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Smallholders' Willingness to Pay for Mechanization (Tractor Services) in Delta and Benue States, Nigeria

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ABSTRACT The majority of the smallholder farmers mainly crude implements. However, the extent to which they are willing to pay for mechanization services to change such practices unknown. This paper investigates the smallholders' willingness to pay (WTP) for tractor services, factors that affect the smallholders' WTP for tractor services, and factors that affect the amount of money the smallholder is willing to pay for tractor services. Multi-stage sampling technique was used to collect data from 280 respondents in the study area. The contingent valuation methodology was used to measure the smallholders' WTP. Descriptive statistics and the double hurdle model were used to analyse the results. The majority of the smallholder farmers were willing to pay for tractor-use. Age, farm size and location affect the smallholder' WTP for tractor services. Expenditure and location affect the amount of money willing to pay for tractor services by the smallholder. There is a prospective growth for hire tractor services business due to smallholders' WTP. It was suggested that entrepreneurs invest in tractor-hired services business since the farmers were willing to pay for their services. More researches should be done on how to sustain the smallholders' demand and WTP for tractor services.

INTRODUCTION

The use of tractors forms the foundation for the actualisation of mechanization (Achora 2015). Tractors are key tools in any farm mechanisation system that aims to increase the area under cultivation, facilitate the accomplishment of tasks that are difficult to perform by hand, reduce the pressure on human labour, improve the quality of work and products, promote labour efficiency and increase productivity (Singha et al. 2012). Sims and Kienzle (2016) noted that farm powers, including two-wheeled and four-wheeled tractors, are essential for smallholder agriculture to raise labour productivity and boost production. A study by FAO (2016) showed that the used of tractors produced high-quality outputs, which in turn has a positive impact on agri-food value chains. Moreover, the use of tractors for transportation can enable farmers to get their product to market more quickly, which implies lower post-harvest losses (Challa 2016; Zeigler 2013). Despite the significance of tractor in transforming the agricultural sector, the report indicated that the lack and poor use of tractor prevail among smallholder farmers in Africa (Bishop-Sambrook 2005). The failed mechanization (tractor services) in many developing countries has subject many smallholder farmers to the use of crude implements (Bishop-Sambrook 2005). Over the years, and even in the recent time, government tractor service has not ensured sustainable tractor service supply (Akinola 1987; Ajah 2014). Some of the reasons for the failure of mechanization programmes in Africa include, but not limited to the mode of operation of tractor programmes, lack of commitment to duty by those responsible for the running of government tractor programme and untimeliness (Mijinyawa and Kisaiku 2006; Hittersay 2013).

Researches proposed private hire service as a pivotal business model that could sustain the smallholders' mechanization (Sims et al. 2011). Mrema et al. (2008) stated that without access to effective tractor services – whereby small-scale farmers hire people who own tractors and equipment to perform specific farming operations for them – farm mechanization cannot be realized. Tractor services facilitate development, and may even trigger youth involvement in agriculture (Achora 2015). Improved access to tractors and tractor services is seen as necessary not only for individual and specific farming communities but as part of a broader agricultural transformation (Zeigler 2013). According to Zeigler (2013), a

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small-scale farming enterprise can benefit when the owner acquires a tractor, but the benefits are likely to spill over in the local community, as tractor owners offer services to their neighbours who may be unable to afford their tractors. However, none of these researches work on the smallholder farmers' willingness to pay for hired tractor services. In Nigeria, extant works of literature, including Alabadan and Yusuf (2013), Ajah (2014), Takeshima et al. (2015) and Issa (2017) who researched on hired tractor services did not consider the smallholders' willingness to pay for tractor services.

The willingness to pay (WTP) is the optimum price choice at which a client consents to purchase a particular service or product of interest (Marine 2009). The concept of WTP is useful in the assessment of agricultural services, agricultural products market, and public healthcare value benefits with cost analysis, as well the value of environmental public goods (Mariani and Pêgo-Fernandes 2014). Researchers in different countries have addressed several challenges via the investigation of WTP. Castro et al. (2016) investigated the economic value of ecosystem services in the United States where it was discovered that some of the responses had biases toward water management services as a result of social and cultural attributes. Investigating the priorities attached to ecological restoration in the Wei River basin of Northwest China from 900 respondents, Khan et al. (2019) used WTP to discover that the public was willing to offer monetary value of 91.99 RMB for water quality, 11.79 RMB for water quantity and 23.59 RMB for erosion intensity control. Findings by Ndetewio et al. (2013) revealed that education, farm size and household income influenced willingness to pay for conservation services in Tanzania. Again, past works of literature on WTP did not address the willingness to pay for tractor services. Takele et al. (2018) researched on farmers' willingness to pay for tractor services in Ethiopia; however, their research was on two-wheeled tractor hired services. However, their research was not all-inclusive as it excludes the farmers' willingness to pay for a 4-wheeled tractor. Research by Takeshima et al. (2013) was close to the investigation of willingness to pay for tractor services, but their research focused on the supply of tractor services and the trend of its use by farmers. Therefore, this research amidst other things filled the gap in literature by investigating the smallholder willingness to pay for tractor services in the study area.

Amidst different factors, many businesses, including agribusiness failed due to lack of study on the consumers' willingness to pay (WTP). It is more challenging since factors that affect a particular business vary according to location and individual. Hence, this paper analyses the smallholders' willingness to pay for tractor services.

Objectives

Specifically, the objective of this study is to:

Investigate the willingness of the smallholder to pay for tractor services in the farming system Determine the factors influencing smallholder farmers' willingness to pay for hired tractor services in the study area

Investigate the amount of money willing to pay for hired tractor services

Determine the factors influencing the amount willing to pay for tractor service by the smallholder farmer.

METHODOLOGY

The study area is Delta and Benue States, Nigeria. Delta State has twenty-five Local Government Areas (LGA) which constitute the three senatorial districts of the state, which are Delta North, Delta Central and Delta South (NigeriaGalleria 2017). The administrative structure of Delta State is run by two tiers of governments, which are the local and state system of government and these two-tier of government have different legislators (NigeriaGalleria 2017).

The Delta State has a tropical climate that is separated by two major distinct seasons. These are the dry and rainy seasons. The dry season begins roughly from January to April while the rainy (wet) season starts from May to October. However, there is a brief dry period in August that is commonly referred to as August break, which is followed by a short dry period that proceeds the dry season called Harmattan (Akinsanola and Ogunjobi 2014; Igweze et al. 2014).

Delta State has rich agricultural land and three distinct vegetation with a total landmass covering 18,050 km^2 (Awerije and Rahman 2014; United

Nations 2014). The agricultural sector contributes an average of 13 percent to the state's GDP, making it the second-largest GDP contributor outside the oil sector which contributes 79 percent (DSG and UN 2014).

Benue State became an autonomous state on the 3rd of February 1976. The headquarters of the state is in Makurdi. Benue State is named after the River Benue because the river is the most distinct geographic feature of the state. Benue State presently has twenty-three (23) LGA.

The state has good guinea savannah vegetation of grasses with different species of forest trees. The soil is mainly formed from sedimentary parent materials that bring about the deep loam soils which stimulate agricultural activities eventually in all the location of the state (BENSEPA 1999). The climatic condition of Benue State favours agriculture and it belongs to the tropical wet and dry or savanna (Aw) (Nyagba 1995). The dry season begins from November to March. Though there are usually one or two heavy rainfall incidences within January, February or March, such rainfall incidences make room for early planting, and the temperature is higher in March and April. The rainy season commences in late April and runs through to October (Nyagba 1995).

Research Design

This study used descriptive research design. Data was collected from 280 smallholder crop farmers using a semi-structured questionnaire and different sampling techniques. Purposive sampling was used to sample the two states, which is to enable comparison among the states. In Delta State, two senatorial districts of Delta North and Centre were purposively selected because they have higher numbers of smallholder crop farmers compare to Delta south.

In Benue State, the simple random sampling technique was used to select two of the three senatorial districts because of their active involvement in crop farming.

One local government area (LGA) from each senatorial district was randomly sampled after purposefully excluding the LGA that are not actively involved in agricultural activities. Hence, the data were sampled from four LGA in four senatorial districts of the two states. Furthermore, using the names of the communities and the numbers of wards, seven communities were randomly selected in each LGA. Finally, ten smallholder farmers were systematically selected using the systematic random technique from each of the community.

The populations of the smallholder farmers in both states were gotten from the State Ministry of Agriculture. In Delta State, the population was collected from the office of Central Bank of Nigeria (CBN) attached to the Ministry of Agriculture while in Benue State; the population of the smallholders was collected from All Farmer Association of Nigeria (AFAN). Hence, the sample size was calculated based on the population of the registered farmers, which are 970 and 1350, 2555 and 2160 registered smallholder farmers in Oshimili-North, Ethiope-East, Agatu and Konshisha local government areas respectively.

Empirical Measurement of Willingness to Pay for Tractor Services (WTP)

Following the steps of Takele and Selassie (2018), the smallholder farmer has a decision (willingness) to use tractor services by paying for tractor hired services or not to use tractor services by not paying for hiring tractor services. The willingness decision to pay for agricultural services or non-market goods as suggested by early researchers is best elicited by the contingent valuation (CV) (Bateman et al. 1994; Reaves et al. 1999). The various methods of the contingent valuation (CV) methodologies proposed to elicit WTP include the open-ended (OE) and the close-ended (CE) approaches (Reaves et al. 1999). The criticism that traced the (OE) promoted further research into the several (CE) approaches such as the payment card (PC) and the dichotomous choice (DC) format. In what was seen to be a better substitute to the (OE), the payment card (PC) format allows the respondents to select a value from a pre-specified developed list (Kerr 2001). The (PC) approach gives guidance to the respondents but not able to holistically overcome starting point challenge, including difficulty in arriving at single mean value (Heinzen and Bridges 2008).

To find a more acceptable solution on how to elicit the WTP, Arrow et al. (1993) revised CV methodology and suggested the double-bounded format (referendum or dichotomous choice).

In the double-bounded format, questions are either demanded in a referendum or presented in

a dichotomous way. The double-bounded format is similar to the real market condition where a buyer is presented with the price of the value of the product/service and it is left for the individual to decide to purchase the product at that specific price or not. DC also has a positive motivational influence that stimulates the respondents to disclose willingness. The challenge of cognitive confronted by the respondents is reduced (Hoyos and Mariel 2010). Hence the DC was used to measure the WTP. The respondents were asked to indicate their interest if they were willing to pay X naira amount for tractor service per hectare. The question was accompanied by a follow-up question. If the smallholder answer was yes, then the respondent was asked the maximum amount he/she could pay for hired tractor services per hectare. If the respondent answer was no, he/she was then asked the minimum naira amount willing to pay for tractor services. A proposed hired tractor service price by the government was used as a benchmark for the question on willingness to pay for tractor services. A respondent who reported zero naira amounts was an indication that such respondent is not willing to pay for tractor services.

The Double Hurdle Model Analytical Framework for Investigating the Smallholders' WTP

Assuming that the probability of the smallholder farm firm *M* making a choice decision to pay for hired tractor services C_1 is the probability that the satisfaction *S* derived from using tractor service is positive, higher and greater; than the choice decision of not paying for hired tractor services C_0. If the farmer decides to pay for hired tractor services, the probability that the cumulative distribution function *F* estimated as $ßX_m$ is high and positive. The distribution function *F* is influenced by the random error term which follows a Bernoulli distribution with unknown probability, or normal distribution $ü= e_{1m} - e_{0m}$. The challenge is finding the relationship that exists between the variables if the farmer is willing to pay for tractor services C_1 and otherwise C_0 with the independent variables. Assuming that the smallholder choice decision *C* is a function of different specific challenges, *X* which include the household exogenous characteristics, (HH_C) and the area cultivated *AC*. The relationship that exists between any of the farmer's decision and the farmer's specific characteristics are expressed as:

$$C = f(HH_c, + AC, + e_{CM}) \ldots\ldots \ldots\ldots\ldots\ldots\ldots\ldots 1$$

Leaving the model in the form of ordinary least square OLS linear regression or its direct application will restrict the smallholder decision since it does not give room for the smallholder to make a choice decision. More so, since the outcome variable is a probability choice which ranges between 0 and 1, direct use of linear regression is not appropriate because the outcome of linear regression goes to plus-minus infinity. Hence, the application of OLS is not considered to be the best model (Greene 2003; Spermann 2009). Hence, to investigate the challenges that form the smallholder decision either to pay for hired tractor services C_1 or not to pay for hired tractor services C_0 based on the firms' specific characteristics could be explained by various economic models including binary model such as Double hurdle models (Patnaik and Sharma 2013). This alternative model to the OLS as used by Pohlman and Leitner (2003), Boughton et al. (2007), Chilundika (2011) and Reyes et al. (2012) is better fit, unbiased, consistent and efficient parameters in dichotomy variable.

The Double Hurdle which is also referred to as the two-part hurdle suggested that the smallholder decision is in two separate stages (Wooldridge 2010). Firstly, there must be an option or choice decision willingness to pay or not to pay for the hired tractor service . Secondly, there must be an option about the intensity or actual amount willing to pay for the use of tractor services (Osmani and Hossain 2015). The double-hurdle model follows the first steps of Probit model and nests (relaxes) the Tobit model by using the truncated model to relax the restrictive assumption of Tobit's model (Wooldridge 2010; Comola and de Mello 2011). The second stage of the double hurdle analyses the factors that affect the actual amount willing to pay for tractor using the truncated model. The double hurdle model is the best model for the analysis of WTP in contingent evaluation method as suggested and used by Fonta et al. (2010), Wooldridge (2010), Chilundika (2011) and Reyes et al. (2012). Therefore, the double hurdle model was used to analyse the smallholder willingness to pay for tractor services.

Assuming that the factors affecting the outcome of the smallholder choice decision under the influence of the random error term e_{CM} using the Probit model are derived from linear regression.

$$Y = \beta X_{MC} + e_{CM} \quad (2)$$

In equation 2, the dependent variable (Y) can be substituted for (WTP) as shown in equation 3. That is

$$Y = WTP_{c1c0} = \beta X_{MC} + e_{CM} \quad (3)$$

WTP_{c1c0} is a dichotomous dependent variable which is a probability function. Hence, moving away from the linear combination of the independent variables with the dummy variable, the inverse standard normal distribution of the probability dependent variable is modelled as a linear combination of the predictors.

Hence,

$$F(WTP_{c1c0}) = WTP_{c1c0}^{*} = \beta X_{MC} + e_{CM} \quad (4)$$

$F(WTP_{clc0})$ = probability function, and WTP_{clc0} is inverse probability of willingness to pay (WTP) that tends to infinity (-∞,∞), since WTP_{clc0} being a limited dependent variable.

$WTP_{c1c0} = 1$ if $WTP_{c1c0}^{*} \geq 1$

$WTP_{c1c0} = 1$ if $WTP_{c1c0}^{*} \leq 0$

Where -∞,∞ stands for tending to from 0 to minus infinity and 0 to plus infinity.

Since the dependent variable is a probability that the smallholder farm firm is willing to, or not to pay for tractor services, the linear combination of the independent variable that lies between minus infinity plus infinity for the Logit or Probit is given as

$$F(WTP_{c1c0}) = WTP_{c1c0}^{*} = F(\beta X_{mc}) + e_{CM} \quad (5)$$

Note that taking a non-linear function of the independent variable βX_{MC} as in equation 5, and since probability lies between 0 and 1, and not minus infinity to plus infinity, we have that the function of minus infinite is = 0 and the plus infinite is = 1. That is,

$F(-\infty) = 0$ and $F(+\infty) = 1$

Hence, the probability of the for the smallholder farm firm who is willing to pay for tractor services is given as

$$P(WTP_{c1}) = WTP_{c1}^{*} = 1/\beta X + e_{CM} \quad (6)$$

Assuming that the farm decision is not to pay for tractor service, the probability of the farmer's decision when derived from equation 5 can be expressed as

$$P(WTP_{c0}) = WTP_{c0}^{*} = 1\text{-}1/\beta X_{mo} + e_{CM} \quad (7)$$

Equation 8 is a typical example of a latent variable that follows the Bernoulli distribution (Logit model).

Hence, the likelihood function for the Logit model can be expressed as

$$P(WTP) = WTP_{c1c0}^{*} X = \left(F(\beta_{C0} + \beta_{C1})^{WTP_{C1C0}}\right)\left(1 - F(\beta_{C0} + \beta_{C1})^{1-WTP_{C1C0}}\right) \quad (8)$$

Where

WTP = the probability of WTP

WTP_{clc0} = The inverse probability function of that takes the value of 1 or 0 given X which stands for the independent variables that define the likelihood function.

Probit model follows the normal distribution function. Hence it is expressed as an integer of the normal distribution

$$F(WTP) = \int_{-\infty}^{WTP_{C1}} \theta(\beta X_{mc})du + e_{CM} \quad (9)$$

Where

$F(WTP)$ = the probability function of (WTP)

$\int_{-\infty}^{WTP_{C1}}$ The integer on minus infinity to maximum infinity of decision

$\theta(\beta X_{mc})du$ is the integration of the Cumulative Distribution Function CDF

X_{MC} is exogenous household characteristic, geographical location and others challenge influencing the smallholder's decision

β is the regression parameter coefficient

e_{CM} is the error term with mean zero and unit variance of unknown disturbance assuming there are different independent variables (X_{mc}..... X_n).

x_1 = gender of the household head (male= 1, 0 otherwise)

x_2 = Age of household head (continuous)

x_3 = Educational status (have formal Edu = 1, 0 otherwise)

x_4 = Marital status (Married =1, 0 otherwise)

x_5 = Household involvement (Used household member = 1, 0 otherwise)

x_6 = Farming experience (years) (continuous)

x_7 = Other occupation (Involved in another occupation as sources of income=1, 0 otherwise)

x_8 = Area cultivated (Hectare)

x_9 = Expenditure (Naira)

x_{10} = Location of the farmer (Delta =1, 0 otherwise).

The researchers carried out a collinearity diagnostic test to identify the variables that had high collinearity with other covariates. The Variance Inflation Factor (VIF) and pairwise Pearson correlation coefficients were used. Since collinear-

ity commonly occurred in socio-economic research (Gujurat and Porter 2009). The researchers dropped the variable that was collineared with other variables to ensure that the outcome of the result was BLUE and that the confidence interval is not wider than it should be. One variable that was removed due to collinearity was income, which was highly correlated to expenditure.

RESULTS AND DISCUSSION

The section presents the results and discussion of the study. The smallholders' WTP for tractor services, factors that affect their WTP and the actual amount willing to pay for tractor services are discussed under this section.

Description of the Number of Smallholders Willing to Pay for Hire Tractor Services

One of the reasons early mechanisation programmes failed in many African countries was attributed to the lack of desire by the majority of the farmers to use tractor services. However, the result revealed that the majority of the smallholder household heads in the study area were not only willing to use the tractor but also desirous to pay for hired tractor services. This result is in contrast with the findings of Bishop-Sambrook (2005). However, it agrees with the findings of Takeshima et al. (2015) which stated that there was a high demand for tractor services by smallholder farmers. The result expressed that there is current prospective growth and patronage of hired tractor service business in Delta and Benue States. However, the distribution of the smallholder farmers' WTP for tractor services in Table 1 shows that Benue State has the highest numbers of smallholders reported positive WTP. In other words, Benue State recorded either fewer protests or true zero bid than Delta State. This means that the willingness to pay for mechanization services varies from place to place. This could be attributed to the farming practices of the farmers in a particular location. It could also be attributed to the determination of the smallholders in an area to use improved implements.

The Mean Amount in Naira (₦) of WTP for the Tractor in the Study Areas

The ability to estimate the WTP for a product enables the producer or the service provider to know the best price the larger proportion of the consumers or the clients are determined to accept the product (Marine 2009). Table 2 shows the mean amount of money the respondents were willing to pay for tractor services. The mean WTP for tractor services, excluding the farmers with zero WTP for tractor services is ₦12706. Hence, policymakers, government, cooperatives and individuals wanting to go into the business of tractor services, should consider pegging their price for ploughing a hectare around ₦12706 for the smallholders.

With the mean WTP tractor services at ₦12706, and the price of hiring a government tractor in Benue State being ₦12000, the payment for tractor services should not be a problem for the average smallholder farmer in Benue State who is willing to use tractor services, provided the government tractor service providers do not charge additional money through corruption and if the cost of fuel consumption by the tractor is not passed on to the farmers. This is because the average cost of using human power (labour) to plough a hectare of land for those who use hired labour is ₦15000. With references to the minimum amount of money paid for government hire tractor services in Delta State, excluding the cost of diesel charged is ₦15000. This means that the average smallholder farmer may be unwilling to hired tractor services since the 15000 naira is higher than the 12706 naira willingness to pay by smallholders who indicated an interest in the use of tractor services for their farm. The price variation in the

Table 1: The frequency distribution of the smallholder willingness to pay for tractor services

	All respondents		*Delta State*		*Benue State*	
WTP distribution	*Frequency*	*Percentage*	*Frequency*	*Percentage*	*Frequency*	*Percentage*
Not willing to pay	17	6	11	8	6	4
Willing to pay	263	94	129	92	134	96
Total	280	100	140	100	140	100

Table 2: Mean description of the smallholders' willingness to pay for tractor service

Variables	*NUM*	*Min (₦/Ha) plough*	*Max (₦/Ha) plough*	*Mean (₦/Ha) plough*	*Std dev plough*
WTP for positive response	263	7500	18 800	12706	3174
WTP for positive response Delta	129	8000	18800	13818	2995
WTP for positive response Benue	134	7500	17000	11477	2564

amount the smallholders are willing to pay for hired tractor services in Delta and Benue States and the amount they paid for hired labour is contrary to the report of Takeshima et al. (2013) which stated that the smallholder farmers in Nigeria demand hired tractor service at any price if available.

The result in Table 2 also indicates that the smallholder farmers in Delta State were willing to pay higher prices for tractor services when compared to their Benue state counterparts. Thus, a tractor service provider driven by the high price of hiring out tractor services should focus on Delta State where there may be higher payment for rendering tractor service per a hectare plough. One reason the WTP for tractor services is higher in Delta State could be attributed to the fact that there are less tractor service providers in Delta State than in Benue State.

The difference between the minimum amounts the respondents in the two states were willing to pay for ploughing a hectare is ₦500. However, there is a large difference (₦1800) of the highest WTP in Delta State and that of Benue State. Again, this shows that some of the smallholder farmers in Delta State were willing to pay a premium price for hiring tractor services than their Benue State counterparts. It should be noted that though the WTP for tractor services in Delta State looks more attractive, the proportion of the smallholder farmers who were willing to pay for tractor services were fewer in Delta State as compared to Benue State.

Actual Numbers of Household Who Use the Tractor Versus Those with a Positive Response to WTP for Tractor Services

As shown in Table 3, there were more respondents with positive willingness to pay for tractor services than those who used the tractor services. This is an indication that various challenges limit the majority of the smallholder farmers who desire to use the tractor services.

Table 3: Households with positive WTP and those actually using the tractor

States	*A household with positive WTP response*	*The household currently using tractor services*
Delta	129	27
Benue	139	52
Total	263	79

Factors Affecting WTP for Tractor Service Decision

Again, the smallholder' WTP is measured using the choice decision of the contingent evaluation method. That is, "Yes", if the smallholder is willing to pay X amount of naira for tractor services and "No", if otherwise, with a follow-up question of the actual amount the respondent is willing to pay for tractor services. The smallholder who was not willing to pay for hire tractor services recorded zero amounts in Naira. It was then analysed using the probit regression model of the Double Hurdle. Knowing the various factors, including the socioeconomic characteristics of the respondents, that explain the smallholders' WTP allows for strategic planning on how to address those factors (Marine 2009). The estimation results are presented in Table 4. Among the variables fitted in the model, gender, education type, marital status, the household head involvement in another occupation and farming experience were not significant to the smallholders' WTP for tractor services. The educational status not being significant is contrary to expectation and the findings of Takele et al. (2018) which reported that the smallholders' educational status influenced their willingness to pay for a two-wheeled tractor. The educational status not influencing the smallholders' WTP could be attributed to the fact that education does not determine farming activities in the study area. However, the results showed

that the age of the household head, total area cultivated and location significantly associated with smallholders' WTP for tractor services.

The willingness to pay for tractor services is associated with the age of the smallholder household head. As the smallholder farmers get older by one year, the less likely they are willing to pay for tractor services. While the Probit result estimates the probability of the independent variable and the coefficient as the z-value of the normal distribution, the marginal effect estimates the actual latent change (Williams 2018). The marginal result in Table 5 indicates that with the addition of one year of age, the smallholder willingness to pay for tractor services decreased by-. 0054. The result could be explained that as the smallholder farmers get older, the less likely they will be interested in the commercialization of their farm; consequently, the less likely they will be willing to pay for the use of the tractor that could expand their production due to the use of modernise implements.

The area cultivated has a negative significant association with the smallholder WTP for tractor services at the 1 percent significance level. This outcome is similar to the research of Takele and Selassie (2018). The negative sign of the coefficient could be attributed to the fact that though the farmers were willing to pay for the tractor, the areas cultivated which they wanted to use the tractor for were relatively small. For example, out of the 280 respondents sampled; 131 of them cultivate less than 2 hectares. In other words, some of the smallholders who cultivated less than 2 hectares were still willing to pay for tractor services which may not be economically viable.

The location of the farmer has the likelihood of affecting the smallholder willingness to pay for tractor services. This could be attributed to the availability of alternative labour for the small-

Table 4: Estimation of the factors affecting WTP using the Probit model (first hurdle)

Explanatory variables	*Coeffi-cient*	*Std. Err*	*Z*	*P>|T|*	*95%*	*Conf interval*
Gender of the household head	-.15	.39	-0.40	0.69	-.91	.60
Age of household head	-.06	.04	-1.86	0.06*	-.14	.00
Type education (dummy	.21	.45	0.46	0.65	-.68	1.09
Marital status	.25	.39	0.64	0.52	-.511	1.00
Use of household member	.97	. 1.44	0.67	0.50	-1.85	3.78
Farming experience (years)	-.03	.02	-1.24	0.21	-.07	.02
Involvement in other occupation	-.45	.39	-1.15	0.25	-1.22	.32
The area cultivated	-.47	.15	-3.11	0.00***	-.76	-.17
Expenditure	.00	.00	1.29	0.19	-.00	.00
Location	.98	.52	1.89	0.06*	-.04	2.00
Cons	4.59	2.71	1.70	0.09	-.71	9.89

Where *** and * are significant at the 1% and 5% levels respectively: STD Error is the standard error. Number of observations =280, LR chi2 (10) = 47.56, Prob> chi2 =0.000, Pseudo R^2 = 0.3710 and Log likelihood = -40.321.

Table 5: Marginal estimated using the Probit model

Explanatory variables	*Coeffi-cient*	*Std. Err*	*Z*	*P>|T|*	*95%*	*Conf interval*
Gender of the household head	-.01	.0301	-0.40	0.691	-.0710	.0471
Age of household head	-.00	.00	-1.89	0.06*	-.01	.00
Educational status (dummy)	.02	.04	0.46	0.64	-.02	.08
Marital status	.02	.03	0.64	0.52	-.01	.06
Use of household member	.08	.11	0.68	0.49	-.14	.29
Farming experience (years)	-.00	.00	-1.24	0.21	-.01	.00
Other occupation	-.03	.03	-1.16	0.24	-.09	.02
Area cultivated	-.04	.011	-3.26	0.00***	-.06	-.01
Expenditure	3.00	2.00	1.29	0.19	-1.00	9.00
Location	.08	.04	1.91	0.06*	-.00	.16

Where, *** and * are significant at the 1%, and 10% levels respectively

holder farmer. This could also be attributed to the location of the tractor service provider, especially since the majority of the tractor service providers lived far away from the majority of the smallholders. The farther the location of the tractor service provider from the farmers, the less likely the farmers are willing to pay for tractor services. Table 4 indicates that the smallholders in Delta State were more likely to show the willingness to pay a premium price for tractor services. The possible reason the farming household heads in Delta State were more likely willing to pay a premium for tractor services compared to their Benue State counterparts could also be attributed to the level of commercialisation in Delta State.

Factors Affecting the Actual Amount Willing to Pay for Tractor Services Using Truncated Regression

The truncation regression is the second step of the Craigs' double hurdle model. The truncated regression analyses the factors that affect the intensity of WTP upon the decision to pay for tractor services. To investigate the factor influencing the actual amount of money the smallholder is willing to pay, the 280 respondents were truncated to 263 respondents. This means that a total of 263 respondents fitted in the truncated regression model of respondents who had a positive WTP for tractor service.

The truncated regression results in Table 6 reveal that expenditure and location affect the intensity of willingness to pay for tractor services. This result suggests that the factors affecting the willingness to pay are dissimilar to the factors affecting the intensity to pay. This result is comparable to the findings of Reyes et al. (2012), who reported that factors affecting the first hurdle (Probit) and second hurdle (truncated model) are not uniform.

The smallholder household head's expenditure is associated with the actual amount of money willing to pay for tractor usage per hectare at a 1 percent significance level. If the expenditure on tractor services increase by 0.01 naira per hectare, there is the likelihood that the smallholder farmers were still willing to pay for a tractor hired service. Hence, efforts should be made to ensure that hired tractor services are available to smallholder rather than considering if they will be willing to pay for tractor services.

Upon the decision to pay for tractor services, Table 7 indicates that farmers in delta state are less likely to pay additional money per hectare for hire tractor services. That is, the location of the smallholder farmers determines the amount of money willing to be paid to use tractor services. This could be as a result of the forces of demand and supply. For example, if the number of the smallholders who are willing to pay for hire tractor services in a location is small, they may not be willing to increase the amount of money willing to pay for tractor services especially when supply outweighs the demand. In some condition, if

Table 6: Estimation of factors affecting the actual amount of money (₦) willing to pay for tractor services using truncated regression (second hurdle)

Explanatory variables	*Coefficient*	*Std. Err*	*Z*	*P>|T|*	*95%*	*Conf interval*
Gender of the HH head	-452.68	335.82	-1.35	0.18	-1110.89	205.53
Age of household head	-25.49	26.48	-0.96	0.34	-77.396	26.41
Educational status	599.91	485.87	1.23	0.22	-352.37	1552.20
Marital status	-438.74	501.55	-0.87	0.38	-1421.75	544.27
Household involvement	493.67	1173.59	0.42	0.67	-1806.53	2793.88
Farming experience (years)	-23.09	20.94	-1.10	0.27	-64.14	17.95
Other occupation	-477.67	383.14	-1.25	0.21	-1228.60	273.27
Area cultivated	-40.35	141.75	-0.28	0.78	-318.16	237.48
Expenditure	.01	.00	2.55	0.02**	.00	.02
Location	-2372.90	444.55	-5.34	0.00***	-3244.20	-1501.60
Cons	17666.55	1927.90	9.16	0.00	13887.94	21445.17
Sigma	2559.01	111.65	22.92	0.00	2340.19	2777.84

Where *** and ** are significant at the 1% and 5% levels respectively; STD Error is the standard error. Number of observations =263, Wald chi2 (10) 100.80, Prob> chi2 =0.000, and Log likelihood = -2437.02. Lower limit = 0.

Table 7: Marginal estimate factors affecting the actual amount of money (₦)willing to pay for tractor services for the second hurdle

Explanatory variables	*Coeffi-cient*	*Std. Err*	*Z*	*P>|T|*	*95%*	*Conf interval*
Gender of the household head	-440.11	-440.11	-1.30	0.19	-1101.66	221.43
Age of household head	-22.63	26.98	-0.84	0.40	-75.50	30.25
Educational status (dummy)	52.41	49.85	1.05	0.29	-45.30	150.12
Marital status	-443.92	503.01	-0.88	0.37	-1429.80	541.96
Use of household member	660.05	1183.31	0.56	0.57	-1659.19	2979.30
Farming experience (years)	-24.15	20.89	-1.16	0.25	-65.10	16.81
Other occupation	-475.63	384.09	-1.24	0.22	-1228.45	277.19
Area cultivated	-61.75	144.29	-0.43	0.67	-344.55	221.06
Expenditure	.00	.00	2.36	0.02**	.00	.01
Location	-2460.33	439.89	-5.59	0.00***	-3322.52	-16

Where *** and ** are significant at 1% and 5% levels respectively

the tractor service provider is far away from the smallholder farmer, the less likely the smallholder farmer will be willing to pay a huge sum of money for hire tractor services irrespective of furthers cost that would have been incurred by the tractor service provider. These costs could either be additional expenditure from long distance to the location of the farm, or cost of hiring someone to remove stumps from the field. Again, this result could also be attributed to the size of the land available. For example, if the arable land available in a location is such that is not big enough for the smallholder household head to increase area cultivated, he/she may not be willing to pay more to use tractor services if the issue of economy of scale arises. More so, if there is no profitable output market for the smallholder farming household head in a location, he/she may not be disposed to increase the intensity of payment for tractor services.

CONCLUSION

The paper investigated the smallholders' WTP for hire tractor services, factors that affect the WTP and the amount they are willing to pay in the study area. The study found that smallholder farmers are willing to pay for hire tractor services. Unlike early mechanization programmes in many Africa countries that failed as a result of lack of demand, the current situation is that the majority (94%) of the smallholder farmers is willing to pay for hire tractor services. Therefore, entrepreneurs are encouraged to invest in the business of hired tractor services particularly in the study area because there is a high prospect of growth for the business of hired tractor services since the majority of smallholder farmers are willing to pay their services. Older people are less willing to pay for hire tractor services, probably because of their unwillingness to change their old ways of farming or due to loss of interest to expand, which could have risen from being aged. The area cultivated plays a key role in the smallholders' WTP and the location of the smallholders is one major factor that determined their WTP for tractor services.

RECOMMENDATIONS

It is recommended that the government should create an atmosphere that will allow sustainable mechanization hired services of business-oriented venture driven by the SME for the smallholders.

An intended investor who is willing to go into the business of SME tractor services should focus more on the young smallholder farmers and those in their middle age because older smallholder farmers are less likely willing to pay for tractor services.

The smallholder farmers should be encouraged to increase the area cultivated by making more land available to them or they should form a cooperative that may likely increase the area cultivated since the area cultivated affect their decision to pay for tractor services.

Tractor services business should be located closer to the smallholder farmers, rather than locating their offices in the city while expecting the smallholder farmers to go to the city for their ser-

vices. More so, a feasibility study should be done in any location before the establishment of tractor services by to-be SME tractor service provider.

To ensure that the smallholder farmers expand the use of tractor services on their farm, tractor services should be made available to them.

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