and Badstue, 2013). It has therefore become relevant for stakeholders-governments, researchers and farmers to identify the policy options that would help to address the negative consequences of climate change with the aim of promoting sustainable food production (Kamel et al., 2020). Particularly, with about 40-60% of women being engaged in agriculture in Africa and the need to increase their resilience to climate change because of its effect on food security (Doss, 2018, Doss et al., 2015).

To address the problem of climate change, the Food and Agriculture Organisation introduced the concept of CSA practices in 2010. The CSA practices include minimum or zero tillage, compositing that stores carbon in the soil, terracing, contouring and irrigation activities that create water efficiency (Karpouzoglou and Barron, 2014, Wang et al., 2016), weather smart practices that help farmers deal with climate related shocks such as floods, storms, surges and prolonged drought (Akudugu et al., 2012), and finally, knowledge based smart practices or indigenous knowledge systems-traditional knowledge and skills held by farmers outside the formal scientific domain embedded in culture and traditions (Nyong et al., 2007; Codjoe et al., 2014, Tume et al., 2019). The knowledge based smart practices integrate farmers' knowledge on how to implement the other related CSA practices in dealing with climate change effects. Glazebrook (2011) studied women and climate change from Northeast Ghana and found that women farmers have knowledge systems that could contribute to climate change adaptation efforts.

Since the introduction of the climate smart agricultural practices, several studies have examined farmer adoption and the factors that drive farmers' adoption of these practices. For instance, Akudugu et al. (2012) examined the determinants of climate smart agricultural practices among small-holder farmers in Ghana and found that

financial availability, access to labour and demand for farm produce drive farmer adoption. Lipper et al. (2014) study on climate smart agriculture for food security revealed that climate change interrupts with food markets, posing population wide risks to food supply. Schlenker and Lobell (2010) study on the negative impacts of climate change on African agriculture showed that diversity in factors including land, credits, markets and technology tend to affect the severity of climate change effect on agriculture.

In another study on determinants of farmer adaptation of climate smart agricultural practices in Tanzania, Mwungu et al. (2018) found that access to credit, wealth, literacy and household food security are important in farmer adoption of these practices. Teklewold et al. (2013) study on adoption of multiple sustainable agricultural practices in rural Ethiopia found the following drivers of farmer adoption including household wealth, social capital and networks, availability of labour and household trust in government support. In a study on the factors affecting adoption of multiple climate smart agricultural practices, Aryal et al. (2018) found that farmer adoption is influenced by access to credit, climate risks, access to extension services in addition to farm related characteristics. Furthermore, Azumah et al. (2016) studied contract farming and the adoption of climate change coping and adaptation strategies in the Northern region of Ghana and found that contract farming enhances adaptation strategies to climate change. Zakaria et al. (2019) also examined factors influencing the adoption of climate smart agricultural technologies among rice farmers in Northern Ghana and found that adoption of CSA is affected by perceived decrease in rainfall, training, and farmers' experience. Other studies have also identified factors of climate smart agricultural practices adoption such as education/literacy (Deressa et al., 2009b), farm size (Acquah, 2011; Deressa et al., 2009a; Saguye, 2011), among others.

Apart from the broad studies on farmers adoption of CSA practices, other researchers have focused on gender differences in climate change perceptions. For instance, Partey et al. (2018) studied gender and climate change risk management with evidence from Ghana and found that men and women had similar perceptions about climate change with majority perceiving changes such as strong winds, higher temperatures, increased frequency of drought and increased rainfall variability. Murage et al. (2015) also examined gender specific perceptions and adoption of the climate smart push-pull technology in Eastern Africa. Using a sample of 900 farmers, the study found that women farmers perceived the climate smart push-pull technology as more effective compared to the men farmers. Therefore, the technology would be more useful to vulnerable women farmers than men farmers. In a related study in Ghana, Owusu et al. (2018) investigated gendered perception and vulnerability to climate change in urban slum communities. The study found that perceptions and knowledge of climate change are differentiated by gender. Similarly, Adzawla et al. (2019) studied gender perspectives of climate change adaptation in two districts in Ghana. Using a sample of 300 farmers, the study found that women farmers are severely impacted by climate change effects compared to men farmers. Also, both men and women farmers have different adaptation strategies to include changing planting dates, row planting and intercropping.

3. Methods

3.1. Study Area

The study was conducted in the Akwapim North district of the Eastern region of Ghana. The Akwapim North district lies between longitude $0^0\ 00^0$ E and $0^0\ 20^0$ E of the Greenwich Meridian and latitude $5^0\ 51^0$ and $6^0\ 10^0$ north of the equator (Ministry of Food and Agriculture [FAO], 2019). It shares boundaries to the northeast with Yilo Krobo, north with New Juabeng municipal, southeast with Akwapim South municipal and west with Suhum Kraboa Coltar district. It covers a land mass of about 480kmsq, representing 2.3% of the total land area in the Eastern region (Owusu et al., 2014). The inhabitants of the district are mainly farmers involved in the production of food and cash crops. Maize is one of the major crops cultivated in the district. Maize cultivation in the district is mainly rain-fed and subsistence-based. Given that maize is a food security crop, it is important to consider farmers adoption of climate smart agricultural (CSA) practices and identify policy options for government to improve adoption of CSA practices to reduce the negative consequences of climate change on maize production.

3.2. Survey Instrument

The purpose of the study was to compare climate change perception, awareness and adoption of climate smart agricultural practices on gender basis. The individual inter-household level data employed in the study were generated using household survey. The household survey was adapted from the Climate Change Agriculture and Food Security (CCAFS) survey (Mwungu et al., 2018). The survey instrument consisted of three sections. Section one contained information on the socio-economic characteristics of respondents (age, gender, average income, years of education, among others). The second section was composed of questions on farmers' perception of climate change and experience with climate related shocks

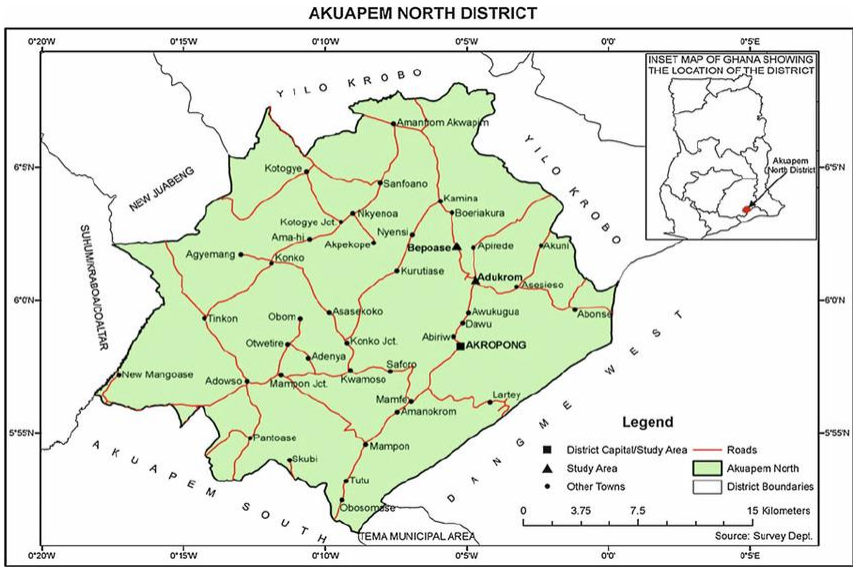

Figure 1. Map of Study Area.

Source: Owusu et al. (2014)

(droughts, erratic rainfall and floods). Here, climate change was defined as perceived changes in the average temperature and average rainfall over the last 10 years. The last section, section three comprised questions on farmers' awareness and adoption of climate smart agricultural practices.

3.3. Sampling and Survey Method

The respondents for the study were randomly selected from the Akwapim North district taking into consideration the gender dynamics (differences) of the study. Gender balance was achieved by interviewing men and women maize farmers who were heads of their households. A total of 105 respondents were interviewed comprising 51 men and 54 women.

3.4. Econometric Modelling

Econometric analyses were conducted to determine the best predictors of men and women farmers' adoption of climate smart agricultural practices. Generally, farmer adoption decision is modelled as a binary variable, which takes the value of 1 for adopters and 0, for non-adopters using probit or logit estimation techniques. However, adoption of farmers in developing countries often happen sequentially and to address this scenario, count regressions are proposed, where adoption equals 0,1,2…n, where *n*, represents the largest number of technologies adopted (Jara-Rojas et al., 2012). In this paper, a Poisson regression model, a member of the family of count regressions is used to examine farmer adoption of CSA practices.

Given that the utility a farmer derives from the adoption of CSA practices depends on W, a vector of farm specific factors, and K, a vector of fixed regional effects, the utility (U) to farmer i as a result of adopting a number of j climate smart agricultural practices can be represented as:

$$U_{ji} = \gamma_j(W_i, K_i) + \varepsilon_{ji} \;\; j = 0,1,2 \ldots, n \qquad (1)$$

where j is an integer that represents the number of climate smart practices adopted by the ith farmer, γ is a vector of conformable parameters to be estimated, and ε_{ji} is the error term. The ith farmer adopts ($j = 1$ or higher) when $U_{ji} > U_{0i}$. Given a dependent variable, Y_i the number of practices adopted by farmer i can be expressed as:

$$prob(Y_i = j) = \frac{e^{-\lambda_i}\lambda^{j_i}}{j!}, \text{ j=0,1,2…m; i=1,2…n} \qquad (2)$$

where j shows the number of practices adopted by farmer i, λ_i is both the conditional mean and the variance of the Poisson distribution, and m is the maximum number of climate smart agricultural practices adopted. The equality of the mean and the variance distinguishes the Poisson model from other count regression models. The expected number of practices adopted, and the variance are given as:

$$E|Y_i| = Var(Y_i) = \lambda_i = e^{\beta\prime(W,K)} \qquad (i = 1,2, \ldots n) \qquad (3)$$

where $E|Y_i|$ is the expected value of the dependent variable for the ith farm, β is a vector of unknown parameters, n is the number of farms, W and K are as defined earlier. The Poisson regression model requires that the mean and variance are equal. If the variance is higher than the mean, we have a case of overdispersion. On the other hand, if the variance is lower than the mean, we have under dispersion. In both cases of overdispersion and under dispersion, the Poisson model becomes inappropriate, under which case a negative binomial regression model becomes appropriate (Kim et al., 2005). A diagnostic test conducted revealed that the Poisson model is suitable in this application because we neither had an issue of overdispersion or under dispersion.

4. Empirical Results and Discussion

4.1. Adoption Levels and Socio-economic Characteristics of Respondents

Table 1 presents the adoption levels and socio-economic variables of the respondents. From the table, about 28% of men farmers (14) had adopted between 4 or 5 CSA practices, 17.6% had adopted 7 practices, and 1.9% had adopted 9 practices. Only 4, representing 7.8% of the sampled men farmers had not adopted any of the CSA practices. Also, none of the sampled men adaptors had adopted less than one practice. Similarly, for the women farmers, about 22% had adopted 5 practices and there was no woman non-adopter in the sample. However, unlike the men, about 5 women, representing 9.3% had adopted only 1 practice (Table 1). The composition of the CSA practices adoption between the men and women farmers also justify the application of the Poisson regression model.

The results also show that the age of the respondents ranges from 23 to 89 years with a minimum of 44 years, indicating a youthful sample. In terms of years of education, the average years of education is 7 years, indicating a minimum of primary education. The average household size is 5 and the average farm size is 2 acres, showing that these farmers are producing on a small scale. The farm size is also slightly larger for the men farmers compared to the women farmers. The small farm sizes of the women farmers could be resulting from the gender inequalities in land ownership and access (Yaro, 2009). Culturally, in Ghana, women cannot inherit lands when there are men members in the family. Such a cultural barrier in land ownership affects women access to land for agricultural purposes. It is therefore not surprising that women have smaller farm sizes as recorded in this study. The men farmers are also more productive compared to the women farmers (Table 1). The productive nature of men farmers compared to the women farmers has also been reported in previous studies (Sneryers and Vandeplas, 2015). Men farmers are more productive probably because they are able to spend more time on farm work compared to women farmers that also engage in domestic activities, which limit their access to productive resources such as extension and advisory services and participation in income generating activities (Diiro et al., 2018; Wekwete, 2014).

Table 1. Adoption Levels of CSA Practices and Other Socio-economic Variables

	Men		Women	
Variables	Category	Freq.	Category	Freq.
Non adoption	0	4	0	-
CSA practices counts	1	-	1	5
“	2	4	2	5
“	3	4	3	7
“	4	14	4	6
“	5	14	5	11
“	6	3	6	2
“	7	9	7	4
“	8	5	8	1
“	9	1	9	-
“	10	3	10	1
“	11	2	11	-
Independent	Mean	SD	Mean	SD
Age	43.9	11.4	43.0	9.9
Years of education	8.3	6.2	6.0	5.1
Farm size	2.6	1.5	1.9	0.9
Household size	5.6	2.9	4.5	1.8
Average farm income	1187.1	1296.5	681.0	390.7
Labour cost	309.6	359.3	179.6	103.2
Flood shock	0.3	0.5	0.4	0.5
Drought shock	0.9	0.2	0.9	0.3
Erratic rainfall shock	0.7	0.4	0.8	0.4
Yield	180.7	99.4	129.5	53.0
N	51		54	

SD=Standard deviation; Freq=Frequency, N=Number of observations

4.2. Men and Women Farmers’ Perception of Climate Change

In furtherance to examining differences in men and women attitudes towards climate change, their perceptions of climate change specific changes over the last ten years were sought and the responses are presented in Table 2 and Table 3. The results in Table 2 represent perceived temperature specific climate changes. The findings show that a greater percentage of women farmers observed more hot days (70.37%), as compared to the men farmers (54.90%). The results further show that greater percentage of men farmers (49.02%) observed more cold days than women farmers (29.63%). With exception of the significant difference in the perception of more cold days (Wilcoxon rank-sum test, p-value<0.04), the men and women farmers’ perception of more hot days and more frequent heatwaves are similar because the difference between them is not significant. This finding is consistent with McKinley et al. (2016) study on gender differences in climate change perception and adaptation strategies that found that both men and women farmers

observed similar changes in temperature. The gender difference in the perception of men and women farmers to temperature specific changes could be resulting from the biological makeup of the men and women (Vierck et al., 2008). By nature, women are more sensitive to cold weather compared to men, which could be affecting their perception of temperature changes. Partey et al., (2018) findings on similar perception of men and women farmers in Ghana confirms the outcome of this study.

Table 2. Perceived Temperature Specific Changes

	Men (% Yes)	Women (% Yes)	Percent point	Sig.
More hot days	54.90	70.37	-15.47	0.10
More cold days	49.02	29.63	19.39	0.04
More frequent heatwaves	36.00	51.85	-15.85	0.13

Note: Sig.=Significance.

Table 3 presents perceived rain-fall specific climate changes based on gender differences. The results show that both men and women farmers noticed a change in climate. On the average, majority of the women farmers (94%) affirmed that they have observed decreasing rainfall in the last ten years. This is followed by late onset of rains (74.07%). Similarly, majority of the men farmers observed decreasing rainfall (86.27%) and late onset of rains (94.44%). Nevertheless, there was no significant difference in their perceptions about specific changes in rainfall specific climate changes (Table 3). This finding is also consistent with McKinley et al. (2016) study that found both men and women farmers reporting differences in rainfall patterns, particularly, decreasing rains, but could not establish a significant difference in their perceptions. However, it is contrary to the findings of Partey et al. (2018) that found that men and women farmers observed an increasing rainfall pattern compared to the findings of this study of a decreasing rainfall. The difference in the perception of rainfall by respondents in Partey et al. (2018) study and this study is the fact that the present study was conducted in the Eastern region of Ghana, a forest zone with much rainfall, compared to their study that was

Table 3. Perceived Rainfall Related Changes

	Men (% Yes)	Women (% Yes)	Percent point	Sig.
Increasing rainfall	19.61	9.26	10.35	0.13
Decreasing rainfall	86.27	94.44	-8.17	0.15
More erratic rains	54.90	42.59	12.31	0.21
Early rains	25.49	16.67	8.82	0.27
Late rains	70.00	74.07	-4.07	0.64
Longer periods of drought	9.80	12.96	-3.16	0.61
More frequent flood	64.71	57.41	7.3	0.44
Less frequent flood	2.00	1.85	0.15	0.96

Note: Sig.=Significance.

conducted in the Upper West region of Ghana, a savannah zone. It may therefore suffice to suggest that prevailing climatic conditions of a study could affect the perception of the respondents and therefore the findings.

4.3. Men and Women farmers' awareness of climate smart agricultural practices

Table 4 presents the inter-household analysis regarding the awareness of climate smart agricultural practices. The outcomes of the survey show that men and women maize farmers were aware of climate smart agricultural practices. Specifically, both the men and women farmers were aware of the use of improved high yielding varieties as a climate smart agricultural practice compared to the other practices.

Table 4. Awareness of Climate Smart Agricultural Practices

	Men (% Yes)	Women (% Yes)	Percent point	Sig.
Agro forestry	76.47	59.26	17.21	0.06
Terraces, bunds	23.53	11.32	12.21	0.10
Use of stress tolerant varieties	88.24	85.19	3.05	0.65
Water harvesting	82.35	88.89	-6.54	0.34
Use of irrigation	84.31	64.81	19.5	0.02
No tillage/minimum tillage	27.45	7.41	20.04	0.00
Leaving crop residue	86.00	86.79	-0.79	0.90
Composting	42.00	20.37	21.63	0.01
More efficient use of fertilizer	86.27	70.37	15.9	0.04
Use of improved high yielding varieties	94.12	92.59	1.53	0.75
Cover cropping	68.63	35.85	32.78	0.00
The integrated pest management	39.22	7.41	31.81	0.00

Note: Sig.=Significance.

The men farmers were more aware of the use of improved high yielding varieties as a CSA practice (94.12%) compared to the women farmers (92.59%). However, the difference in the level of awareness of high yielding varieties as a CSA practice is not significant (Table 4).

Also, it can be deduced from the table that a significant difference exist among the men farmers and the women farmers concerning the awareness of CSA practices such as the use of irrigation (p-value < 0.02), no tillage or minimum tillage (Wilcoxon rank-sum test, p-value < 0.00), composting (p-value < 0.01), more efficient use of fertilizer (Wilcoxon rank-sum test, p-value < 0.04), cover cropping (p-value < 0.00) and integrated pest management (Wilcoxon rank-sum test, p-value < 0.00). The finding of difference in the perception of men and women farmers on the integrated pest management technique confirms the study finding of Murage et al. (2015) that found similar differences in the perception of men and women farmers.

4.4. Men and Women Farmers' Adoption of Climate Smart Agricultural Practices

Table 5 presents the CSA practices adopted by both men and women farmers. Generally, both men and women farmers adopted CSA practices to deal with the harsh weather conditions. There is a slight similarity between the men and women farmers concerning the adoption of improved high yielding varieties as a CSA practice, though there was no significant difference between men and women farmers (Table 5).

Table 5. Adoption of Climate Smart Agricultural Practices

	Men (% Yes)	Women (% Yes)	Percent point	Sig.
Agro forestry	37.25	27.78	9.47	0.30
Terraces, bunds	9.80	3.70	6.1	0.21
Use of stress tolerant varieties	70.59	59.26	11.33	0.23
Water harvesting	50.98	61.11	-10.13	0.30
Use of irrigation	39.22	42.59	-3.37	0.73
No tillage/minimum tillage	21.57	3.70	17.87	0.01
Leaving crop residue	78.43	62.96	15.47	0.08
Composting	21.57	7.41	14.16	0.04
More efficient use of fertilizer	78.43	57.41	21.02	0.02
Use of improved high yielding varieties	84.31	81.48	2.83	0.70
Cover cropping	35.29	14.81	20.48	0.01
Integrated pest management	27.45	5.56	21.89	0.00

Note: Sig.=Significance.

The probability values indicate that a substantial difference exist amongst the men and women on the adoption of CSA practices such as no tillage or minimum tillage, composting, more efficient use of fertilizer, cover cropping and integrated pest management. The use of improved high yielding varieties and use of stress tolerant varieties are consistent with Deressa et al. (2009a) study that also established that improved high yielding varieties and use of stress tolerant varieties are unique techniques for addressing the negative effects of climate change, especially among farmers in developing countries.

4.5. Determinants of the Adoption of Climate Smart Agricultural Practices

The Poisson count regression model estimates for the determinants of climate smart agricultural practices are presented in Table 6 with the corresponding marginal effects reported in Table 7. The model estimates are presented based on gender differences-that is whether the respondents are men or women. The results for the men respondents are presented in the second and third columns of Table 6, while those of the women respondents are presented in the fourth and fifth columns of Table 6. Prior to estimating the final model, in this case the Poisson model, a goodness of fit test was conducted in Stata 14. The estimated test results based on the Bayesian Information criteria (BIC) revealed that the Poisson model (253-men

and 257-men) is appropriate for the sampled data compared to the Negative Binomial counterpart[2] (256-men and 261-men). Also, the Pearson goodness of fit test based on GOF Stata command revealed that the Poisson model (30.36, p>chisq 0.88-men and 35.26, p>chisq 0.82-women) is more suitable for our analysis compared to the Negative Binomial model.

From the estimated results (Table 6), three variables have significant impact on the adoption of CSA practices by men: years of education, farm size and erratic rainfall shock. The positive and significant coefficient on the years of education variable in predicting adoption of CSA practices imply that men adoption of CSA practices is directly related to the years of education, suggesting that men maize farmers with higher years of education adopt more CSA practices compared to men maize farmers that have lower years of education. It is likely that men farmers with higher years of education are involved in active search for information and might have the exposure about profitability and proceed to adopt the CSA practices (Conley and Udry, 2010; Krishnan and Patman, 2013). This finding that education affect men farmers' adoption of CSA practices is consistent with Deressa et al. (2009a) study that found education as important for farmers' adaptation to CSA practices. The implication of this finding is that government investment in extension activities for farmers would prove beneficial to increase farm productivity.

Table 6. Estimates of the Poisson Count Regression Model

Variables	Men		Women	
	Coef.	Robust SE	Coef.	Robust SE
Age	-0.010	0.006	0.007	0.007
Years of education	0.034***	0.007	0.008	0.015
Farm size	0.088**	0.039	0.347***	0.116
Household size	0.000	0.015	-0.066*	0.040
Average farm income	0.000	0.000	0.000	0.000
Labour cost	0.000	0.000	-0.001	0.001
Flood shock	0.095	0.110	-0.005	0.127
Drought shock	-0.227	0.151	-0.100	0.237
Erratic rainfall shock	0.340***	0.119	0.078	0.150
Yield	0.001	0.001	0.002*	0.001
Constant	1.274	0.239	0.741	0.464
LL	-106.86		-108.72	

Note: SE=standard errors, LL=Log likelihood

The results also show that men farmers with large farm sizes are likely to adopt more CSA practices compared to men farmers with smaller farm sizes, suggesting that resource availability is very vital for farmer adoption of CSA practices. Similarly, women farmers' adoption of CSA practices is positively and significantly affected by farm size, suggesting that women with larger farm sizes are more likely to adopt more CSA practices. This finding has implications for the culture

[2] Detailed results are available upon request from the author.

governing acquisition of lands in developing countries. In countries such as Ghana, women are not culturally allowed to own lands, which could affect their access to land and therefore adoption of CSA practices. Generally, the finding that farm sizes predict adoption of CSA practices confirm Saguye (2011) and Aryal et al. (2018) study outcomes that farm size is important in CSA adoption. They are, however, contrary to Uddin et al. (2014) and Acquah (2011) study outcomes that established a negative relationship between farm size and adaption to climate change effect. The influence of farm size on adoption of CSA practices imply that government should invest in land tenure systems and promote corporate farming systems to increase farm size in developing countries such as Ghana given that generally, farm sizes are small.

In addition, men farmers with experiences with erratic rainfall patterns have high probability of adopting more CSA practices. However, for the women farmers, erratic rainfall variable is not significant suggesting that the factor may not account for women adoption of CSA practices. For the women farmers, larger household sizes reduce the adoption of more CSA practices. Also, the likelihood of obtaining higher yields from the production process increases their adoption of more CSA practices. However, these variables are not significant in the men farmers' adoption model, implying that the factors may not necessarily affect their adoption of CSA practices.

Considering the marginal effects (Table 7), age is inversely related to men farmers' adoption of CSA practices. This implies that younger farmers are more likely to adopt more CSA practices compared to older men farmers. This finding confirms Deressa et al. (2009a) study outcome that age is relevant in farmers' adoption of CSA practices. The average marginal effects also show that a percentage increase in erratic rainfall experience improves men farmers' adoption of CSA practices by about 185%. Similarly, a percentage increase in farm size increases CSA practices by about 48%.

Table 7. Marginal Effects of the Poisson Count Regression Model

Variables	Men		Women	
	ME	Delta method SE	ME	Delta method SE
Age	-0.052*	0.031	0.031	0.028
Years of education	0.187***	0.039	0.034	0.063
Farm size	0.479**	0.201	1.437***	0.481
Household size	0.001	0.080	-0.273	0.167
Average farm income	0.000	0.000	-0.001	0.001
Labour cost	-0.001	0.001	-0.004	0.003
Flood shock	0.515	0.586	-0.022	0.526
Drought shock	-1.234	0.836	-0.416	0.983
Erratic rainfall shock	1.849***	0.646	0.324	0.619
Yield	0.004	0.003	0.009**	0.005

Note: ME=Marginal effects; SE=standard errors

In the case of the women farmers, a percentage increase in farm size increases CSA adoption by about trice the value of the men farmers, suggesting that women with larger farm sizes have greater probability of adopting more CSA practices compared to men farmers in the sample. The findings of this study corroborate previous study outcomes (Saguye, 2011, Deressa et al., 2009a, Aryal et al., 2018).

4. Conclusion

This study investigated the factors that determine the probability of farmers' adoption of climate smart agricultural practices with specific emphasis on the gender dynamics. Gender dynamics implies the differences in the perception of men and women farmers on climate change and adoption of climate smart agricultural practices. Generally, there could be a broad perception of climate change but that would not give a holistic picture of the differences in perceptions and adoption of the climate smart agricultural practices. Gender is very important in climate change studies because of the susceptibility of women to climate change impacts (Alston, 2013). It has been widely acknowledged that the effects of climate change and variability are not gender neutral but has far reaching effects. Studies have examined some of these differences in perceptions and practices, howbeit with some confusion in the definition of gender. Some studies by gender make use of males and females (Ahmed et al., 2016; Codjoe et al., 2012), while others use men and women (Partey et al., 2009; Murage et al., 2015; Adzawla et al., 2019). This study therefore refers to men and women, when referring to gender.

Gender in agriculture is very important because women contribute about 43% to the agricultural labour force in developing countries (Quisumbing, 2014). Women in developing countries' agriculture have limited access to productive resources and opportunities in terms of inputs, land, labour, technology, education, extension and financial services. In agricultural production, men are often involved in the production, while women are involved in harvesting, processing and marketing. In recent years, however, women have been involved in the production as well as performing their primary operations-harvesting, processing and marketing. In Ghana for instance, about 37% of women are involved in cultivating crops such as maize (Doss, 2002). Regarding climate change adaptation practices, Wrigley-Asante et al., (2017) found that many men farmers cultivate drought resistant crop varieties, adopt improved seed varieties, soil fertility conservation practices, soil and water conservation practices, while women farmers practice traditional and mixed cropping systems. Also men are interested in an on-farm adaptation strategies compared to women who are interested in off-farm adaptation strategies (Assan et al., 2018). In Ghana, Adzawla et al. (2019) found that about 78% of men-headed households have very high adaptation levels, compared to 51.1% women-headed households. Specifically, about 96% of men had adopted row planting as a climate change adaptation strategy as compared to 88% women. The climate smart agricultural practices are measures adopted to address climate change effects through adaptation.

This paper provides a good understanding of the barriers to adoption of climate smart agricultural practices in Ghana with the aim of providing guidelines in

designing and formulating agricultural policies. It is important to provide a gender-responsive climate change adaptation strategies to encourage and support women in promoting food production in developing countries including Ghana. Using Poisson count regression model, the results revealed that men farmers' adoption of climate smart agricultural practices is driven by farm size, educational status, age and experience of climate shock. For the women farmers, adoption is driven by larger farm sizes and the likelihood of obtaining higher yields from the production. The results imply that the likelihood of men and women farmers to adopt climate smart agricultural practices is influenced by availability of cultivable land for large scale production.

The findings of the study have policy implications. Firstly, factors that have significant effect on climate smart agricultural practices adoption should be considered in the design of extension activities for farmers. For instance, the findings show that large farm sizes have positive effect on the adoption of climate smart agricultural practices. Therefore, Government should reconsider the cultural laws that ban women from having access to land for agricultural practices. Also, government should devise strategies such as corporate farming systems to increase farm sizes of farmers for agricultural production in Ghana. This suggestion is stemming from the fact that farm sizes in developing countries like Ghana are low, and on top of that, women are disadvantaged in having access to large farm sizes (Doss, 2002). In addition, Government should invest in extension services to ensure that farmers engaged in climate smart agricultural practices are well educated to understand the practices involved and undertake them effectively. Proper application of the climate smart agricultural practices would also increase the yield of farmers, which will in turn improve upon their adoption of the practices as is in the case of the women farmers.

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A Comparative Analysis of Consumers for Determining the Perception and Attitudes of Domestic Production Applications in Terms of Following Innovations

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Abstract

This study aims to determine the perceptions and attitudes of consumers towards domestic production practices in terms of following innovations and to explain how and in what direction consumer perceptions and attitudes are shaped in line with these practices. Accordingly, the data collected in March 2019- June 2019 were analyzed using the structural equation model. The results show that consumers who take into account the technological developments, quality, competitiveness and cost advantage in the long term take more risks and rush when a new domestic product is launched and adapt to the product early, which show more conservatism and care for the protection of local products. It has revealed that although it tends to focus on more domestic products due to labor, it constitutes a late majority, and moreover, consumers who have a very strict attitude towards domestic products constitute the traditional consumer group. These findings provide some suggestions for both manufacturers and consumers.

***Keywords**: Diffusion of innovation, Domestic product applications, Following innovations*

***JEL Classification**: M31, M39*

Yenilikleri Takip Açısından Tüketicilerin Yerli Üretim Uygulamaları ile İlgili Algı ve Tutumların Belirlenmesine Yönelik Karşılaştırmalı Bir Analiz

Özet

Bu çalışma yenilikleri takip açısından tüketicilerin yerli üretim uygulamalarına yönelik algı ve tutumlarını belirlemeyi ve bu uygulamalar doğrultusunda tüketici algı ve tutumların nasıl ve ne yönde şekillendiğini açıklamayı amaçlamıştır. Mart ve Haziran 2019arasında toplanan veriler yapısal eşitlik modeli ile analiz edilmiştir. Sonuçlar uzun vadede teknolojik gelişmeleri, kaliteyi, rekabetçiliği ve maliyet avantajını dikkate alan tüketicilerin, daha fazla risk aldığını, yeni bir yerli ürün piyasaya sürüldüğünde acele ettiğini ve ürüne erken adapte olduğunu göstermektedir. Daha fazla muhafazakârlık gösteren ve yerli ürünlerin korunmasına önem veren tüketicilerin ise yerel ekonomi ve emek nedeniyle daha fazla yerli ürüne odaklanma eğiliminde olmasına rağmen geç çoğunluğu oluşturduğu bulgusuna ulaşılmıştır. Dahası yerli ürün konusunda çok katı tutum gösteren tüketicilerin ise geleneksel sona kalan tüketici grubunu oluşturduğunu ortaya koymuştur. Bu bulgular hem üreticiler hem de tüketiciler için birtakım öneriler sunmaktadır.

***Anahtar Kelimeler**: Yeniliklerin yayılımı, Yerli üretim uygulamaları, Yenilikleri takip etme*

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1. Introduction

Businesses, in order to maintain their activities, either introduce a product, a new version of the product to the market, where consumers are aware of what is already available in the market, or introduce to the market a new product or a new version of the product that consumers are not familiar with before. When considering today's global markets as a pool where each individual has desired local habit, the local life style and the product yearned, the domestic markets are not lost but are constantly in contact with each other, it will be inevitable to develop new, different products for the businesses. From this way, it is very difficult to describe new product both domestic and foreign markets. Because defining products entering the current country's market from domestic and foreign market, depends upon innovations of current product, creating value in terms of time, generating innovations in market share and being perceived as innovation by customers (Robertson, 1971). In addition, another factor that may affect the identification of new products in the current market is the country-origin effect, expressed as the abstract barriers that cause consumers to create negative judgment against foreign products (Wang and Lamb, 1980).

Consumers' perceptions of product quality are directly affected by the country in which the product is produced. Therefore, the knowledge of country of origin and ethnocentrism tendency of consumers may be an advantage that can be used by marketers, but can also turn into a disadvantage if it cannot be managed properly. Before evaluating the tendency of consumers towards ethnocentric or in other words domestic products, it is necessary to first mention what innovation is and what it means in marketing.

The main purpose of this study is to determine how and in what direction consumers' perception of domestic products is shaped in terms of following innovations. It is thought that this study will benefit literature in terms of determining how domestic production and applications perceived by consumers, which are prominent recently, and whether they shape the purchasing behavior of consumers. In this study, innovation in terms of marketing and customer was mentioned first and eventually diffusion of innovation and then customer perceptions of domestic products and findings, discussions and recommendations.

2. Innovation and Marketing

When the concept of innovation is mentioned, the first thing that comes to mind is technology and product development; however, marketing where both concepts are integrated is an important component of innovation. Marketing innovation is the development of new designs and methods, giving a new and different direction to marketing.

Marketing innovation, according to Penning and Kim (2009); includes changing the product design, packaging, product positioning, product promotion activities and pricing in order to increase the acceptability of the products. These innovations can be expressed with examples such as original visual designs that will give the product a different image, virtual advertising application in films, new showroom

concepts, discounted prices on membership card, etc. (Elçi, 2006:32). Accordingly, marketing innovation includes innovations to be realized in all marketing mix elements called 4P. Therefore, marketing innovation; product design or packaging, product positioning, product promotion or pricing as a new marketing method that includes significant changes (Shergill and Nargundkar, 2005:32-33).

Innovations in marketing may increase consumer demand. The use of new marketing themes and channels in advertising can provide access to new customers, consumers' price sensitivity can be reduced by differentiation of products (Porter, 2000:221-222).

3. Innovation and Consumers

Consumers' tendency to adopt new ideas, goods and services; can play an important role in brand loyalty, decision making, choice and communication theories. If consumers did not have innovation, consumer behavior would become a routine purchase of similar products on the market. Innovation, a natural desire of a consuming society, leads to a dynamic structure of the market (Hirschman, 1980:283). From this perspective; consumer innovation may be considered as the tendency of individuals to purchase new products and brands rather than their previous product selection and consumption habits (Steenkamp, Hofstede, and Wedel, 1999:56).

So a question is needed to reveal "why is the consumer's level of innovation sought?" There are several reasons for this. These are the need for companies to better understand the differences and similarities of consumers between markets as a result of the globalization of the markets, and more and more often, companies need to learn the tendencies of consumers in different markets towards new products (Telis, Yin and Bell, 2009:1).

When the studies in the consumer behavior literature are examined, it is seen that the concept of consumer innovation is explained in two dimensions. These are global/innate innovativeness and domain specific innovativeness (Midgley and Dowling, 1978:235; Goldsmith and Flyn, 1993:378). Midgley and Dowling (1978) defines the global/innate innovation as the tendency to adopt innovations independently, regardless of the experience conveyed by other members of the social system in which the individual is involved. Global/innate innovation leads to consumers' decision to buy new products. Consumers rely on others' own experience rather than the knowledge of new products or services. The high level of personal innovation makes it more relevant to new experiences and new stimuli.

In global/innate innovation, innovative people are less affected by the subjective norms of the society in which they are located, and therefore consumers of this type are more likely to adopt new products because they are not more affected by social pressures and tend to be seen differently from society. There are twelve hidden personal feature sizes of global/innate innovation. These; seeking innovation, seeking risk, seeking change, stimulus variation, habit, longing for the past, suspicion, social dependence, inactivity (laziness), frugality, enthusiasm for buying (Tellis, Yen and Bell, 2009:4).

The second dimension of consumer innovation is that domain specific innovation is narrower than personal innovation, and the adoption of new products in the area of interest reflects the tendency to learn about these products. The scale developed for domain specific innovation is widely used in two areas. These are fashion and technology. Fashion innovation is a concept that marketers take care of. Fashion innovators have been described as the first to age the existing styles by adopting different styles. When new styles are introduced to the market, fashion innovators are the first to buy them. Technological innovation can be expressed as a tendency to adopt technological innovations. Technological innovation affects the individual's tendency to obtain information about the product class and new products in the technological field (Goldsmith and Hofacker, 1991:209). Consumer perceptions, attitudes and characteristics of the product category have a significant effect on innovation. The idea leadership, expertise and meaning of the product for the consumer affect the innovation. Idea leaders are those who convince consumers to buy products and services. They are also the first to try new products or services. Therefore, they are likely to affect other consumers related to new products (Goldsmith and Flynn, 1993:380).

4. Diffusion, Adaption and Acceptance of Innovation

Diffusion is the process of transmitting innovation over time through certain channels between members of a social system, and at the same time, diffusion is a special type of transmitting messages about new ideas (Rogers, 2003). In other words, innovation can be either an alternative solution to problems to meet the needs of individuals or organizations, or new ways of perceiving the problem or needs.

In 1962, E.M. The Theory of Innovation Distribution (DOI) developed by Rogers who is one of the oldest social science theories. It stemmed from communication to explain how an idea or product accelerated and spread over time through a particular population or social system. The result of this expansion is that people adopt a new idea, behavior or product as part of a social system. Adoption means that a person does something different from what he or she has before (ie, he buys or uses a new product, acquires and performs new behavior, etc.) (Rogers, 1995). The key to adoption is that one should perceive the idea, behavior or product as new or innovative. This allows diffusion to be possible. Adopting a new idea, behavior or product (ie, “innovation”) does not happen simultaneously in a social system; instead, it is a process in which some people tend to adopt innovation more than others. Researchers have found that individuals who adopt an early innovation have different characteristics than those who later adopt an innovation. However recent literature suggests two substantial constituents for diffusion of innovations: signals and network externalities. Signals are described as any market information rather than personal comments which could be used by potential adopters to make an adoption decision. Network externality is defined as the observation in which benefit of some products or services may increase as more consumers adopt the new product such as mobile phones or internet (Peres et al.2009).

However, according to Rogers (1995), innovations consist of four stages: invention (innovation), extension to social system (or communication), time and results. The invention or innovation is the thought or practice perceived by an individual. This innovation spreads through the social system or communication channels. Then the adaptation process begins. The process of adapting or accepting new ideas and innovations varies from person to person depending on time.

When promoting an innovation to an audience, it is important to understand the characteristics of the target population that will help or hinder the adoption of innovation. There are five accepted categories identified and it is still necessary to understand the characteristics of the target population, while the majority of the general population tends to fall into the middle categories. While promoting an innovation, there are different strategies used to address different adoptive categories (Rogers, 2003:277). Individuals within the social system are classified as low, medium and high in terms of innovation. When the graph showing the adopters of innovation over time is drawn, a normal "S" shaped bell curve emerges. (Rogers, 2003:280). It means the attitudes of consumers towards innovation vary. In other words, even if consumers are in the same social system, their response to innovation is not at the same speed. In line with all these explanations, Rogers (1995) discussed innovation in 5 different stages. The first one is *innovation* that is first consumer group to adopt products (Blacwell et al., 2006:556). This group accounts for 2.5% of consumers and wants to buy and test every product they see. They are too hasty to try new ideas. They do not hesitate to take risks and endure risks. Innovators come from young, well-educated, well-established families, who engage with many. They are self-confident, giving more importance to their values and judgments than group norms. Sources of information extend beyond local communities; establish close relationships with other innovators, personal resources, scientific resources and experts. They closely monitor mass media and professional resources (Rogers, 1995). According to Rogers (2003), innovators are hard-working, aggressive, challenging and risk-taking; they have the financial resources to meet the losses of innovations, have the ability to understand and apply complex technical information, and are capable of dealing with the high uncertainty of innovation (Kotler and Keller, 2006:660). In the promotion efforts for innovators, product features and benefits to consumers should be emphasized. Innovators are less brand-dependent and are more inclined to products or environments that create different opportunities.

Early adopters are the second stage of product buyers after innovators. According to Rogers (1995), it accounts for 13,5% of adaptors of innovations. They tend to be the most influential people in any market area, and will often take some "thought leadership'' to other potential adopters. Early adopters integrate more with the local social system than innovators. Possible adopters in the whole community follow early adopters to get ideas and advice on innovation (Odabaşı, 1995:125). Early adopters will normally have a reasonably high social status (which in turn enables thought leadership), reasonable access to finances (beyond those of later adopters), high levels of education and a reasonable approach to risk. However, they do not

take as many risks as innovators and tend to make more reasoned decisions as to whether or not to become involved in a particular product. They will try to obtain more information than an innovator in this decision making process. They can be very active on social media and often create reviews and other materials about new products they like or dislike.

Early majority is the stage that people queries for a while before fully accepting a new idea and accounts for 34% of adaptors of innovations. Their period of decision-making for innovation is relatively longer than the innovators and early adapters. Individuals in the early majority are often eager to adopt innovations that interact with the other innovative stages, but rarely lead to others. These members tend to observe the choices and decisions of the early members and shape their own decisions when the time comes (Rogers, 1995:249).

Another stage is the *late majority* that accounts for 34%. People in the late majority adopt innovations with a doubt and cautious approach. The category of skepticism does not accept innovation until others adopt, because the potential economic and communication difficulties that innovation may arise are important for the late majority. If the late majority is given extensive information about the benefits of new ideas by those who have previously been innovative, they may exhibit a positive attitude towards innovation (Rogers, 1995:249-250).

Laggards are traditionalists and the last innovation to be adopted by accounting of 16 % of adopters. Possessing almost no opinion leadership, laggards are being compared to the other adopter categories. They are fixated on the past, and all decisions have been made in terms of previous generations. While traditionalists generally need a lot of help with technology, their social communication and interaction is very limited. Therefore, they acquire information about innovations through face-to-face communication from individuals they trust more (Rogers, 1995:251).

5. Consumer Perception and Attitudes towards Domestic Production

In this study, attitudes and behaviors of consumers about domestic product consumption were examined. There is a point to be mentioned before this review. According to the regulation published in the Official Gazette dated 08.09.2018 and numbered 30539 and entered into force on 3/10/2018, the Article 5th of the Price Tag Regulation was amended and the information required to be included in the labels and lists; "Place of production of goods to be implemented by the date of commencement of the sale price and the unit price for goods Turkey, the Ministry determined and declared by the way, logo or mark" points have been added. In this direction, the "*Domestic Production*" logo has been prepared to attract the attention of consumers at first glance in order to show that the product is produced in our country in the sales of goods for consumers and shared with the public by the Ministry of Commerce (Ticaret Bakanlığı, 2018).

However, since the main object of consumer buying attitudes is the product, it is inevitable that the product category has an effect on the consumers' choice of domestic products. In some cases, product characteristics may affect product

preferences more strongly than domestic product perception (Hong and Wyer, 1990). Researches on the reasons why consumers prefer domestic and foreign products and the criteria they use when evaluating these products contain very different results. The reason for this is the differences between cultures and countries in terms of macro factors and the reason for each difference is that each individual has different information processing, evaluation and decision making processes and the criteria they use in these processes are different in terms of micro factors. It has been observed in some cases that consumers prefer domestic products first and in some cases tend to prefer foreign products instead of domestic products (Özçelik and Torlak, 2011). For example, Varma (1998) found that Indian consumers were in high demand for foreign goods and listed the reasons for the search as the status symbol, the inferiority complex, the increase in relations with the west, the increase in consumer income, the change in expectations and the openness of consumers to brands. Another example from Turkey to support domestic products is as follows. It has taken its place in the literature as consumer ethnocentrism and the best example of the behavior of buying domestic products, popular in the 1980s, "*Domestic goods of the country, every Turk should use it*" slogan can be said to have a perspective that manifests itself (Armağan and Gürsoy, 2011: 69). From a different viewpoint,

Consumers prefer products produced in their own countries first. If domestic products cannot be found or are not sufficient in terms of various features, then consumers prefer to buy products from countries with good commercial relations with their home countries. The consumer who buys a product of foreign origin tries to reduce the risk of the unknown by choosing the products of the countries with the same level of development or having strong commercial relations with the country (Okechuku, 1994).

In fact, consumers who take the concept of *domestic* economically generally have beliefs about their products' superiority. This belief does not mean that the products of the country are superior only in economic and functional areas; In addition, it assumes that it has more noble foundations based on ethics. In other words, it suggests that the purchase of foreign products harms the local economy, causes unemployment and is perceived as a non-patriotic behavior. This perception, which summarizes consumer behavior, causes some consumers to think that it is wrong to buy foreign origin products and thus, by supporting the purchase of domestic products; question the accuracy of receiving foreign-origin products (Shimp, 1984: 285). In another study, consumers were divided into two groups as nationalist and universalist in relation to the cultures of their countries. According to the model developed in the study, if individuals who form a culture have a sense of nationalism, they will probably be "nationalist". If their culture is at peace with the world, then individuals are defined as "universalist". Commitment to the nation lies at the basis of nationalism, which leads to a commitment to the nation in consumer attitudes and purchasing behaviors. The consumer group, defined as nationalist, buys local products and brands with the idea that buying foreign goods will harm the national economy. Consumers in the universalist group, on the other hand, have

a more universal view of the world as they have knowledge of international phenomena and try to create an international partnership (Rawwas et al, 1996). Studies addressing innovation in terms of differences between cultures and countries have also been conducted. Steenkamp, Hofstede, and Wedel (1999), in their study in 11 different countries, tried to identify the individual and national cultural variables of consumer innovation. The authors found that consumer innovativeness is negatively related to conservatism and that innovativeness declines with high ethnocentrism. Balabanis et al (2002) in their study, compare Czech Republic and Turkey and found that in both two countries increasing in openness to innovativeness bring about high consumer ethnocentrism. However, adaptation of innovation does not only depend on nationalism and culture, but also it depends on economy politics of a country. Hsu, Tian, & Xu (2014) investigated how the development of financial markets affects innovation using a data set of 32 developed and developing countries. As a result, it was stated that industries that are more dependent on external resources exhibit a higher level of innovation performance. In today's high technology, the spread of innovation and the consumers' tendency to innovation is happening easier and faster. Especially the speed and ease of use in accessing the data brought by the mobile technology that emerged in recent years affects the consumers' perception of innovation and these effect consumer's ethnocentric attitudes. In the study conducted by Leong, Hew, Tan, and Ooi (2013: 5613), the effect of the innovativeness variable on the perceived ease of use variable is examined and it is revealed that this effect is positive. Goldsmith and Foxall (2003), in their study, stated three different approaches in adopting innovation. These approaches; intrinsic innovativeness, interest-based innovativeness and consumer innovativeness. Intrinsic innovativeness is the willingness of a person to try something new, depending on personal characteristics. Internal innovativeness is a personality trait. Interest-specific innovativeness is the pioneering behavior that a person exhibits to stand out in a particular product category and the sector of interest. Consumer innovativeness is the first tendency to buy a new product. For adapting innovations these all approaches determine the consumer buying decision.

6. Methods and Methodology

In this study, it is aimed to determine consumers' perception and attitudes of domestic production applications in terms of following innovations. The study was conducted between 15 March and 30 June 2019 in sloppy and/or significant missing data are cancelled out. The available survey rate of 95% is considered sufficient to represent the population. Questionnaires are drawn up from the related literature. In this context, in the first part, Önal (2009) study was taken as the 'Adoption of Innovations Scale' and the scale was adapted and included in the questionnaire. In the second part, the CETSCALE scale developed by Shimp and Sharma (1987) in order to reveal consumer ethnocentric tendencies and which has been used in many international studies, has gone through the process of adapting the scale into Turkish. In order not to cause any errors and confusion about the expressions of the scale, the Turkish translation was checked by another researcher who had a good command of English and was put into the survey after the necessary corrections

were made. Both scales are prepared on 5-point Likert scale (1 - strongly disagree, 2 - disagree, 3 - undecided, 4 - agree, 5 - strongly agree). In the last section, questions are asked to determine the demographic characteristics of the respondents.

6.1. Sampling Process

The main population of the research is all consumers in Düzce. Since it is not possible to collect data from the whole population in terms of time and cost, a sample selection was made from the main population described above. Since the confidence interval generally accepted by the researchers in the social sciences is 95%, the sample size is obtained as 384 based on the Z value of 2.58. Accordingly, the sample size was determined and data were obtained from 389 consumers after missing and inaccurate surveys.

6.2. Analysis of information and data

Since it is known that factor analysis is a suitable tool for determining the variable structures in determining the validity of the adoption of innovation and CETSCALE scale used in the research (Hair et al., 1998: 94); in the determination of reliability, alpha coefficient method, which is widely studied, was used. In order to determine the consumer's attitude towards domestic product, a scale that was used in Ellialtı (2009)'s research was developed and advanced with the help of academicians acknowledged expert in the field.

7. Findings and Discussions

Demographic and socio-economic characteristics of the participants included in the study are shown in Table 1.

Table 1: Demographic Characteristics

Gender	**N (389)**	**%**	**Income Status**	**N (389)**	**%**
Male	168	43,2	Article I. ≤2020 ₺	147	37,8
Female	221	56,8	2021 ₺- 2999 ₺	60	15,4
Marital Status	**N (389)**	**%**	3000 ₺- 4499 ₺	87	22,4
Married	227	58,4	4500 ₺- 5999₺	64	16,5
Single	162	41,6	6000 -7999₺	18	4,6
			≥8000 ₺	13	3,3
Education Status	**N (389)**	**%**	**Occupation**	**N (389)**	**%**
Primary School	9	2,3	Housewife	43	11,1
High School	104	26,7	Artisan	13	3,3
Two-year Degree	44	11,3	Worker	15	3,9
Bachelor's Degree	184	47,3	Officer	102	26,2
Post Graduate	48	12,3	Self-employment	30	7,7
			Other	186	47,8

According to the table, 57% of the participants were women and 43% were males. The fact that 62.2% of the sample has a monthly net income over ₺ 2021 could make the research more interesting. In addition, it can be claimed that the sample is composed of high education and relatively young individuals.

When the scales used in the research are subjected to factor analysis, the results in Table 3 and Table 5 are obtained.

Table 2: Kaiser-Meyer-Olkin Measure of Sampling Adequacy

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,827
Bartlett's Test of Sphericity	Approx. Chi-Square	2231,875
	df	136
	Sig.	0,000

The data obtained from 389 questionnaire forms were analyzed using confirmatory factor analysis. KMO value was found to be 0.643 and Bartlett test result was significant (Sig = 0.000). In the first analysis, a 6-factor structure explaining 51,381% of the total variance was obtained. Three items with cross-factor loading (1, 2, 6, 9, 10, 14, 18, 21) were excluded from the scale and re-factor analysis was performed. In the confirmatory factor analysis with the remaining 16 items, a four-factor structure was found, and the KMO value was significant as 0.827 Bartlett test (Sig. = 0.000). The obtained four-factor structure explains 59,609% of the total variance and differs from the original scale.

Table 3: Confirmative Factor Analysis for Following and Diffusion of Innovations

Variables		**Factor Loads**	**Variables Explained**	**Alpha**
Factor I: Innovators			14,04	,76
Y3	I would like to use it immediately when a new product is released.	0,723		
Y4	I want to have the innovation right before other people discover it.	0,828		
Y5	When a new product is released, I would like to buy it immediately, regardless of price.	0,819		
Y7	I think innovations increase my standard of living.	0,675		
Factor II: Early Adapters			20,81	,82
Y8	The appearance of a product I buy is important to me.	0,571		
Y11	The type or size of innovation affects my purchase decision	0,633		
Y12	Feature of innovation affects my purchase decision	0,822		
Y13	The level of meeting the need for innovation affects my purchase decision	0,811		

Y15	I feel the need for additional information in innovations with high technical features.	0,566		
Y16	It affects my decision to purchase a product in a simpler structure and in use, which provides an advantage over the old product.	0,627		
Y17	Offering a free trial of a new product affects my decision-making level	0,628		
Factor III: Late Majority			9,73	0,69
Y19	I expect new products to become widespread	0,748		
Y20	I expect new products to become cheaper	0,745		
Factor IV: Laggards			15,01	0,78
Y22	I generally react to innovations. Because if I buy a product which I don't know, my money can squander away	0,813		
Y23	I am often skeptical of new products.	0,764		
Y24	I do not approve so many new products.	0,858		
Y25	I think innovations have increased the consumption frenzy.	0,629		

Factor analysis was also conducted to determine the sub-dimensions of attitudes and perceptions of consumers towards domestic production. According to the confirmatory factor analysis results, KMO value was found to be 0.643. In the analysis, a 5-factor structure explaining the total variance was obtained and then three items with cross-factor loads (7,10,13) were removed from the scale. In exploratory factor analysis with 19 items, KMO value was 0.917 and Bartlett test result was significant (Sig. = 0.000). The obtained four-factor structure explains 64,232% of the total variance.

Table 4: Kaiser-Meyer-Olkin Measure of Sampling Adequacy

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,917
Bartlett's Test of Sphericity	Approx. Chi-Square	3787,403
	df	171
	Sig.	0,000

Table 5: Confirmative Factor Analysis for Attitudes of Consumers towards Domestic Product

Variables		**Factor Loads**	**Variables Explained**	**Alpha**
Factor V			9,482	0,739
TM1	Purchasing domestic products increases employment.	0,806		

TM2	Buying domestic products reduces unemployment.	0,867		
Factor VI:			21,836	0,883
TM3	Domestic production reduces dependence on foreign countries.	0,620		
TM4	Turkish people should always buy Turkish products instead of imported ones.	0,697		
TM5	Only products that cannot be found in Turkey must be imported	0,633		
TM6	Turkish-made products must be purchased and Turkey to continue to operate.	0,748		
TM8	Instead of allowing other countries to become rich by selling goods to us, we buy products made in Turkey.	0,738		
TM9	Domestic production contributes to the enrichment of the country.	0,665		
TM11	Domestic production increases the market value of TL (₺).	0,598		
Factor VII:			19,225	0,849
TM14	Domestic production positively reflects on technological developments.	0,741		
TM16	I prefer to support Turkish products, although it costs me more in the long run.	0,583		
TM17	Domestic production increases the quality standards.	0,715		
TM18	More domestic production gives companies more competitive advantage.	0,751		
TM21	Domestic production reduces costs.	0,582		
TM22	Domestic production enables the emergence of domestic brands worldwide.	0,646		
Factor VIII:			13,719	0 ,757
TM12	It is always best to buy Turkish products.	0,604		
TM15	Barriers must be placed on all imported products.	0,827		
TM19	For the reduction of inflows to Turkey, foreign products should be taxed at higher rates.	0,761		
TM20	We should only buy products that we cannot produce in our own country from foreign countries.	0,540		

In this research, Structural Equation Modeling (SEM) and Path analysis were conducted in this research in order to follow the innovations of consumers and show the relationship between their perceptions and attitudes towards domestic production practices. Path analysis provides a systematic and comprehensive examination of a complex research problem in a single process by modeling the relationships between one or more dependent and independent variables, compared to commonly use statistical techniques such as regression (Anderson and Gerbing, 1988). In more general terms, multiple regression analyzes are performed at the same time, and path coefficients, variance values and regression weights between the variables in the structural model are given in Figure 1.

Coefficients show how much a variable changes depending on the other variables affecting it. First the compatibility of the model was tested by considering the values that the researchers concentrated more and the goodness of fit values obtained were as follows:

Table 6: Goodness of Fit Values of the Model

Goodness of Fit	Value	Acceptability
X^2/ df	2,775	✓
RMSEA	0,070	✓
GFI	0,812	✓
CFI	0,834	✓
NFI	0,764	✓
TLI	0,818	✓

In the model, the coefficients of error (e1-e2; e10-e11; e26-e27; e28-e29; e33-e34; e34-e35) of some variables were correlated and meaningless paths were removed from the model and the analysis was repeated. The revised model obtained as a result of the modifications has reached acceptable a values in the goodness of fit indices values (RMSA = 0.70 GFI = 0.80, NFI = 0.75, CFI = 0.82, TLI = 0.80). For RMSEA, values below 0.05 indicate a perfect fit, and values below 0.08 indicate an acceptable value fit (Browne & Cudeck, 1993). (GFI) expresses the ratio of the explained variance to the total variance, and the initial value is accepted as 0.8, and it is compatible with values close to 1. For the Comparative Fit Index (CFI), the value between 0 and 1 and being close to 1 is sufficient for the fit criterion. For (NFI) values of 0.95 and above show a good fit, while values of 0.70 and above are acceptable and the same is valid for (TLI) (Byrne, 2010).

As a result, goodness of fit values obtained from the analysis show that the model is acceptable. In other words, the data obtained from the research corresponds to the predicted theoretical structure of the model. Figure 1 that shows paths to conform a model detected the model of relationship between variables is given as follows and the estimation parameters in the structural model are given in Table 7.

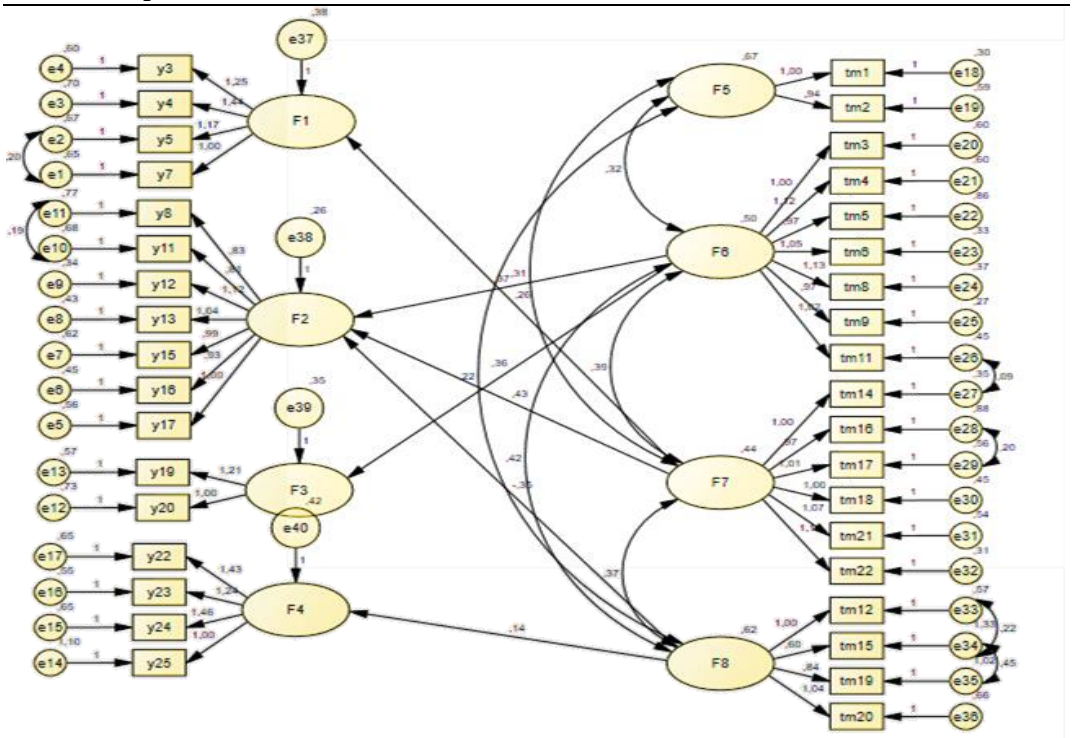

Figure 1: Path Coefficients of Model

Table 5: Estimation Parameters of the Model

Estimation Parameters	Standardized Weights	Unstandardized Weights	P
Scaling Model			
F6 → F2	0,372	0,314	**0,016**
F8 → F4	0,225	0,138	**0,010**
F6 → F3	0,406	0,364	**0,000**
F7 → F1	0,506	0,429	**0,000**
F6 → F1	-0,321	-0,260	**0,046**
F7 → F2	0,396	0,365	**0,000**
F8 → F2	-0,327	-0,249	**0,000**

When the regression weights are evaluated in terms of coefficients having values less than 0.10, the effect is small; It is medium to be around 0.30; 0.50 and above means that it is at a high level (Simsek, 2007: 126). When Table 5 is analyzed, the most significant effect is seen (rw= 0,429 and p=0,000) among the innovators that is factor 7 with factor 1, which indicates increasing in domestic production, technological developments, quality standards, competition and the emergence of domestic brands, while reducing the costs of consumers. In other words, consumers taking technological developments, quality, competitiveness and cost advantage in the long term into account, take more risks, and are in a hurry when a new domestic product is released. Balabanis, and Melewe Mueller (2002: 29), in their research,

on the citizens of Turkey and Czech Republic, examined the relationship between internationalization, to be open to innovation, conservatism, and consumer ethnocentrism. In line with this study, there is a positive relationship between being open to innovations and consumer ethnocentrism in support of this study. In other words, consumer ethnocentrism was measured to be higher in societies consisting of individuals open to innovation.

The second highest value has a positive effect on factor 7 and factor 2. (rw = 0,365 and p= 0,00). Factor 2 represents early adopters. Early adopters are crucial to the success of a new product. Because they affect their friends and their environment through word of mouth communication; group members are interested and influenced by their views. Early adopters observe the first innovators who use the product and then turn to the same product after seeing that they are successful. They are more advanced than average consumers in adapting to innovations; therefore they form a model in the market. The risk they bear is lower than that of innovators. They have to act more rationally and thoughtful (Rogers, 1995). Therefore, it is the priority of this group to focus more on domestic goods as a cost-reducing factor and to be a reference to the consumer groups that adopt it. Because they feel that they have to make their plans in the longer term. Kavak, Sunaoğlu and Taner (2016) stated that one feature of innovators and early adopters are that they have holistic thinking structure and on the other hand, followers have analytical thinking style. In other words, it can be said that consumers with holistic thinking show more innovative behavior (innovators and early adopters) than consumers with analytical thinking. The common finding is that; early adopters are trying to set an example for consumers with a sense of representation and aiming at more domestic goods and thus have the idea to benefit both in terms of their own costs and in terms of national income.

Another is that factor 6 has a significant positive effect on factor 3 (rw =0,364 and p =0,000). Consumers representing factor 6, which means more conservatism and protection of domestic products, tend to focus more on domestic products because of the local economy and labor. This consumer group affects the late majority. This group accepts innovation immediately after average consumers adopt innovation. Adoption of innovation occurs for economic reasons or under pressure from the environment (Rogers, 1995). In the findings of Asil and Kaya's (2013) study, related to consumer ethnocentrisms of respondents, such variables as "domestic products should always be used instead of foreign products", "only products not available in our country should be imported", "Buy Turkish made products, Turks should not be unemployed", "I think Turkish products come first, then and always", we should buy Turkish products instead of allowing other countries to become rich by selling goods to us", products should not be imported from other countries unless compelled to do so", "Turks should not buy foreign products because this will harm the Turkish economy and cause unemployment", "only we have to buy the products we cannot produce in our own country from foreign countries" averages of the responses are above the general average of the scale. In other words, the Turkish consumer is very sensitive about these issues and the advertising effect is very low

for this group and national feelings are the priority. Factor 6 significantly effects factor 1 negatively (rw = -0,260 and p =0,046). In fact, this is a possible outcome that can be expected. Innovators are hard-working, dashing, challenging and risk-taking; they have the financial resources to meet the losses caused by innovations, have the ability to understand and apply complex technical information, and are able to cope with the high uncertainty created by innovation. However, consumers who act by taking into account the benefits to their country rather than adopting new products indifferently will make product choices by considering more reference groups. One effect is the negative and significant relationship between factor 8 and factor 2 (rw = -0,249 and p =0,000). Factor 8 refers to the group of consumers representing high taxation on imported products and solid conservatism involving various barriers. When the consumer's point of view of domestic products is based on extremely strict rules, it is almost hostile towards imported products. Together with boycotting imported products and encouraging domestic products in all areas, this group of consumers can afford to take more risks, and when brand dependency is considered to be less, they will tend to make decisions suddenly and follow innovations only because of the perception of Turkish goods and go to buying behavior. In a study conducted on this subject, it was concluded that nationalist consumers tend to be more dependent on their own country products and because of this tendency they find Turkish brands better than foreign brands (Armağan and Gürsoy, 2011: 76). In this study, it has been revealed that ethnocentric-prone consumers prefer the domestic one of the two brands with the same characteristics, they contribute to the national economy by choosing domestic products and believe that the welfare level will increase with this behavior (Armağan and Gürsoy, 2011: 76).

Factor 6 also effects factor 2 positively and significant. (rw = 0,232 and p =0,048). Even if they share many things in common with innovators, especially in the case of symbolic products such as clothing, cosmetics, etc., it is more important to engage in socially acceptable behavior for early adopters (Rogers, 1995). Because adopting common values and leading other groups is the main feature of this consumer group. In order for domestic product and import product reduction discourse to be reflected more intensely on consumption behavior, in addition to the balance of price and quality of domestic product, brand strength must be able to surpass foreign competitors and at least equalize itself with others. As it can be seen, many reasons cause risk factors on domestic production and consumers expect these products to be used by a certain group and they aim to start operations thereafter.

One of the results in the table is that factor 8 positively effects factor 4. (rw =0,180 and p =0,010) It takes a very long time for the laggards to adopt innovations. When they adopt innovations, those products are already replaced by a new product. The last ones are people with low education, low social status and low income. They communicate with those who end up like themselves, they are sources of information. This group has no opinion leaders (Rogers, 1995). As a result of the strict domestic product nationalism contained in Factor 8, or in other words, the hostility fed to imported products, consumers may adopt a more skeptical approach

towards products, even if the products have the domestic production logo or label. In Turkey, when it was first introduced in the market related to domestic production logo, it was in the following discussion to the forefront in the display: Consumers will decide how of what is native, was the subject of debate will be considered on domestic products. Consumer opinion prevailing in the society were as follows: For example, a packaging of the pulses has been imported by a local company in Turkey when done, is put on 869 barcode. Or will we use the same label for tomatoes whose seeds were taken from Israel but grown in our country? There are quite a few of these examples. If the only criterion would be the 869 barcode number, it would seem a bit dubious that the desired target would be captured. With this approach, it is possible that new domestic products will reach the end consumer groups after passing through the filter of the market. Here the study was concluded and presented recommendations for customer, producer and future research.

6. Conclusion and Recommendations

In this study, it is seen that consumers react to domestic production practices in terms of diffusion and follow-up of innovations. It has been observed that some consumers are able to change their traditional purchasing behavior according to the perception of domestic production, while others continue their past purchasing styles and behavior with the effect of traditionalism and conservatism, or remain unresponsive to changes. It is seen that technological development, quality standard, and cost of product are effective on innovators and early adapters, however when conservatism and protection perceptions of consumer against domestic product increase perception of innovativeness detain and it comprises late majority. Social status, low income and education effects laggards which is related to people who have lack of communication and social intractability.

The process of adopting an innovation for the individual is related to the evaluation of this innovation according to current practices. The person does not immediately reveal his positive or negative response to innovation; he can decide to apply it after a certain examination and observation. This will be the same in domestic production applications. Although the individual takes into consideration the concepts of " return to domestic " and " national capital " required by the economic and social conditions in the country, it can be expected that the product adopts innovation and shows sustainable purchasing behavior, and the product will be dependent on the degree of customer expectation and satisfaction. The important point here is the applications that will ensure the adoption of innovation. Innovation should be better than the idea or application it will replace (Crouch, and Chamala, 1981). Otherwise, its sustainability will not be ensured. Innovations fulfil very important functions such as changing the production style and understanding of production in developing societies. In addition, with the emergence of beneficial results of innovations at the domestic production point, producers are assisted to take a positive attitude towards new thoughts and practices and to take action towards change.

In order for a domestic product to be launched as a new product to be long-lasting, it must be able to take its place in the market and have a quality value between the

buyer and user in the past years, when it was said that Turkish products, poor quality products appeared in mind. Of course, the people who aim to make poor quality products and defraud the people have great contribution, as well as the size of the competing companies and their market shares could affect the firms. But this perception has been changing in recent years, which will affect the degree to which consumers adopt innovations.

There are some limitations in the study. Preferring the sampling technique from random methods constitutes a constraint. Researches that will be carried out by using random techniques and by increasing the sample size will allow to reach more generalizable findings. The limitation of the study to Düzce province only constituted the other constraint. In future studies, attitudes and perceptions of consumers in different cities towards innovations for domestic products can be measured. The findings to be obtained with the sample to be selected in different countries will provide the opportunity to compare with the research results in question. Thus, the source of the differences in domestic product preferences of individuals living in different cultures and the factors affecting the preferences can be examined. Including different variables into the research model by analyzing the literature may mediate to reach different findings. It is thought that the perception of domestic goods may have an impact on product preference.

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Role of Agriculture Sector on the Economy of East Java Province, Indonesia (Input-Output Analysis)

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Abstract

The purpose of this research is to analyze backward linkage, forward linkage, and analyze the economic impact that agriculture sector has caused based on the multiplier effect on the output, income, and absorption of labor in the Province of East Java. Data used is sourced from Table Input-Output domestic transactions based on price classification of 110 sectors East Java Province year 2015 which is aggregated into a classification of 14 sectors. Results of the analysis showed index of degrees of sensitivity (backward linkage) of agricultural sector has a value of 0.795, below average degree of sensitivity of entire economic sector. Agricultural spread power index (forward linkage) had a value of 0.803 lower than average of spread power index of the entire sector. Output multipliers, income multipliers, and labor multipliers of agricultural sector respectively, i.e. 1.259, 1.203, and 1.094 lower than other sectors in the economics of East Java Province. This indicated that agricultural sector serves as a supporting sector instead of leading in the economy of East Java Province.

***Keywords**: Agriculture, Backward linkage, Forward linkage, Multiplier effect*

***JEL Classification**: Q10, R15*

Tarım Sektörünün Doğu Java İl Ekonomisindeki Yeri, Endonezya (Girdi-Çıktı Analizi)

Özet

Bu araştırmanın amacı, Doğu Java Eyaletindeki emeğin çıktısı, geliri ve emilimi üzerindeki çarpan etkisine dayanarak, geriye doğru bağlantıyı, ileri bağlantıyı ve tarım sektörünün yol açtığı ekonomik etkiyi analiz etmektir. Kullanılan veriler, Doğu Java Eyaleti 2015 yılı 110 sektör fiyat sınıflandırmasına dayanan 14 girdi sınıfında toplanan Tablo Girdi-Çıktı yurtiçi işlemlerinden elde edilmiştir. Analiz sonuçları, tarım sektörünün hassasiyet derecelerinin (geriye doğru bağlantı) endeksinin, tüm ekonomik sektörün ortalama hassasiyet derecesinin altında 0.795 değerinde olduğunu göstermiştir. Tarımsal yayılma güç endeksi (ileri bağlantı) tüm sektördeki yayılma güç endeksinin ortalamasından 0.803 daha düşük bir değere sahiptir. Tarım sektörünün üretim çarpanları, gelir çarpanları ve emek çarpanları, yani Doğu Java Eyaleti ekonomisindeki diğer sektörlerden sırasıyla 1.259, 1.203 ve 1.094 daha düşük. Bu, tarım sektörünün Doğu Java Eyaleti ekonomisinde lider olmak yerine destekleyici bir sektör olarak hizmet ettiğini göstermektedir.

***Anahtar Kelimeler**: Tarım, Geriye doğru bağlantı, İleri bağlantı, Çarpan etkisi*

***JEL Sınıflandırması**: Q10, R15*

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1. Introduction

Economic development aims to improve the community's living standards, increase revenues, and ensure the availability of jobs and drivers of change and renewal of other life areas. Success of the economic development of a region is seen from its economic growth. Economic growth indicator is seen from Gross Domestic Product (GDP). GDP is gross value added arising from all sectors of the economy in a given period. Value-added is difference between production value (output) and intermediate cost. Gross added value includes of income factor (wage and salary, interest, lease, and profit), net depreciation and indirect taxes (Ratag et al., 2016). Contribution of sectors to GDP shows that there is a gap in economic sectors. Intended gap is income gap and labor gap (Suryani, 2013). Therefore, role of sectors is expected to contribute revenue for economic development. Also, it is important to approach non-superior sector, so it becomes a subsystem in developing superior sector (Firman, 2008; Prawoto, 2010).

Agricultural sectors contribute to GDP, creation of employment opportunities, increasing public income, and acquisition of foreign exchange (Widyawati, 2017). It was reviewed from agricultural sector's contribution to GDP, not as a primary sector. Growth of agricultural sector in 2014 by 3.29, less than national growth (5.06) and other sectors. Industrialization process has resulted in a change in the role of agricultural sectors in Indonesian economy shown by a decrease in proportion of agricultural output. Comprehensively, agriculture sector is a development driver (engine of grow) which serves as a food security and raw material provider, saving foreign exchange derived from substitution product import, potential market by products' industry, transfer surplus labor to industry, capital provider for other sector development, and environmental service provider. Agricultural sector is still a main sector of job creation than other sectors. It is seen from percentage of labor absorption of 33.20% in Indonesia (Kembauw et al., 2015; Widyawati, 2017).

Contribution of agriculture sector is placed in the 3F framework of food, feed, and fuel. Food is a basic human need that is very essential because it contains of nutrients (carbohydrates, fat, proteins, vitamins, minerals, and water) that human needed to sustain the life. Given importance of food meaning, food is an important of human rights that must be fulfilled (Rosmawati, 2009; Lantarsih et al., 2011).

Efforts to increase farm productivity and fisheries to support food security then feed quality, quantity, continuity should be assured. Availability sustainable feed can drive growth of farms and fisheries. Waste and byproducts of agro industries that can be used for livestock include straw (rice and corn), tip of sugarcane, grains (peanuts and cowpea), tubers (cassava and sweet potato), oilseed meal (oil palm, cotton, and copra), mixture rice and bran (Pratiwi et al., 2015).

Energy needs continue to increase but more limited reserves of fossil energy and concern for environmental sustainability, because attention to renewable energy is increasing especially to renewable energy sources of agricultural. Almost all

commodities in agricultural can produce biomass, as a source of materials that can be transformed into renewable energy. Biomass is all organic ingredients that are relatively young and come from plants/animals; products and waste of cultivation industry (agriculture, plantation, forestry, animal husbandry, fisheries), which can be processed into bio-energy (Prastowo, 2007).

Based on the role of agriculture, Strategic plan of Agriculture Research and Development Agency (2010) contains that the Ministry of Agriculture has established a sustainable industrial-agricultural system of on-going local resources to improve food independence, value-added, export, and welfare of farmers. Vision of the Master strategy for agricultural development in 2013-2045 also emphasized the realization of a sustainable bio-industrial farming system that produces a variety of healthy food and high value-added products from agricultural and tropical marine biological resources. This shows that agriculture sector can reduce poverty while creating economic and employment growth (Pratiwi et al., 2015).

Agricultural sector is distinguished into five subsectors: food crops, plantation, fisheries, forestry, and livestock. The sector is not only food but includes commodities produced from five subsectors. Agricultural subsector according to Dumairy (1996):

1) Food crops subsectors are also often called people's agricultural subsectors because they are usually cultivated by people, not companies or governments. These subsectors include commodity commodities such as rice, soy, corn, cassava, cassava, peanut, mung beans and vegetables, and fruits.

2) Plantation subsectors are distinguished from people and large plantations. People's plantations are cultivated by people or society, usually on a small scale and with simple technology. Plantation crops consist of rubber, copra, tea, coffee, tobacco, clove, cardamom, cotton, chocolate, and various spices. Large plantations are all plantation activities run by legal plantation companies. Large plantation plants are mostly same as people's plantations covering rubber, palm oil, tea, coffee, tobacco, chocolate, sugarcane and many more.

3) Forestry subsector consists of three activities such as logging, harvesting of other forests and hunting. Logging activities resulted in logs, firewood, charcoal, and bamboo. Other forest products include resin, rattan, wood sap, bark, as well as various kinds of roots and wood bulbs.

4) Livestock subsector includes farm's activities and its results. These subsectors include production of large and small livestock, eggs, fresh milk, wool, and animal slaughtering.

5) Fishery subsector includes of marine fisheries, general waters, ponds, ponds, paddy fields, keramba, as well as simple processing of fishery products (salting and drying). Based on its technical terms of effort, this subsector

differentiated over three sectors: sea fisheries, land, and rake. This subsector not only includes fish commodities but also shrimp, crabs, jellyfish and such.

East Java is the largest industrial area in Indonesia. East Java Province was the second largest contributor to GDP (15.25%) after DKI Jakarta. Gross Regional Domestic Product (GRDP) East Java Province in 2018 reached IDR 1,563.76 trillion. Economic structure of East Java according to business field in 2018 is dominated by three: processing industry 29.73 percent; large and retail trade, car and motorcycle repairs 18.19 percent; agriculture, forestry, and fisheries 11.90 percent (BPS, 2019).

Contribution of agriculture in East Java Province is output 11.23%, gross value-added 15.88%, and income 17.24%. Agricultural sectors are also instrumental in the absorption of manpower. Most of East Java population depend on agriculture, but the labor absorption of this sector is decreasing. Agricultural sector's labor absorption in 2008 reached 43%, decreased to 42% in 2009 and 2010, and 39% in 2011 and 2012, and 25.96% in 2016 (BPS, 2014; Oktavia et al., 2016).

Input-Output Analysis has been carried out by several researchers at home and abroad. Analyze economy structure and determine key sectors to be developed in the Polish State. Based on Input-Output Tables for 1990, 1995 and 2000, there are five sectors included in superior category (high backward and forward linkages). Five sectors are: (1) textile; (2) ready-made clothing; (3) food, production and service sector construction; (4) agriculture, forestry, and fisheries, and (5) transparency (Gurgul and Majdosz, 2015). Kula (2008) analyzed economy structure and determination of Turkey's leading sector using 2002 Input-Output table (classifying 59 sectors). Analysis shows that there were 11 sectors that are recommended as leading sectors in Turkey: (1) agriculture, hunting and related services; (2) food and beverage products; (3) textiles, chemicals and chemical products; (4) other non-metallic mineral products; (5) base metals; (6) electricity, gas and hot steam energy; (7) wholesale and retail trade; (8) land transportation; (9) supporting and additional transportation services; (10) travel agent services; and (11) real estate. Botric (2013) identifies leading sector in Croatia. Based on the I-O table for 2004 (classification of 57 sectors), sectors with high backward linkages are: (1) electricity and (2) construction. Sectors had high forward linkages are: (1) processed foods, (2) processed tobacco, and (3) services.

Bekhet and Azlina (2010) analyzed relationship of energy sector to other sectors, especially agricultural sector in Malaysia. Based on I-O table in 1991 and 2000 (sectors are aggregated into 15 sectors), shows that energy sector had a strong relationship with agricultural sector. Agricultural has a very strong relationship with coal refined oil sector.

Astrini (2013) examined revitalization of agricultural sector in the economic development in East Java by input-output approach. As a result, sectors that have forward and backward linkage, as well as being a leading sectors in East Java

Province, were electricity, gas and water supply sector; financial sector, leasing, and company services.

Oktavia et al. (2016), indicating that agricultural sector contributed to output structure of 11.23%, gross value-added structure of 15.88%, revenue structure of 17.24%, and labor structure of 25.96%. The largest interconnectedness is other livestock of 1.46, while the most linkage of rice is 1.48. Agricultural sector's superior commodity: marine fish and other fishery products, land fish and other fishery products, rice, corn, vegetable, fruit, soybean, eggs, beef, chicken, fresh milk, other livestock, sheep and goat, sugarcane, tobacco.

Widyawati (2017) shows that processing industry and electricity, gas, and clean water sectors have a forward related to agricultural sector. Furthermore, electrical, gas, clean water; and building sector has a backward linkage to agricultural sector. Agricultural sector has a lower output multiplier impact than other sectors, while household income multipliers and employment opportunities have a greater multiplier impact than other sectors.

The contribution of this research is to assist the government in determining the right policies in the development of the agricultural sector. Policy making is carried out based on the results of backward linkage analysis, forward linkage, and analyze the economic impact that agriculture sector has caused based on the multiplier effect on the output, income, and absorption of labor in the Province of East Java, Indonesia.

2. Materials and Methods

Input-Output (I-O) analysis is a method that systematically measures relationship between several sectors in an economic system (BPS, 2015). Model I-O serves as superior sector for a region economic development. Superior sector is a sector that has high coverage and sensitivity capability (Haris et al., 2017). Analysis with model I-O based on a matrix-shaped table that presents information about transactions of goods and services (in monetary unit size, e.g. IDR) as well as interconnectedness between an economic activity in a region a certain period. Along I-O table, rows indicate an allocation of output generated by a sector to meet industry and final demand. Besides, value-added line shows a composition of sectoral added value creation, while along column indicates input structure used by each sector in production, both in input between and primary inputs (Firmansyah, 2006). Impact analysis is closely related to multiplier. Multiplier is a measurement of a response or impact of economic stimulus. Economic stimulus is generally assumed to be an increase in sales of one currency unit to final demand of a sector. Economic stimulus can be output, income or employment (Firman, 2008).

Data has been used I-O table of East Java Province year 2015 based on domestic transaction at producer price and has classification of 110 sectors (secondary data). Then, it has been aggregated into 14 sectors. Analysis consists of multipliers effects

and linkage. Matrix multiplier is inverse matrix that is used to connect final demand with output production. Steps to find inverse matrix element Leontief.

2.1. Create a Transaction Matrix

Input-Output Table of classification 110 sectors has been aggregated into 14 sectors.

2.2. Calculating Input Coefficient

$$a_{ij} = \frac{x_{ij}}{x_j} \quad (1)$$

Description:

i = 1, 2, 3

a_{ij} = i sectors technology derived from j sector

X_j = Total sector input j with $X_j > 0$ (IDR)

X_{ij} = Quantity of sector output i used as input by j sector (IDR)

The matrix is compiled as follows:

$$a_{11}x_{12} + a_{12}x_{12} + a_{13}x_{13} + F_1 = X_1$$

$$a_{21}x_{21} + a_{22}x_{22} + a_{23}x_{23} + F_2 = X_2$$

$$a_{31}x_{31} + a_{32}x_{32} + a_{33}x_{33} + F_3 = X_3$$

$$a_{n1}x_1 + a_{n2}x_2 + a_{n3}x_3 + F_n = X_n \quad (2)$$

If there is a change in final demand, there will be a change in national income. The equation is written as follows:

$$AX + F = X \text{ or } (I - A)X = F \text{ or } X = (I - A)^{-1}F \quad (3)$$

Description:

I = nxn identity matrix

F = Final demand

X = Output

(I-A) = Leontief matrix

$(I-A)^{-1}$ = Inverse Leontief matrix

2.3. Backward Linkage

Backward linkage is analyzed based on a sensitivity degree index. Backward linkage can be formulated by:

$$IDK = \frac{\sum i\, b_{ij}}{(\frac{1}{n}) \sum i \sum j\, b_{ij}} \quad (4)$$

Description:

IDK = Degree of sensitivity index

$\Sigma i\ b_{ij}$ = Number of input coefficients between/Leontief, which i = row sector

$\Sigma i\ \Sigma j\ b_{ij}$ = Number of input coefficients between/Leontief, which j = column sector

n = Number of sectors

Conclusion criteria:

IDK = 1: j sector backward linkage equals average linkage to all economic.

IDK > 1: j sector backward linkage is greater than average linkage behind entire economic.

IDK < 1: j sector backward linkage is smaller than average linkage behind entire economic.

Sectors are said to have a high degree of sensitivity when IDK > 1 or greater than average degree of entire economic. Sectors are said to have low sensitivity degrees when IDK is < 1.

2.4. Forward Linkage

Forward linkage analyzed by power index deployment that can be formulated mathematically:

$$IDP = \frac{\sum j\ b_{ij}}{(\frac{1}{n}) \sum i \sum j\ b_{ij}} \quad (5)$$

Description:

IDP = Deployment Power Index

$\Sigma j\ b_{ij}$ = Number of input coefficients between/Leontief, which j = column sector

$\Sigma i\ \Sigma j\ b_{ij}$ = Number of input coefficients between/Leontief, which i = row sector and j = column sector

n = Number of sectors

Conclusion criteria:

IDP = 1: i sector forward linkage equals average linkage all of sectors.

IDP > 1: i sector forward linkage is greater than average linkage all of sectors.

IDP < 1, i sector forward linkage is smaller than average linkage all of sectors.

Sectors are said to have high deployment power when IDP > 1 or greater than average deployment power all of sectors. Sectors are said to have low deployment power when the IDP is < 1. If IDK > 1 and IDP > 1, the sector is a key sector or can

be said as leading sectors, because it has a level of forward and high relation to the backward.

2.5. Output Multiplier

Output multiplier is total value of output generated by the economy to meet (or result) the change in a single unit of final demand. Magnitude of output multiplier for n^{th} sector is calculated from n^{th} column of Leontief inverse matrix for relevant economy, formulated by:

$$O_{ij} = \sum_{i}^{n} a_{ij} \quad (6)$$

Description:

O_{ij} = j sector output multiplier

a_{ij} = Element in Leontief inverse matrix

i = Row 1, 2, 3... n

2.6. Income Multiplier

Income multiplier occurs when there is a change (increase) in final demand of a sector that will also increase total revenue. Magnitude of this increased multiplication can be seen from income multiplier. Household income of a sector indicates the total amount of household income created due to add one unit of final demand money in the sector. Household income multiplier is translated as an increase in final demand in a household. If the multiplier is quoted with I_j then it can be written:

$$I_j = \sum_{i=1}^{n} a_{n+1,i} a_{ij} \quad (7)$$

Description:

I_j = Income multiplier sector j

$a_{n+1,i}$ = Value added section of wages/salary per total output

α_{ij} = Inverse matrix of Leontief

2.7. Labor Multipliers

Labor multipliers occur when there is a change in labor opportunity as a result of increased production. Magnitude of the effect can be taken into account from labor multiplier. The multipliers are the total effect of labor change in the economy due to a single unit of the final demand change in a sector. To be able to capture a change of final demand in a production sector against labor changes across the economy, the initial labor or workforce amount in each production sector is required has been used to perform production processes during this time. Data is used to calculate contribution of each worker, on average, in producing its respective sector outputs. If the average output value of each worker in sector j is quoted with wj, it is obtained:

$$W_j = \frac{l_j}{x_j}, \text{then } L_j = \Sigma W_j \, (I - A)^{-1} \quad (8)$$

Description:

W_j = Labor coefficient of a sector j

L_j = Labor multiplier figures

l_j = Total labor in sector j

x_j = Number of outputs in sector j

$(I\text{-}A)^{-1}$ = Inverse matrix of Leontief

3. Results and Discussion

The role of agricultural sector in East Java Province is seen from its attractiveness to the upstream sector (backward linkage), its driving force to the downstream sector (forward linkage), and its impact on final demand, and other sectors (multiplier effects) described the following.

3.1. Backward Linkage Agricultural Sector in East Java Province

Relations between economic sectors in the form of interconnectedness are relationship with raw material (Haris et al., 2017). This analysis shows ability of agricultural sectors that include subsectors of food crops, horticultural crops, plantation, forestry, and fisheries to attract growth economy of East Java. Backward linkage shows the effect of one unit money of final demand in agricultural sectors will increase input demand from all sectors. High-relation sectors mean the potential to increase production, which ultimately results in high output, reflected in the degree of sensitivity.

Degree of sensitivity is indicated by index. Sensitivity index demonstrates a degree of sensitivity of a sector to final demands of other sectors. This index is used to identify key sectors that can be developed (Hartono et al., 2015). A sector is said to have a high degree of sensitivity when IDK > 1 or greater than average degree of sensitivity of entire economic sector, vice versa (Malba and Taher, 2016). IDK and IDP per sector can be seen in Table 1.

According to Table 1, it is known that IDK agriculture sector of 0.795. Degree of sensitivity is below average of entire sector. It means that agriculture sector is not able to withdraw sectors so that the influence on the economic growth of East Java Province is also small. Agricultural sector has a high dependence on other sectors. According to (Pudjiastuti et al., 2013); (Pudjiastuti, 2014) and (Pudjiastuti and Kembauw, 2018), if this is left, there will be imports of high agricultural commodities and will disrupt the trade balance.

Table 1. Coefficient of Sensitivity Degree Index (IDK), and Distribution Power Index (IDP) of East Java Province, 2015

No.	Sector	IDK	IDP
1	Agriculture	0.795	0.803
2	Mining and excavation	1.102	0.850
3	Agricultural-based processing industry	**1.058**	**1.130**
4	Other processing industries	1.024	**1.139**
5	Procurement of electricity and gas	**1.236**	**1.150**
6	Water procurement, waste processing, and recycling	0.655	0.897
7	Construction	0.753	**1.096**
8	Large and retail trade, car and motorbike repair	**2.006**	0.811
9	Transportation and warehousing	0.926	**1.205**
10	Provision of accommodation and eating drinks	1.021	0.970
11	Information and communication	**1.925**	0.906
12	Financial services and insurance	0.943	0.919
13	Real estate	**1.294**	0.834
14	Other services	0.736	**1.082**
Total		**15.472**	**13.790**
Average		**1.105**	**0.985**

Source: East Java Province Input-Output Table 2015, processed

Therefore, to increase agricultural output, the key sectors developed for economic growth are major trading and retail sectors, car and motorcycle repair, information and communication, real estate, electricity procurement and gas, and agricultural-based processing industries. The results of this study are in line with several research results which show that the agricultural sector is not a leading sector based on backward linkages. Botric (2013) research in Croatia has found that the sectors with high backward linkages are electricity and construction. Astrini (2013) examined revitalization of agricultural sector in the economic development in East Java by input-output approach. As a result, sectors that have forward and backward linkage, as well as being a leading sectors in East Java Province, were electricity, gas and water supply sector; financial sector, leasing, and company services. Different from Kula's research (2008) which shows that agricultural sector is a leading sector in Turkey. It proves that agricultural sector is not a leading sector in East Java.

Sectors that have a high degree of sensitivity (IDK > 1) in East Java Province are:

1) Wholesale and retail trade, car and motorcycle repair (2.006)

2) Real estate (1.294)

3) Electricity and gas (1.236)

4) Agriculture-based manufacturing industry (1.058)

It means that the sectors can attract other sectors including agriculture sector to increase their output. Therefore, development driving by the sectors will have an impact on the development of agriculture sector in East Java Province. These results are in line with (Widyawati, 2017) that sectors that had a backward linkage to agricultural sector were electricity and gas, clean water and real estate.

Identification of a sensitivity index of more than 1 (> 1) or high, means that these sectors were able to attract other sectors including the agricultural sector to increase output. Therefore, developing in these sectors will have an impact on the development of agricultural sector. These results are in line with (Gurgul and Majdosz, 2005; Botric, 2013); and Widyawati, 2017) that the sectors that have a backward linkage to the agricultural sector are electricity and gas, water and real estate, textile, apparel, as well as production and services of construction sector.

3.2. Forward Linkage Agricultural Sector in East Java Province

Relations between sectors in the form of forward linkage that is relationship with sale of goods and services (Haris et al., 2017). Forward linkage analysis demonstrated ability of agricultural sectors to promote growth of all upstream and downstream sectors in East Java Province. The future interconnectedness shows the effect of the rising in one unit final demand in agricultural sector unit that can increase the total output of all sectors. Sectors that have a high forward linkage indicate that they can produce high outputs that ultimately increase the growth of other sectors in East Java Province.

Degree of forward linkage is indicated by Deployment Power Index. The index shows deployment of sector power to final demand in other sectors. It is used for determining key sectors that can be developed (Hartono et al., 2015). A sector is said to have a high power of deployment when IDP > 1 or greater than average sensitivity index of entire sector, vice versa (Malba and Taher, 2016).

Based on Table 1, it is known that the IDP agriculture sector has a value of less than 1 (< 1) and less than the average spread of entire sector power index 0.803. It means that agricultural sector has not been able to fulfill the demand for use as inputs by other sectors. Agricultural output is used as inputs for other sectors. Agriculture sector has not been able to promote growth of downstream sectors in East Java Province.

Sectors that have a high deployment power (IDP > 1) in the province are:

1) Transportation and warehousing (1.205)

2) Procurement of electricity and gas (1.150)

3) Other processing industries (1.139)

4) Industrial agricultural-based processing (1.130)

5) Construction (1.096)

6) Other services (1.082)

Deployment Power Index more than 1 or high means that agricultural sector (in production output distribution), mostly used as inputs by other sectors. Therefore, development in transportation and warehousing, procurement of electricity and gas, other processing industries, agricultural-based processing industries, construction, and other services will have an impact on agricultural sector development.

Overall, agricultural sector has a total degree of sensitivity index (IDK) 15.472 greater than distribution power index (IDP) 13.790. The results are inversely proportional to (Diyana et al., 2008) and (Ropingi and Alusi, 2006) which concluded that food sector has a forward linkage greater than backward linkage. This proves that there has been a transformation in the role of agricultural sector. The transformation is food crop agriculture sector initially played a role as a driving sector turning into a pulling sector. It is occur because use of inputs continues to increase but output not. Increased in production requires high seed input and high fertilizer. High input requirements cause the industry sector to provide superior seeds and fertilizers continues to grow. That is, the food crop agriculture sector attracts industry sectors that provide superior seeds and fertilizers.

The dependence of food crop on fertilizer is higher because land fertility is decreasing. Organic matter levels in intensively managed agricultural centers contain <2% organic material (Suriadikarta and Simanungkalit, 2006). In addition, agricultural land near the mining industry center has been polluted by industrial waste, especially heavy metals (lead, mercury, copper, cadmium, arsenic, nickel and chromium). Land contaminated with heavy metals is difficult to restore. It requires a large cost and a long time to recover (Handayanto et al., 2017).

Intensification must be accompanied by extensification so that food crop productivity increases. However, extensification is a difficult problem because of agricultural land conversion (especially food crops). Narrowing of agricultural space has implications for the decline in food production and in the long run will affect food security. Transfer of agricultural land functions is a threat to development of food commodities (Wijaya, 2017).

On the other hand, agriculture-based processing industry continues to grow. Increasing demand for agricultural commodities causes an imbalance between supply and demand, so that dependence on imported food will be even greater (Fagi, 2013). It shows that a role of food crop as an input provider cannot be replaced, but has not been able to be a driver for the growth of other sectors in East Java Province.

3.3. Role Agricultural Sector based on Output Multiplier

Output multiplier indicates that every final demand change is one unit of money, it will increase output of entire sector (Wijaya et al., 2014). Based on analysis of output multiplier (Table 2), agricultural sectors in East Java Province seen that agricultural sector is low (rank of 14). The value of 1.259 means that any change in

final demand of one IDR in agricultural sectors will increase output of all sectors (including agricultural sectors) of 1,259 IDR. Agricultural sector can stimulate or encourage additional low output in East Java Province. This results following (Widyawati, 2017) which concluded that ability of agriculture sector encourages additional output in Indonesian is very low.

Table 2. Output Multiplier, Income Multiplier, and Labor Multiplier of East Java Province, 2015.

Numb	**Sector**	**Output Multiplier**		**Income Multiplier**		**Labor Multiplier**	
		Value	**Rank**	**Value**	**Rank**	**Value**	**Rank**
1	Agriculture	1.259	14	1.203	12	1.094	14
2	Mining and excavation	1.326	11	1.374	9	6.536	2
3	Agricultural-based processing industry	1.764	3	3.093	2	4.846	3
4	Other processing industries	1.763	4	2.792	3	2.812	4
5	Procurement of electricity and gas	1.794	2	13.749	1	13.472	1
6	Water procurement, waste processing, and recycling	1.400	10	1.191	13	1.255	12
7	Construction	1.711	5	1.549	6	1.647	6
8	Large and retail trade, car and motorbike repair	1.265	13	1.117	14	1.142	13
9	Transportation and warehousing	1.880	1	1.684	5	2.739	5
10	Provision of accommodation and eating drinks	1.513	7	1.343	10	1.627	7
11	Information and communication	1.413	9	1.342	11	1.441	10
12	Financial services and insurance	1.434	8	1.411	8	1.534	9
13	Real estate	1.301	12	1.968	4	1.316	11
14	Other services	1.689	6	1.468	7	1.581	8

Source: East Java Province Input-Output Table 2015, processed

Lack of agricultural sector contribution to additional output is caused by limitations of facilities and infrastructure. Equipment used by farmers in production activities is still simple or traditional so that output produced is low. The low capital of farmers in accessing production facilities (fertilizer, seeds/seeds superior, pay lease land) to produce both base and non-base commodities (Widyawati, 2017).

Main problem faced in agricultural development is the function of productive agricultural land to non-agriculture (Tuminem et al., 2019). Comprehensive regulatory devices relating to land protection and efforts to grant incentives to farmers have been made but land conversion remains high. Land control based on BPS data of East Java Province in the span of 4 years since 2012-2014, there is 4400 ha of agricultural land that switch function into an industrial sector. It leads to a narrowing of agricultural space that implicates production of agricultural commodities decreases, even in the long term it affects food security. Conversion of farm land to non-farm is a threat to development of excellent food commodities (Wijaya, 2017). According to (Fagi, 2013) over productive land, function causes an imbalance between supply and demand, and depend on imported food will be greater.

Sectors that have high output multipliers based on Table 2, sorted from the rank of 1-5:

1. Transportation and warehousing sector (1.880)

2. Procurement of electricity and gas (1.794)

3. Agricultural-based processing industries (1.764)

4. Other processing industries (1.763),

5. Construction (1.711).

This means that any change in the final request of 1 unit of money in the relevant sectors (transportation and warehousing, procurement of electricity and gas, agricultural-based processing industries, other processing industries, construction) will be increase the output of the entire economic sector amounting to 1.880 units of rupiah transportation and warehousing, 1.794 units of rupiah of electricity and gas, 1.764 units of the industrial-based processing of agriculture, 1.763 units of other industrial processing rupiah, and 1.711 rupiah unit of construction. This sector can stimulate or encourage the addition of high output in the economy of East Java Province. This results following (Widyawati, 2017), that the ability of the procurement sector of electricity and gas, construction, and transportation and warehousing encourages additional output in the Indonesian economy is very high.

3.4. Role of Agriculture based on Income Multiplier

Income multiplier is an increase in revenue due to changes in output. In I-O table, incomes are wages or salaries received by households. The multiplier indicates that every final demand change of one unit of money in a sector will increase income of entire sector (Anas, 2015).

Based on the analysis (Table 2), income multiplier of agriculture sector in East Java was 1.203. It means that any change in final demand was one IDR on agricultural sector will increased income of all sectors (including agricultural sector) of 1.203 IDR. Agricultural sector can stimulate or encourage additional low income than other sectors in East Java Province.

The low agricultural sector contribution to additional income was caused by the function of agricultural land which implicates on employment in agriculture sector. Limitations of employment in agricultural resulted in farmers move to other sectors or becoming unemployed. The main problem in agricultural development is the transformation land of productive agricultural to non-agricultural. This causes a narrowing of agricultural space which results in low productivity of agricultural commodity production and decreases in farmers' income (Tuminem et al., 2019).

Sectors that had high income multiplier in East Java Province are:

1) Electricity and gas (13.749),

2) Agricultural-based processing industries (3.093),

3) Other processing industries (2.792),

4) Real estate (1.968),

5) Transportation and warehousing (1.684).

It means that any change in final demands of one IDR in the sectors will be increased income by 13.749 IDR in electricity and gas, 3.093 IDR in agricultural-based processing industry, 2.792 IDR in other industrial processing, 1.968 IDR in real estate, and 1.684 IDR in transport and warehousing. These sectors can stimulate or encourage additional high revenues in East Java Province. This results following (Widyawati, 2017) that ability of electricity and gas contributes greatly to increase revenues in Indonesian economy.

3.5. Role of Agriculture based on Labor multiplier

A production activity is not separated from labor factor because it can affect to output and final demand. Final demand demonstrates impact of labor needs. Labor multiplier is a change in labor that caused initial change from output side. Impact of final demand on labor is done by measuring workforce coefficient. The multiplier indicates that every final demand change of one unit of money in a sector will increase the employment of entire sector by the number of labor multipliers generated by a sector. The result of analysis of labor multiplier can be utilized for the labor absorption in each sector. The higher labor multipliers in a sector shows the higher power absorption in sector concerned because more labor required to produce one IDR output (Suryani, 2013; Haris et al., 2017).

Based on the results, the agricultural sector's labor multiplier by 1,094 is ranked 14th in East Java Province. It shows that to produce one IDR output required 1,094 labor in agricultural sectors. This sector's ability to absorb labor is very low compared to other sectors. The results of this research correspond to (Haris et al., 2017) and (Astrini, 2013) which concluded that agricultural sector is not a leading sector in the structure of output and the linkage between the upstream and downstream sectors. Low labor absorption is caused by land function change (Tuminem et al., 2019). Land conversion resulted in the threat of food resistance, loss of farmer livelihood and then unemployment (Director General of Agriculture and agricultural facilities, 2020). In the long term, it will be affect food security.

Sectors that can induce high labor in East Java Province are:

1) Electricity and gas (13.472)

2) Mining and excavation (6.536)

3) Agricultural-based processing industries (4.846)

4) Other processing industries (2.812)

5) Transportation and warehousing (2.739).

It means that any change in final demand of one IDR will increase workforce demand of all sectors as much as 13.472 labor; 6.536 labor; 4.846 labor; 2.812 labor; and 2.739 labor. These sectors can absorb high manpower in the economy of East Java Province.

4. Conclusion

Role of agricultural sector in East Java has changed based on backward linkage, forward linkage and multiplier effect. Degree of sensitivity index (backward linkage) of the sector is 0.795, below average index of entire sector. Agricultural spread power index (forward linkage) is 0.803, lower than average of index all sectors. It means that agricultural sector has not been able to attract upstream sectors and drive downstream sectors in the economic growth of East Java Province.

Output multiplier, income multiplier, and labor multiplier in agricultural sector is lower than other sectors. These multipliers of agricultural sector respectively, i.e. 1.259, 1.203, and 1.094. It indicates that agricultural sector serves as a supporting sector instead of leading in East Java Province.

Policy recommendations that can be suggested to the government that are the government continues to complement the infrastructure of facilities and infrastructure and provide subsidies so as to increase output in the agricultural sector. Protection of perennial agricultural land comprehensively by improving the welfare of farmers so that land conversion does not occur

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Socio-economic and Institutional Factors Affecting the Adoption of Improved Breeds of Small Ruminants in Nigeria

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Abstract

The current paper examines the socio-economic and institutional factors affecting the adoption of improved breeds of small ruminants in Nigeria. Data were collected from one hundred and fifty (150) farmers through a multi-stage random sampling procedure from five Local Government Areas in Ondo State. Data retrieved were subjected to both descriptive and inferential statistics. Results showed that 68.7%of the farmers were between 31 and 50 years of age with 96.0%level of literacy. Results of the logistic regression model show that age of respondents, household size and feeding expenditure decrease the odds of adopting improved sheep and goats. However, results further reveal that adoption of improved small ruminants is positively impacted by herd size, farmer's monthly income, level of education, monthly visitations by extension agents and sources of information. The study, therefore, suggests that government should pursue policies that will promote level of education, herd size, income and extension services of small ruminants' keepers.

Keywords*: Socio-economic, binary logistic regression, small ruminants, Nigeria*

JEL Classification*: Q22 C25 C13 C83*

Nijerya'da Geliştirilmiş Küçükbaş Hayvan Irklarının Benimsenmesini Etkileyen Sosyoekonomik ve Kurumsal Faktörler

Özet

Bu çalışma, Nijerya'da geliştirilmiş küçükbaş hayvan ırklarının benimsenmesini etkileyen sosyoekonomik ve kurumsal faktörleri incelemektedir. Kullanılan veriler, Ondo eyaletindeki beş yerel yönetim alanından çok aşamalı rastgele örnekleme prosedürü yoluyla yüz elli (150) çiftçiden toplanmıştır. Elde edilen veriler hem tanımlayıcı hem de çıkarımsal istatistik yöntemlerine tabi tutulmuştur. Veriler çiftçilerin yüzde 68,7'sinin 31-50 yaşları arasında ve yüzde 96'sının okuryazarlık düzeyine sahip olduğunu göstermiştir. Lojistik regresyon modelinin sonuçları ise, katılımcıların yaşının, hanehalkı büyüklüğünün ve beslenme harcamalarının, geliştirilmiş koyun ve keçi ırklarının benimsenme olasılığını azalttığını göstermiştir. Buna karşın çalışma sonuçları, iyileştirilmiş küçükbaş hayvanların benimsenmesinin sürü büyüklüğü, çiftçinin aylık geliri, yayım acenteleri tarafından yapılan aylık ziyaretler ve bilgi kaynakları tarafından pozitif yönde etkilendiğini ortaya koymuştur.

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Bu nedenle çalışmanın, küçükbaş hayvan yetiştiriciliğinde büyük ölçeği, gençlerin katılımını ve yayım hizmetlerini teşvik edici politikalar izlemesi gerektiğini öne sürdüğü söylenebilir.

***Anahtar Kelimeler**: Sosyo-ekonomik, ikili lojistik regresyon, küçükbaş hayvan, Nijerya*

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1. Introduction

Agriculture is the leading sector in term of employment generation in Nigeria. The percentage of labour participation in agriculture as a share of total workforce in Nigeria is approximately 35.1% in 2019 (Trading Economics, 2019). There are four major agricultural subsectors in Nigeria which comprise of crop production, livestock, forestry and fisheries. Livestock is the second largest contributor to the agricultural gross domestic product. It significantly contributed about 1.73% to the real gross domestic product in 2018 (Central Bank of Nigeria CBN, 2018). Livestock is an important source of food (protein) for many people throughout the world, from the Mediterranean to the Caribbean, from South Africa to South Asia. They also provide useful skins, and in some countries, valuable hair (Food and Agriculture Organization [FAO], 1990: 64). The majority of households in the savannah and the sub-humid zones of Africa own some livestock, be it cattle, sheep and / or goats, in addition to poultry. These animals contribute substantially to the quality of human diet as well as to the household economy (International Livestock Research Institute ILRI, 2005).

Livestock production is a very important segment of agriculture. It is referred to as one or more domesticated animals being raised in agricultural settings to produce commodities such as food, employment and income to the rural farm families. Livestock may be raised for subsistence or for profit (Enechi et al., 2012: 5). Not only do they play a significant role in socio-cultural aspects of the people but also, help to balance human nutrition (Adam et al., 2010: 39-66). Furthermore, Baruwa (2013: 44-50) also reported that livestock helps to boost the food security of a household, often being the only asset possessed by a poor family. In difficult situations, such as crop failure or family illness, sheep and goats can be sold and proceeds realized from it can be used to purchase food and drugs for family. Many resource-poor farmers have equally used income raised from sales of goats and sheep to sponsor their wards at schools. Among animals that make up livestock in Nigeria, small ruminant animals comprising sheep and goats, constitute the farm animals largely reared by families in the country agriculture's system. Nigeria has a population of 76 million goats and 43.4 million sheep (FMARD, 2017: 1-60).

Livestock accounts for one third of Nigeria's agricultural contribution to Gross Domestic Products [GDP], providing income, employment, food, farm energy, manure, fuel and transport. These are also one of the major sources of revenue for the government. Traditional livestock production in Nigeria is varied and complex.

Livestock, especially ruminants, are the most efficient users of uncultivated land and can contribute substantially to crop production (ILRI, 2005). In addition to the supplying of protein, livestock serves as a source of farm power in the northern savanna zone and organic manure to boost crop production, as well as their efficient utilization of otherwise unusable plants to produce meat, milk and other products (ILRI, 2005).

The challenges facing livestock industry in Nigeria are numerous. According to Bamaiyi (2013: 54-66), that increased pressure on grazing land, ineffective livestock marketing system, inadequate capital and production credit, inconsistence in government agricultural policies, high cost of livestock equipment, drugs, vaccine, and livestock feeds are major constraints to the development of livestock. Others are lack of efficient and hygienic livestock processing facilities, slow cattle growth and low milk yield and trans-boundary animal diseases in addition to migratory pests. But the greatest challenge in achieving food security in Nigeria so far has been inadequate funding as a paltry 3% of the budget was allocated to the sector up to 2007 while the provision was upped to only 7% in the year 2008 because of the ominous food inadequacy signal staring the Federal Government in the face (Ruma, 2008: 3). With the increase in human population especially in developing countries like Nigeria, there is a lot of demand for animal protein supplies. These demands are far from being met (Okuneye, 2002: 16-22).

In Nigeria, there is no rural home without at least one species of livestock, particularly goats and sheep or a local bird. Given this scenario, why then is the neglect of livestock extension? Anyanwu (1987: 2) noted that the reason could be attributed to the fact that many of the farmers are into crop production. According to Adekunle and Igodan (1990: 2-4), since the conception of extension services in 1910 in the South and 1912 in the Northern Nigeria, respectively, emphasis has been on crop production. Therefore, there is the need to change the orientation and perception of people towards livestock production. Animal breeding which is the application of scientific knowledge to the genetic improvement of animals has evolved from the beginning. Genetics provides the foundation principles which could guide animal breeding practice.

However, plans and programmes to improve the genetic merit of livestock must be drawn heavily on conditions from statistics, biochemistry, physiology, economics and other disciplines (Legates and Everett, 1990: 8-9). The task in animal breeding is two folds; to select the most desirable animals based on the prediction of genetic merit and to produce superior genotypes by combination of genetics through breeding plans and systems of mating. In the developing countries, there are several breeds of small ruminants with low potency. Windock International (1983: 116) opined that small ruminants in developing countries are less productive than those in developed countries.

FAO (2015)'s report is also in line with the earlier findings of Windock International (1983: 116) that most of the local breeds in Africa have poor genetic quality. It concludes that attempt to improve indigenous type by cross-breeding

have not been successful under traditional management system. Some of the exotic breeds of goats identified for this study are: Angora, Saanen, Ango-Nubian, Toggenburg and Alphine. Also, for sheep are Dorper, Blackhead, Persian, Merino and Wensleydare (ILRI, 2005). However, as versatile as livestock is, to the nations' economy and food security, many farmers are still used to rearing the indigenous breeds of animal types. Thanks for scientific breakthroughs that have developed improved breeds of such animals with better quality of products, vitality and longevity. The contributions of small ruminant animals to the food basket of Nigeria in term of meat and milk and the priorities given to their sustainability are disproportionate. It is therefore necessary to find out factors that constrain the adoption of high breeds of goat and sheep.

The main objective of this study is to examine the influence of socio-economic and institutional factors on the adoption of improved breeds of small ruminants in Ondo state, Nigeria. Specifically, the study is to: profile the socioeconomic characteristics of small ruminants' keepers; identify institutional factors influencing the adoption of improved breeds of small ruminants and examine farmers' perception on acceptability of improved small ruminant animal.

A number of empirical studies have been conducted particularly on the economics of livestock production, yet the impact of these researches in developing countries Nigeria inclusive, falls short of the total volume of researches conducted on small ruminant animals. For examples, an earlier study conducted in Nigeria showed that yearly income, education, farm size, source of credit, membership of association and type of livestock were major predictors of adoption rate of livestock management system (Mafimisebi et al., 2006: 183-186). In India, weight, sex and breed of small ruminant animals were found to be major determinants of their sale prices (Shivakumara, et al., 2019: 621-625). The study by Abdullahi et al. (2019: 1-13) reported that the sale return from sheep and goats is positively impacted by number of animals held per week. Offor et al. (2018: 7-11)'s study showed that age, household size, income and rearing experience determine production of small ruminants in Abia State, Nigeria. Similar study reported by Dossa et al. (2008: 581-592) concluded that gender, ethnicity and perception of risk related to species are major determinants of rearing goat and sheep in Southern Benin, though in Tunisia, flock size, education and off-farm were identified as factors affecting the adoption of innovative technologies by livestock holders (Dhraief et al.,2019: 1-18).

Past studies show that factors affecting small ruminant animals are location-specific. It varies from country to country and region to region. However, an investigation into the effects of socio-economic and institutional factors on adoption of improved breeds of small ruminants is still lacking. The implication is that relevant information necessary to formulate policy strategies on small ruminant animals is still scanty. This present paper, therefore attempts to add to the existing

literature on adoption and food security studies to fill the vacuum created by the past researches.

It is also pertinent to ask if farmers are not aware of improved breeds. If they do, why are they not raising improved breeds of small ruminants? The decision to adopt a technology is a complex process. Farmers will have to weigh the benefits and consequences associated with individual technology package before adopting to see if the advantages in the present innovation outweigh the existing technology. A number of factors are interplayed when it comes to adoption or non-adoption. Therefore, such factors could be economic, institutional, environmental and cultural related factors.

The rest of this paper is organised as follows. Section 2 discusses theoretical framework, while Section 3 presents materials and methods used. The results of the findings are interpreted and discussed in section 4 while section 5 presents the conclusion and recommendations for further policy.

2. Theoretical Framework

2.1. Random Utility

Utility is a benefit a ruminant keeper *n* can derive from choosing an improved ruminant *i* from a choice set of alternative *J*. Every farmer is assumed to be a rational decision maker relative to his/her choice. Consider a livestock keeper *n* who is confronted with the adoption decision on improved small ruminant animals, the decision to adopt or not of such a technology can be described as a discrete choice. The decision of individual to adopt the innovation depends on his perceived utility about the product and the farmers' characteristics. The utility maximizing behavior of the farmer is reached when the utility associated with option *i* exceeds the utility he/she can derive from not adopting an innovation. Mathematically, adoption will only occur if

$$U_{ni} > U_{nj} \qquad \forall_j \neq i \tag{1}$$

where, U_{ni} is the utility of individual n adopting i

U_{ij} = is the utility of individual *n* for adopting alternative j

But let us consider a researcher who is investigating a discrete choice. The choice of the individual depends on many factors. Some of the factors are observable and some are not observable. This utility decomposes into various components that depend on factors that are observed the researcher. The observed factors normally include the farmers attributes and the characteristics of the technology while the other part of the equation is the unobservable attributes that are considered less important in this study. The linear form of this model can be written as

$$U_{ni} = \beta z_{ni} + \varepsilon_{ni} \tag{2}$$

We can deduce equation (3) from 2 as

$$z_{ni} = z(X_{ni},\ S_n) \tag{3}$$

From equation (3), z_{ni}= a vector of observed variables relating to alternative *i* for individual household that depends on the attributes of the alternative, X_{ni} = vectors of attributes describing interaction between alternatives *i* and *j*, respectively. S_n = vector of individual characteristics that influence his/her choice. β= is the vector of the coefficient of observed variables while ε_{ni} = vector of random component that captures the effects of all unobserved variables that affect individual choice Bateman et al. (2002)

The conditional probability of his choice then becomes.

$$=P(i/C_n) = P_r\left(\bigcap_{j\neq i} \beta z_{ni} + \varepsilon_{ni} > \beta z_{nj} + \varepsilon_{nj},\right) \quad (4)$$

$$=P\left(\bigcap_{j\neq i} \varepsilon_{nj} - \varepsilon_{ni} < \beta z_{ni} - \beta z_{nj},\right). \quad (5)$$

Given β, the choice probability is the probability that $\varepsilon_{ni} - \varepsilon_{nj}$ are below the respective quantities$\forall_{j\neq i}$: $\beta z_{ni} - \beta z_{nj}$. Different choice models depend on the assumption about the distribution of error term for all *i* and different treatment of β. In this study, we assume that our random component is logistically distributed.

3. Methodology

The study was conducted in Ondo state, Nigeria. The State has a population of 3.4 million people (National Population Commission [NPC], 2006). With respect to the climate of the state, it is tropical with two distinct seasons of rainy and dry seasons. The study area is characterized with moderate temperature between 23^0-26ºC (Adejumo, 2008: 91). The state is divided into 18 Local Government Areas (L.G.As). The state is blessed with 12 diurnal sunshine hours and annual rainfall varies from 2,000mm in the southern parts to 1,150mm in the northern extremes. Sequel to the favourable climate condition of the state, the people engage in livestock production such as Cattle, Sheep, Goat, Piggery, and Poultry.

The study was conducted between July/September, 2019.A multi-stage sampling technique was employed to select small ruminants' farmers in this study. Five out of the eighteen Local Government Areas (LGAs) of Ondo State which are prominent in small ruminant production (sheep and goats) were purposively selected for this study. The Local Government Areas were Akure north, Owo, Ose, Akoko southwest and Okitipupa. A random sampling technique was used to select three communities from each LGA, making a total of 15 communities that were chosen. Each community was divided into five wards from which two were randomly selected. From each selected ward, five respondents were randomly interviewed, giving a total of 10 respondents per community and 150 for the study. Primary data was used for this study. The primary data were collected by interviewing farmers with a well-designed and pre-tested questionnaire to ensure its reliability. Data collected from the field survey were analyzed using descriptive and inferential statistics on SPSS version 25.

3.1. Econometric Model

i. Binary Logistic Regression Model

The binary logit/probit models are widely used economic tools in adoption studies with a dichotomous dependent variable such as adoption versus non-adoption. The choice between these two models is often based on computational convenience and easy interpretation of the parameter estimates through its odds ratio. The difference between logit and probit lies on the distribution of their functional forms and assumption builds around the disturbance term. Probit and logit usually give similar results when estimates are compared. The two modes can only be differentiated by considering the distribution of their dependent variables. Probit assumes that the dependent variable follows cumulative normal distribution while logit is logistically distributed. We, therefore, use binary logit model in this study because the dependent variable of the model is dichotomous. Secondly, the computation and interpretation are easy (Gujarati, 2003: 501). Several studies have used binary logit model to analyse data on adoption of technologies (see Dhraief et al., 2019: op cit; Johnson, Ajibefun and Adetarami, 2018: 99; Dossa et al., 2008, op cit; Ladular, 1990: 258-268). Following Guajarati (2003: op.cit), binary logit model is written as

$$\text{In}\left(\frac{\text{P}}{1-\text{P}}\right) = \text{Z}^{*}_{\text{i}} = \frac{1}{1+exp^{-(\beta_0+\beta_i X_i+\varepsilon_i)}} \quad (6)$$

Where, Z^*_i = latent dependent variable

$\ln\left(\frac{P}{1-\text{P}}\right)$ =Log of odds ratio of adopter/non-adopter

In = natural logarithm

P_i = Probability of adopting improved breeds of sheep and goat

1-P = Probability of not adopting improved breeds of sheep and goat

β_i = column vector of unknown parameters to be estimated,

β_0=constant,

X_i = a row vector of explanatory variables

The reduced form of equation (2) can be rewritten as

$$Z_i^{*} = \beta_0 + \sum_{k=1}^{J}\beta_j X_i + \varepsilon_i, \quad \begin{cases} if\ J > 0, & Z_i^{*} = 1 \\ otherwise & Z_i^{*} = 0 \end{cases} \quad (7)$$

ε_i = vector of unobserved random effect.

ii. Description, Measurement of Variables and A Priori Signs.

Z* = 1, if farmers adopt improved breed of small ruminant,

Z* =0, if farmers do not adopt improved breed of small ruminant.

X_1= Age of farmers (in year) (±)

X_2= Household size (in number) (+)

X_3= Level of education (number of years spent in schooling) (+)

X_4 = Herd size (number of animals available) (+)

X_5= Monthly income (₦, Nigeria currency) (+)

X_6 = Feeding expenses on animals (₦/kg) (-)

X_7 = Number of time an extension agent visited farmers (+)

X_8 = Membership of a group (yes = 1, 0 otherwise) (±)

X_9= Sources of information on improved breeds of Sheep and Goats (Extension agent = 1, 0 otherwise) (+)

ε_i = Error term[5]

4. Results and Discussion

4.1. Socio-economic Characteristics of Small Ruminant Animal Keepers

The results in Table 1 reveal that pools of 68.7% of the small ruminant keepers are between the ages of 31 and 50 years. This implies that they are in their middle aged thus showing that most of them are still very active in livestock production. Thus, 70.0% of the respondents are female households while 30.0% are male households. The dominance of the female over the male may be attributed to the fact that female have more time in keeping few numbers of small ruminants than their male counterparts in the study area. This is contrary to the findings of Faizal and Kwasi (2014: 309-321) and Offor et al. (2018: 7-11) that reported that more male farmers compared with female counterparts were principal keepers of sheep and goats in Northern Ghana and Abia State, Nigeria, respectively. However, 60.0% of the respondents are married. In addition, 50.0% have their family sizes of 1-5 people. 96.0% of the respondents have one form of education or the others, suggesting that respondents will be able to read and understand instructions require technical expertise in animal husbandry. Moreover, about 56.7% of the small ruminant keepers possess 1-10 herd size of sheep and goats. Thus, majority (79.3%) of the respondents fall within the range of less than ₦100,000 as their monthly income. In addition, majority (80.3%) of the respondents usually spend less than ₦10,000 on small ruminants' feeds, therefore, they may not be able to embark on large animal husbandry in the study area.

[5] Note: In SPSS version 25.0, the exponential (Exp (β) of the slope coefficient β_j associated with the explanatory variables (X_1-X_9) is interpreted as the odds ratio (OR) of the occurrence of the events for an increase in each of the explanatory variables while holding other constant. A positive coefficient will always give an odds ratio greater than 1, otherwise less than 1.

Table 1: Socioeconomic Characteristics of Small Ruminants Farmers (n= 150)

Characteristics	Categories	Percentage (%)
Age	31-40 years old	30.7
	41-50 years old	38.0
Gender	Male	30.0
	Female	70.0
Marital status	Married	60.0
Household Size	1-5	50.0
Education	Primary School Education	52.7
	Secondary School Education	25.3
	Tertiary School Education	18.0
Herd Size	1-10	56.7
Monthly Income	Less than ₦100,000	79.3
Monthly Expenditure	Less than ₦10,000	80.3

*note: for monthly income and expenditure: US$1 = ₦380

Source: Field survey, 2019

4.2. Institutional Factors of the respondents

Our results in this study show that farmers' sources of information are mainly from fellow farmers (69.3%). Therefore, there should be more mobilization of extension agents to provide relevant information to the farmers with respect to improved livestock breeds.

Revelation from our results also shows that about 64.3% of the small ruminant keepers have no access to extension services while 35.7% have. Findings indicate that over 64.7% of the respondents are not visited at all by extension agents in the study area. Similarly, 24.7% of the respondents have contact in group with agricultural extension agents while on individual contact basis with extension agents accounts for 10.6 % of the total sample.

About 67.3% of the respondents are not members of any group while the remaining 32.7% belong to one form of association or the others. The reason for not being in any association may possibly be due to the lack of interest, lack of awareness or different in ideology.

4.3. Farmers' Perceptions on Acceptability of Improved Breeds

Information in Figure 1 shows the perceptions of small ruminant farmers towards acceptability of improved breeds of small ruminants, using five points Likert Scale of Strongly Agreed, Agreed, Undecided, Disagreed and Strongly Disagreed. There were ten statements in all. Values of 5,4,3,2 and 1 (and/or the reverse) were assigned depending on the working of the statement whether positively or negatively as depicted from the results below. Hitherto, percentages were used to score the statements.

The results indicate that 38.7% of the respondents are undecided to the first statement. This implies that many small ruminant keepers neither agreed nor disagreed that improved breeds give more yield than the local types.

Secondly, it was stated that period of parturition and maturity of improved breeds is too long; 30.0% and 28.0% of the respondents disagreed and strongly disagreed with the statement, respectively. Therefore, they believe that period of parturition and maturity of improved breeds is short, and this would influence their acceptability.

The third statement reads that local types are highly resistant to diseases than improved breeds; 38.7% and 42.0% of the respondents strongly agreed and agreed to the statement. The final judgment of this statement can be concluded that majority will not accept improved breeds with the belief that local ones are highly resistant to diseases.

In addition, based on the findings, 38.7% and 44.6% of the respondents strongly agreed and agreed, respectively to the statement that improved breeds are costlier than local types. This is a positive statement, with the affirmation that improved breeds are costlier. This implies small ruminant keepers may still accept improved breeds due to their value.

Furthermore, 32.7% and 40.0%of the respondents strongly agreed and agreed, respectively to the statement that improved breeds are too sluggish. As the majority fall to these categories, they may not accept improved breeds with this character.

Also, 28.0%of the respondents disagreed that local breeds have better taste. Moreover, 32.7%of the respondents are undecided to the statement that they would not bother themselves about improved breeds.

Also, the analysis in Figure 1 reveals that 22.7% and 27.3% disagreed and strongly disagreed, respectively to the statement that they could save more time and cost in production if they were to raise improved breeds. This is a positive statement, with the affirmation that improved breeds do not reduce time and cost of livestock production. This implies that they may not accept improved breeds.

In addition, 28.7%of the respondents could not on the statement that feeds for local breeds are more readily available. Finally, 76.7% of the small ruminant keepers strongly agreed that acceptability of improved breeds will jack up their income.

The general level of acceptability based on the assessment of all the ten statements, only three (3) statements were totally agreed with by the respondents. Since three statements were agreed with by the respondents, more enlightenment about the qualities and advantages of improved breeds of small ruminants is needed, and this can be achieved through the help of extension agents.

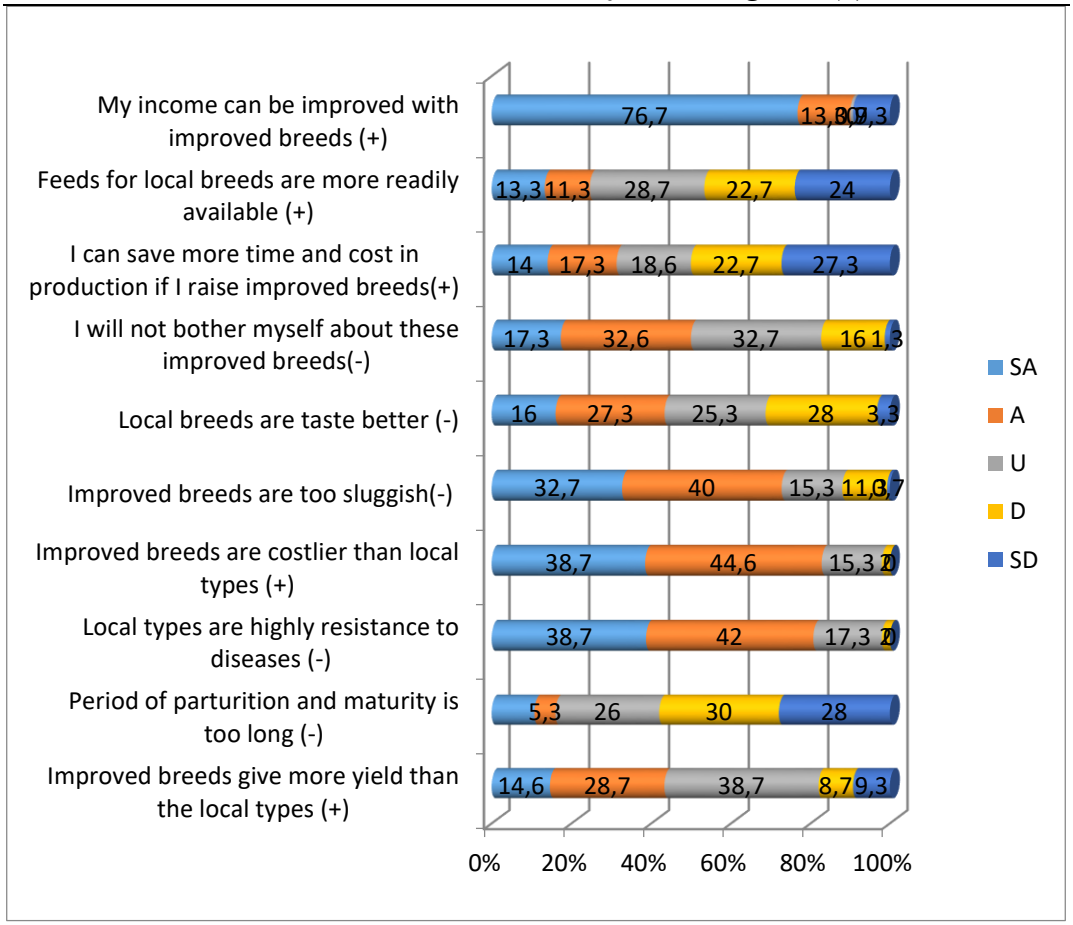

Figure 1: Farmers' Perceptions on Acceptability of Improved Breeds

Key for interpretation: SA= Strongly Agreed, A= Agreed, U=Undecided, D=Disagreed, SD= Strongly Disagreed, P= Positive Statement, N= Negative Statement, % = Percentage, Freq. = Frequency.

For marks assigned to positive statement (+ve): SA=5, A=4, U=3, D=2, SD=1.

Marks assigned to negative statement (-ve): SA=1, A=2, U=3, D=4, SD=5.

Source: Field survey, 2019

4.4. Logistic Regression Results for Factors Affecting Improved Breeds of Small Ruminants

Table 2 shows the parameter estimates and odds ratio estimated from binary logit model. A stepwise logistic regression method was employed to obtain key socio-economic and institutional factors influencing the adoption of improved breeds of sheep and goats. The F-statistics with a value of 112.344 and $p<0.01$ shows that all explanatory variables included in the model exerted a significant impact on the adoption of improved breeds of small ruminants. The Pseudo R^2 estimated in this model is 0.817 and the percentage correct classification is also 72%. The pseudo R^2

implies that about 81.7% of variations in adoption of small ruminants are explained by all variables fitted into the model using maximum likelihood estimation method (MLE) in the logistic regression model. To further confirm the suitability of using logit model in this study, the Hosmer and Lemeshow test was not violated with a p-value greater 5% probability level. Our discussion in this study is based on the odds ratios estimated from logit coefficients because the parameter estimates of logit model cannot be interpreted directly (Gujarati, 2003).

As displayed in Table 2, out of nine (9) regressors postulated, eight (8) are found to have significant effects on the adoption of improved breeds of small ruminants. The predictors in the model are discussed as follows:

Age of respondents

Age of the respondent in this study has negative association with the adoption decision at the 1% level of significance. This result is consistent with the existing literature that older farmers are risk averse and have little interest in long term investment compared to young farmers. The estimated coefficient is negative (-0.208) and the corresponding odds ratio is 0.81. The implication is that an addition of one year to the age of the farmer, all things being equal, decreases the odds of adopting improved small ruminant animals by 19% (i. e. the percentage of one less 0.81) compared to the odds of non-adopter. This finding is similar to the finding of Dhraief et al. (2019: op cit)in Tunisia but contrary to the earlier study conducted in Southern Benin that an addition to age of farmer increases the odds of owning goat and sheep (Dossa et al., 2008: op cit). In the study, goats are commonly reared through extensive system where the owner gives little food especially the remnants or left over of their foods and allow them to walk around either within a fenced or fenceless building. Goats are believed to be stubborn, so the aged farmers may find it difficult to look for them especially when they fail to come back to their tents. However, the young farmers are physically strong to look for or chase and return them home. It is very difficult to get hold of goat unlike sheep when goat loses from where it is tethered. The male goat is an adventurous animal it is common with male goat to look for female goat outside its vicinity and, in the process many of them have gone astray. The older farmers may show little interest in adopting improved breeds.

Household size of respondents

The influence of household size on the adoption of small ruminants turns out to be negative at the 1% level of significance. The negative sign is contrary to our *a priori* expectation. We expect that the higher the family size, the greater the opportunity of having access to more family labour and hours at work in the routine management of small ruminant animals. The logit coefficient estimated is negative (-0.248), and the corresponding odds ratio is less the one (0.78) which indicates a decrease in the probability of adopting improved breeds of small ruminants. Thus,

an additional member to a household decreases the odds of adopting improved small ruminant by 22% (i.e. the percentage of one less 0.78) compared with a respondent with a large household size. The result fails to support the finding of Jera and Ajayi (2008) on logistic modeling of smallholder livestock farmers' adoption of tree-based fodder technology in Zimbabwe.

Education level of respondents

Education of respondents matters a lot in adoption of technologies because it creates awareness and takes away ignorance. Ability to read and write makes it easy to scrutinize and weigh future benefits associated with high or exotic breeds in small ruminant in our own case here. Result of educational level of household head is positively and statistically significant at 1% level of probability. The coefficient of the variable is theoretically consistent with our *a priori* expectation. The logit coefficient and odds ratio were 0.12 and 1.13, respectively. The odds ratio is greater than one which indicates that a farmer is more likely to raise improved breeds of goat and sheep. The result also implies that additional year a respondent spends in schooling, the odds of adopting improved breeds of small ruminant will increase by 1.13 times higher than the odds of uneducated farmers. The result here agrees with the finding of Dhraief et al. (2019: op cit) on adoption of innovative technologies.

Extension contact

Extension service is an institutional body linking research institutes and farmers together with the aim of taking current agricultural innovations from research point to farmers**.** The positive correlation between extension service and adoption of improved small ruminant breeds is expected. The coefficient is statistically significant at the 1% level. This finding reflects the dependability of farmers on agricultural extension workers on information. An additional extension visit received by a farmer will increase the odds of adopting improved breeds of small ruminants by 1.12 times the odd of non-visited farmer in the study area.

Sources of information on improved small ruminant

According to Agbamu (2006: 1), many studies in the developing countries have identified agricultural extension agents as the most important source of information to farmers on agricultural innovations. Sources of information had a positive influence on the adoption of improved breeds of small ruminants in the study area. The result is consistent with our earlier *a priori* expectation in this study. Adequate information is one of the major prerequisites for wide spread of acceptance of agricultural innovations. Agbamu (2006: 1) argues that farmers are well exposed to various sources of information like the use of radio, television, access to agricultural journals, newsletters and newspapers. These are expected to facilitate the acceptability of innovations than those that are not exposed to multi-media system. This implies that, the more the farmers have access to agricultural information, the higher the adoption of improved breeds of small ruminants. Similarly, an additional source of information received by small ruminant farmer, all things being equal,

will increase his/her odds of adopting improved breeds of small ruminants by 1.18 times the odd of farmers without an access to information in the study area.

Monthly income of respondents

Similarly, monthly income was positively and consistently related to adoption decision and thus shows that an additional income received by farmer, the probability of adopting improved breeds increases by 45% while the odds of non-adopters decreases. There is a tendency that the monthly income will increase and this will bring higher potential for the farmers to adopt improved breeds of small ruminants. Also, the more the farmers' monthly income increases, the more they would be able to afford the cost of improved breeds of small ruminants they desire. Capital is needed to purchase livestock equipment, drugs, vaccines and feeds required to raise improved breeds of small ruminants.

Feeding Expenses on goat and sheep

Feeding expenditure incurred on animal feeds has a negative influence on adoption of improved breeds of small ruminants at 1% level of probability. So, a reduction in the cost of feeding animals justifies the adoption of improved breeds of small ruminants in the study area, otherwise farmer will be less likely to adopt technology package of small ruminants because farmers adopt when they find out that benefits from new technology is greater than existing technology. The result indicates that a one unit increase in feeding expenditure, the probability of adopting improved small ruminant breeds decreases by 63% compared with non-adopter.

Herd size

The result in Table 2 shows that herd size controlled by farmers is an important predictor for adopting improved breeds of small ruminants. This variable is positively and significantly related to the adoption of improved breeds of small ruminant at the 1% probability level. The coefficient of herd size is 0.146 and the corresponding odds ratio of 1.157 is greater than one. The positive sign for this variable is theoretically and consistently agreed with the study *a priori* expectation. This implies that farmers with large scale of small ruminants are more likely to adopt improved breeds of small ruminants compared with farmers that have few ruminant animals. The result indicates that increasing herd size by a unit, *ceteris paribus*, the odds of adopting improved breeds will increase by 16% compared to non-adopter. The result is similar to the findings of Jera and Ajayi (2008) in Zimbabwe.

Table 2: Empirical Result of the Binary Logistic Regression Model.

Variable	Coeff.	Std.err.	Z-stat.	Exp(β) OR
Constant	3.31	0.298	11.10***	27.3

Age of respondent	-0.21	0.028	-7.43***	0.81
Household size	-0.25	0.030	-8.27***	0.78
Level of education	0.12	0.024	5.17***	1.13
Extension contact	0.11	0.021	5.43***	1.12
Membership of a group	-0.14	0.289	-0.49	0.87
Sources of information on improved breeds	0.16	0.033	4.94***	1.18
Monthly income	0.37	0.037	10.00***	1.45
Feeding expense on animals	-0.46	0.059	-7.75***	0.63
Herd size	0.15	0.027	5.41**	1.16
Model fit summary				
F-statistics	112.344***			
'% Correct classification	72.0			
McFadden' s Pseudo R^2	0.817			

-2Log likelihood = Omnibus test of model coefficients: χ^2= 61.22***, Hosmer and Lemeshow test: = χ^2 = 9.89 P = 0.331, ***, **, * Sig. at 1%, 5% and 10%, respectively.

Source: Field survey, 2019

5. Conclusion

This study is conducted on socio-economic and institutional factors affecting the adoption of improved breeds of small ruminants in Nigeria. Findings in the study showed that majority of the respondents are in their middle aged which indicates that most of them are still very active in small ruminant production. Our study also shows that female respondents dominate the rearing of small ruminants.

Most respondents are educated, suggesting that respondents would be able to read and understand instructions require technical expertise in animal husbandry and other management practices relevant to improved breeds of small ruminants. The findings show that ruminant keepers in the study area have access to extension services once in a month. However, farmers' sources of information are mainly through fellow farmers.

Further scrutiny of the results, show that most of the respondents earn a monthly income less than ₦100,000, this income is low relative cost of production and this study concludes that low income may constitute a stumbling block to the adoption of improved breeds of small ruminants. Farmers' monthly income plays significant roles in livestock production because, such income will determine the level of production and will also enhance the clienteles' level of judgment in adopting new improved breeds of small ruminants.

According to farmers' perception on acceptability of improved breeds of small ruminant, the majority of the respondent strongly agreed that adoption of improved

breeds will increase their income. But farmers fail to support that period of parturition and maturity of improved breeds of small ruminant is too long.

The study concludes that household size, herd size, level of education, farmer's monthly income, extension contact are factors that positively predicted adoption of improved breeds of small ruminants in the study area. The importance of education and high income cannot be overemphasized in agricultural project. Adoption of improved breeds of small ruminant relies so much on the level of education and better income in such that there will be higher return to compensate farmers' efforts. Frequent visitation of extension agent to his clientele, will help farmers to receive updated information on sheep and goat managements.

Based on our findings, it is therefore, recommends that policies and programmes that will promote education, extension services, level of income of small ruminant keepers, herd size and sources of information should be pursued by both government and private sectors. Therefore, the policies will motivate farmers to embrace improved breeds with good husbandry and effective management practices in order to revive degenerated and abandoned old methods of raising small ruminants for increased production. Also, the programmes will sustain and promote improve breeds of small ruminants production in Nigeria.

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