Socio-Economic Factors Influencing Smallholder Farmers Agricultural Infrastructure Availability, Accessibility and Satisfaction: A Case on North West Province in South Africa

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Abstract: The study investigated the socio-economic factors contributing to smallholder farmers' availability, accessibility and satisfaction of agricultural infrastructure. Using cross sectional data from the North West Province of South Africa. One hundred and fifty smallholder farmers, were selected using the stratified sampling to group the farmers to those had agricultural infrastructure and to those that did not have agricultural infrastructure. The data was coded, captured and analysed using STATA 14.0, the methods used to analyse the data were descriptive analyses and Tobit Regression Models.The results of the Tobit Regression Model showed, among other factors influencing availability of agricultural infrastructure, the following variables played a critical role; household members' assistance in farming enterprise; farm ownership; farm acquisition; farmer Occupation; member of farmer organisations; sources of labour and farming experience and agricultural production inputs. In terms of agricultural infrastructure accessibility, the following variables played a critical role; engage in non-farming activities; contact to extension services; farm ownership; farmer occupation; member of farmer organisations; sources of labour; farming experience and land tenure. In terms of satisfaction with agricultural infrastructure, among other factors influencing satisfaction with agricultural infrastructure, the following variables played a critical role; organisation for extension services; household members' assistance in farming enterprise; farmer receives government agricultural support; farm ownership; member of farmer organisations; farmer age; education level; marital status and gender. The results from the analysis were used to close the gap of knowledge on the impact of agricultural infrastructure, availability, accessibility and satisfaction on the productivity and agricultural income of smallholder farmers in the North West Province.

Keywords: Agricultural infrastructure, availability, accessibility, satisfaction**,** agricultural income, agricultural production.

Introduction

Agriculture plays important role in the economic development of South Africa as it contributes to the GDP, employment, rural development, food security and has backward and forward linkage. In productivity of the agricultural sector, infrastructure plays an important role. The importance of good infrastructure for agricultural development is recognised (Anderson &Shimokawa, 2006). Furthermore, agricultural infrastructure plays a crucial role in the reduction of poverty. According to PCU-NFDO(2005), when looking at the role played by infrastructure, one can compare to secondary and tertiary arteries of the body system and because they are important as the main arteries for blood circulation.

Development of infrastructure is a challenge for smallholder farmers and is not only limited to on-farm infrastructure, but also off-farm infrastructure such as roads can serve as a barrier for smallholder farmers access to markets. Smallholder farmers lack of availability and accessibility to infrastructure such as abattoirs, storage, processing facilities and trading facilities contribute as a barrier for smallholder farmers market participation.

According to Nadeem (2013), in undeveloped countries, agricultural productivity that comes from public investment in research, extension, human capital and infrastructure is important, predominantly when there are weakening factor returns and expansion of cultivated land is constrained. In agricultural investment in social, institutional and physical infrastructure is important in enhancing agricultural productivity, increasing agricultural income and reducing poverty. According to Fan et al. (2002) the government of China's expenditure on production-enhancing investments has contributed to agricultural yield growth, and has reduced regional inequality and rural poverty in China. , China's product-enhancing investments was on activities such as agricultural research and development (R&D), irrigation, rural education, and infrastructure (including roads, electricity, and telecommunications) (Fan et al, 2002).

Improving agricultural infrastructure is central to the challenge of ensuring that South Africa's agricultural sector is economically competitive, while contributing optimally to national food self-sufficiency, job creation and household food security. Infrastructure can narrow the gap between the prices that farmers earn and the price consumers pay, which is good for both producers' profitability and households trying to buy adequate food or building material. Furthermore, infrastructure is essential for realising agrarian reform, in particular by decentralising and de-concentrating agro-processing capacity so that market structure is more favourable, and promoting local food economies and vibrant communities. Most of the current agricultural infrastructure in South Africa is inaccessible to smallholder farmers by either being too far from their lands, too costly or lack of knowledge about the infrastructure. Agricultural initiatives for planting field crops and livestock farming will not succeed without adequate infrastructure, markets and efficient market. Agricultural infrastructure is central to smallholder farmers' own empowerment to encourage and promote surplus production.

According to National Emergent Red Meat Producers Organization (NERPO) (2004), the shortage of access to equipment such as loading ramps and sale pens in South Africa are some of the factors that affect small-scale farmers' ability to market their cattle. Musemwa (2008) states that the lack of infrastructure can seriously delay the development initiatives in rural areas. Ruijs, Schweigman and Lutz (2004) advised that, if farmers can invest in infrastructure their development and productivity level will greatly increase. Lack of marketing facilities imposes a serious constraint on the marketing (Musemwa, 2008). The South African government has since 1994 undertaken several agricultural infrastructural programmes with all of them aiming at improving the smallholder farmer agricultural productivity and income. However, the impact of such infrastructure on productivity of smallholder farmers has not been assessed, more particularly in the North West province. Again there is a scarcity of similar studies in South Africa as a whole. Although government has a number of programmes to develop smallholder farmers with infrastructure investments through programmes such as CASP, *Ilima* and Recapitalisation and development program, there is very limited literature in South Africa on the impact of infrastructure on agricultural productivity, smallholder and emerging farmers, particularly, in the North West Province. The existing literature furthermore, does not cover farmers funded through CASP, *Ilima*and Recapitalisation and Development Programme. This study is intended to fill in the gap in the literature by analysing the impact of agricultural infrastructure on the productivity and income of smallholder and emerging farmers. The further intends analyse the factors contributing to agricultural infrastructure, availability, accessibility and farmers' satisfaction with agricultural infrastructure.

Financing agricultural infrastructure development

A major factor of competitiveness that plays a role in agricultural value chains is farmers having access to affordable physical infrastructure (Warner et al., 2008). Examples of such infrastructure is irrigation, energy, transportation, pre- and post-harvest storage, telecommunications, covered markets, agro processing and packaging facilities, as well as bulk storage (Warner et al., 2008).Therefore infrastructures needs financial investment from different stakeholders (Warner et al., 2008). Financial investments can come from commercial banks, agricultural development banks, non-governmental organizations (NGOs), cooperatives or investors, in the case of equity finance (Warner et al., 2008).

Infrastructure investment in Africa

Infrastructure is one of the main pillars of economic transformation (Economic Commission of Africa, 2013). According to the United Nations Human Settlement Programme (2011:2), the absence of adequate infrastructure hinders economy development and efforts aimed at reducing poverty in Africa. Identifying infrastructure gaps, and the appropriate responses to these gaps, is critical in overcoming development challenges (UN-NEPAD-OECD Africa policy briefs, 2010:1). According to the Economic Commission of Africa (2013), there is evidence that inequality within a society is reduced when there is meaningful infrastructure. This is because sustainable economic growth often occurs in an environment where there is a meaningful infrastructure (Economic Commission of Africa,

2013).. Infrastructure can play an important catalytic role in promoting growth and development in Africa, most specifically promoting growth in agriculture. According to Luiz (2010:515), bottlenecks in African infrastructure have affected its international competitiveness, the cost of doing business, impeded foreign direct investment (FDI) and trade, and retarded its overall economic performance. The poor have been negatively impacted by poor infrastructure which is affecting their ability to access resources such as healthcare, education, and jobs. (Luiz, 2010:515).

Poor infrastructure also affects small-scale farmers' ability to compete in the agricultural market. This is because the farmers do not have access to markets and to basic services that they need in order to compete in the agricultural markets (Economic Commission of Africa, 2013). Development of rural infrastructure (such as: energy, transport, water, ICT, and storage facilities normally contributes significantly to the level and quality of rural development (Economic Commission of Africa, 2013). A major basis of competitiveness in agricultural value chains is access to inexpensive physical infrastructure (Warner & Kahan, 2008: 1). "This includes infrastructure that: supports on-farm production (e.g. irrigation, energy, transportation, pre-and post-harvest storage), ensures efficient trading and exchange (e.g. tele-communications, covered markets), adds value to the domestic economy (e.g. agro-processing and packaging facilities), and enables produce to move rapidly and efficiently from farm-gate to processing facilities and on to wholesalers (e.g. transportation and bulk storage)" (Warner & Kahan, 2008:1).

According to the Economic Commission of Africa (2013), there is evidence that countries with developed rural infrastructure have a higher and better quality of rural infrastructure. With better rural infrastructure people are able to participate in and share the benefits of wider economic growth (Economic Commission of Africa, 2013). This is what the South Africa should also strive towards achieving. People in rural areas are still unable to fully participate in the growth of the country's economy. Instead most rural people expect free services from government; this is what is generally known as the dependency syndrome. Infrastructure plays a huge role in inclusive rural development and high quality rural infrastructure plays a huge role in the quality of life of the rural population (Economic Commission of Africa, 2013).

Limited investment in African agriculture is a key constraint on its production expansion. Domestic Investment in agriculture is often hindered by the limited availability of domestic savings and by heavy reliance on aid funding in most African countries(Cai and Newth, 2015:167). Most African governments spend less than 10 per cent of their public budgets on agriculture (Cleaver, 2012). Therefore , have supplementary agricultural investment financing through domestic sources alone is difficult and also not very strategic (Brzeska et al., 2012). Investing in rural infrastructure in Africa provides the opportunity for rural people to have access to markets and the basic services that they need (Economic Commission of Africa, 2013). Access to markets for small-scale farmers is very important, as it is only through markets that they can generate income from their farms.

The producers and consumers need to be in the same location as the infrastructure facilities, for infrastructure to make a significant impact and promote growth (Ngcobo, 2012:26). Having access to different types of infrastructure often results in integrated economic activities, improved production, consumption and competitiveness (Development Bank of Southern Africa, 2006). It is for this reason that government needs to invest more in agriculture for rural and agricultural development and for the alleviation of poverty.

Study area and data

The study was conducted in the North West Province. According to Stats SA (2012) there are approximately 911 120 households in the North West Province. The North West Province produces a third of the country's maize and makes a contribution to the supply of other agricultural products such as livestock, tobacco, sunflower oil, cotton and wheat. Agriculture in the eastern parts of the province mainly focuses on field crops and livestock. The semi-arid central and western parts are more focused on livestock and game farming. The province has a well-developed commercial agricultural sector, while subsistence farming is a very prominent activity in the communal areas. Field crops and livestock are the foremost contributors towards gross farm income in all districts of the province. In terms of the major field and fodder crops produced in the North West Province, maize (for the purpose of grain or silage) and sunflower combined earn a 91.7% share in terms of total physical output of these crops. The other major field and fodder crops making a meaningful contribution include wheat, groundnuts and Lucerne. The researcher, utilized a structured questionnaire, which enabled him to quantify and numerically present the responses of the sampled participants and conduct statistical analysis. The research used stratified sampling to group farmers that had agricultural infrastructure available and those that do not have infrastructure available. The farmers were mainly divided to those receiving infrastructure support from government and those that do not received agricultural infrastructure support from government.

The econometric model

1.1. Descriptive analysis

Descriptive analyses such as tables, through frequencies and percentages to analyse the personal and socio-economic characteristics of smallholder farmers in the study area. This was also considered for other variables of the study, which could be addressed through descriptive analysis.

1.2. Tobit Regression Models

The Tobit Regression Models were used, this was to assess the main factors influencing agricultural infrastructure availability, accessibility and satisfaction for smallholder farmers in the study area.

1.2.1. Tobit Regression Models for availability, accessibility and satisfaction of agricultural infrastructure

The researcher used the Tobit regression models to examine the main factors influencing agricultural infrastructure availability, accessibility and satisfaction in the study area, for smallholder farmers. The nature of the dependent variable determines the econometric model used. The tobit model is appropriate in this study, since the dependent variable is the availability index, accessibility index and satisfaction index. In this study, the availability index is the dependent variable and is lower censored at zero and upper censored at one. Smallholder farmers who do not have agricultural infrastructure available have a 0 value of dependent variable. Tobit model is the most common censored regression model appropriate for analysing dependent variables with upper or lower limits (Rockneck, 1992 and Tobin, 1958). Tobit model answers both the question on factors influencing a decision and the factors that determine such a decision. The Tobit model was used to quantify the magnitude and direction of the availability of agricultural infrastructure. Generally, the tobit model uses Maximum Likelihood Estimation (MLE) method to estimate the parameters assuming normality and homoscedasticity conditions. The Tobit model introduced by the Nobel laureate economist James Tobin in 1958 can be used when the dependent variable in a regression model equation has a lower and upper limit. In general, Tobit is specified like Ordinary Least Squares (OLS), with a dependent variable and a list of independent variables as in Equation 19. According to Greene (2003), the general formulation of the censored (tobit) is an index function shown below.

The Tobit model is specified as:

$$Y_i* = \beta_1 + \beta_2 X_i + \varepsilon_i \quad (1)$$

In this equation, X_i is the vector of causal variables, and ε_i is a normally distributed error term. Additionally, a truncation in the normal distribution is made at some threshold value that is often set at zero. In such a case, the model specification is given by:

$$y_i = \begin{cases} y_i^* & if \ \ y_i^* > 0 \\ 0 & if \ \ y_i^* \leq 0 \end{cases} \quad (2)$$

Where Y_i is the dependent variable that is only observed or only exists when the latent or unobservable variable Y_i* is greater than zero. Tobit can also be used to model dependent variables where the cut-off value is different from zero, or where observations with large values are those not observed (Dinarte, 2009).

Tobit model parameters do not directly correspond to changes in the dependent variable brought about by changes in independent variables. The coefficients on the agricultural infrastructure availability due to changes in the explanatory variable is given as follows:

$$\frac{\partial \in \left[\frac{y_i}{x_i}\right]}{(\partial x_i)} = \beta \emptyset \left[\frac{\beta x_i}{\sigma}\right] \quad (3)$$

The coefficients as well as Maximum Likelihood Estimates were done through Tobit model using STATA computer software. The marginal effects/ coefficients indicate the (availability, accessibility and satisfaction) index resulting from a unit change in the independent variables. The coefficients also account for the availability, accessibility and availabilityof agricultural infrastructure. A Tobit model provides a single coefficient for each independent variable despite two distinct types of dependent variables (censored and uncensored). Hence, the interpretation of coefficients in Tobit model differs substantially from the interpretation of an OLS regression. A coefficient represents the effect of an independent variable on the dependent variable in an OLS analysis, because the coefficient is the first order partial derivative of the independent variable. The OLS interpretation is not valid for Tobit coefficients because the Tobit coefficients represent the effects of the independent variables on the latent variables of the Tobit model.

Infrastructural index and its correlates

Principal Components Analysis (PCA) was used to compute composite indices of availability of infrastructure, accessibility and satisfaction from the different infrastructure in terms of physical, institutional, social and equipment infrastructure. This approach helped to capture the different dimensions of agricultural infrastructure (availability, accessibility) and that farmers were satisfied with in a composite manner bearing in mind the likely correlation that could exist in some types of agricultural infrastructure. The selection of indicators was guided by insights drawn from the literature on agricultural infrastructure as well as availability of data. All the major dimensions of agricultural infrastructure have been represented by at least one indicator. Following the identification of the indicators as explained above, PCA was employed. PCA is a data reduction method used to re-express multivariate data in fewer dimensions. The procedure transforms selected indicators into smaller components that capture most of the information (variation) in the original indicators. A detailed account of the use of PCA for constructing socio-economic status indices has been outlined in Vyas and Kumaranayake (2006).

Application of PCA on the selected indicators would yield a series of components with the first component explaining the largest variance in the data and subsequent components explaining additional but smaller proportions of the variance in the original variables. Using the factor scores from the first principal component as availability of infrastructure, accessibility and satisfaction, a dependent variable can then be constructed for each of the infrastructure groups for smallholder farmers, which has a zero-mean and variance equal to one. Accordingly, the dependent variables (PCA-based on availability index, accessibility index and satisfaction index) was generated.

The variables selected for constructing the availability index, accessibility index and satisfaction index were the agricultural infrastructure categories stated in the questionnaire, which were coded as 1 if yes and 0 otherwise. These major infrastructure groups were in accordance with the literature on agricultural infrastructure and agricultural infrastructure in South Africa, physical, social, institutional and equipment infrastructure. In order to STATA software was used to provide a simple measure of the aggregation of the agricultural infrastructure index, PCA, after which same STATA command was used to predict availability index, accessibility index and satisfaction index used in the study. Following Rahman (2009), the indexes were computed.

Results and Discussion

Demographic and socio-economic characteristics of the farmers

Table 6.1 below presents the descriptive statistics (i.e. frequencies and percentages) for discrete demographic variables that were investigated and reported on by the sampled smallholder farmer participants of this research. According to Polit and Beck (2004), demographic characteristic profile in an empirical study establishes the biographical parameters of the sampled participant group. Polit and Beck (2004) further add that demographic particulars elicited from participants in both quantitative and qualitative empirical research are nearly identical in most dissertations and theses, which means that empirical research regarding this aspect of research as important in determining personal, social, economic, political, and educational profiles of sampled participants with a view of generalizing for the whole population under investigation.

Analysis of smallholder farmers' demographic and socio-economic characteristics

The socio-economic and personal characteristics of smallholder farmers in the North West Province are presented in Table 6.1. According to Makhura (2001), these characteristics are important because the key household activities are coordinated by the household head and the head's decisions are most likely to be influenced by such demographic characteristics. The results show that majority (65%) of the farmers were male while 35% were female, 61% were married, 81% were Christians and 43% had no formal education. Most of the respondents (59%) aged from 41 to 60

years of age and 70% had contact to extension service, while 45% had contact to extension service only occasionally. The respondents did not engage in non-farming activities (57%), those engaged in non-farming activities (43%) were engaged in construction projects (13%). Majority (59%) of the farmers had less than 10 years farming experience, 57% of the farmers had a household size of ≤ 5 members and with at least (41%) one household member assisting in the day to day farming activities. Most of the farmers are fulltime farmers (57%), with majority (74%) of the farmers not having organisational membership while 17% of them were members of African Farmers Association of South Africa (AFASA).

Interpretation of smallholder farmers' demographic and socio-economic characteristics (N=150)

The analysis above reveals that, participation of women in smallholder farming still remains a challenge in the North West Province. This could be the result of sampled farmers' households consisting of more males than females. All though all things are equal this finding is consistent with a that of Antwi and Nxumalo (2014), that agriculture is mostly for males and women are expected to perform domestic activities in the household. Smallholder farmers in the North West Province are aged from 41 to 60 years, which is indicative of a paucity of involvement of youth in smallholder farming agricultural activities in the Province. This finding is consistent with that of Anyanwu (1992), that indicated the younger men have no interest in agricultural activities. Smallholder farmers do not have a strong education background with the majority of them having no formal education, which could limit in their adaptation to new farming agricultural innovations and agricultural infrastructure. Thus, is consistent with Montshwe (2006), that people with higher education level are abler to interpret information. This is worrisome factor if any progressive development of rural smallholder farming agriculture is to be promoted in rural areas of the North West Province. Smallholder farmers have to use self-labour in their farming activities. This, again, is a worrisome factor in the progressive development of smallholder farming agriculture. This revelation could be linked to labour costs which have risen in the previous years and children being statutorily compelled to be at school during the day. This revelation is also in line with that of Harding et al.., (2005) who highlighted insufficient family labour as a production constraint of smallholder farmers (e.g. agricultural production of various types and requirements and off farm activities). This has resulted in poor management due to labour shortages resulting in straying animals, loos through theft, poor maintenance of agricultural infrastructure and poor handling of production.

Table 6.1: Socio-economic characteristics (N=150)

Variables	**N**	**%**	Mean	SD	Min	Max
Gender	97	65	1.353	0.4796	1	2
Engagement in non-farming activities	65	43	1.56	0.507	1	2
Organisational membership	39	26	1.74	0.440	1	2
Contact to extension services	105	70	1.3	0.459	1	2
Continuous variables	**N**	**%**	Mean	SD	Min	Max
Age	88	59	54.507	11.131	30	79
Education level	65	43	2.52	0.775	1	4
Marital status	91	61	2.253	0.9496	1	6
Religion	121	81	1.74	1.569	1	5
Name of Organisation	25	17	1.1667	1.439	1	4
Number of contacts to extension	67	45	2.073	0.844	1	3
Non-farming activities	85	57	1.073	1.493	0	5
Number of years farming	89	59	9.467	4.515	3	20
Household members' assistance farming	62	41	1.507	1.067	0	8

Source: Data Survey, Where: SD=Data survey and N=Frequency

Smallholder farmers' availability and accessibility to agricultural infrastructure

High transaction costs are one of the major factors constraining growth of smallholder agriculture in African countries and this can largely be attributed to poor infrastructure (Chaminuka et al, 2006 & NEPAD, 2002). The table below presents the availability and accessibility of agricultural infrastructure (physical, social and equipment) to smallholder farmers in the study area. The Table shows that 95% of the farmers have transport (roads) infrastructure available in their area, 51% of them indicated that the roads were not accessible, this was attributed to the condition of the roads. In terms of storage infrastructure 47% of the farmers indicated that storage infrastructure was available in their area, with 47% indicating that storage infrastructure was accessible. Access to storage

facilities increases farmers' flexibility in selling their products, as well as their bargaining power (Bienabe et al., 2004). The table also shows that only 13% of farmers indicated that cold-stores infrastructure was available in their farmers, and also only 13% of the farmers having access to the cold stores. The farmers (72%) indicated that pack-houses are available in their area, with 62% of the farmers having access to pack-houses. Majority of the farmers (55%) of the farmers indicated that they have dipping thanks available in their area, with 51% of the farmers having access to the infrastructure. Only 29% of the farmers indicated that milk parlours infrastructure was available in the area, with only 18% of the farmers having access to the infrastructure. Majority of the farmers have fencing (62%); auction centres (63%); mills (55%) and boreholes (64%) available in their area. With accessibility to fencing (62%); action centres (55%); mills (51%) and boreholes (49%) respectively. Smallholder agricultural growth in Asia shows that physical infrastructure, such as irrigation, roads, storage and others, was a key element in the success achieved by smallholder farmers (Yoshino &Nakahigashi, 2000).

In terms of institutional infrastructure, table 6.2 below highlights that 78% of the farmers indicated that health and education facilities are available in the area, while 51% of the farmers indicated that the facilities were accessible. Electricity and water supply is important in increasing agricultural productivity, 73% of the farmers reported that infrastructure was available in their area, while 63% of the famers indicated the electricity and water supply services were accessible. With regards to institutional infrastructure; 59% of the farmers reported that cooperative societies were available and only 48% of the farmers had access to them. Sixtieth two percent of the farmers reported availability of famers unions in the area, while 61% of the farmers having access to the unions. Moreover, the farmers reported that following institutional infrastructure was available in the area; agricultural extension (86%); trading facilities (61%); and agricultural markets (62%). In terms of accessibility the farmers reported as follows; agricultural extension (46%); trading facilities (44%) and agricultural markets (50%) respectively. In terms of financial institutions 60% of the farmers indicated they were available in the area, while only 37% of the farmers reported they had access to financial institutions. If infrastructural services are more accessible, smallholder farmers may use these services more, leading to improved productivity and market participation (Chaminuka et al, 2006).If infrastructural services are more accessible, smallholder farmers may use these services more, leading to improved productivity and market participation (Chaminuka, 2006). The distance from markets, together with weak infrastructure, poor access to assets and information is shown in high exchange costs (Matungul, 2002 &Makhura, 2001).

Lastly, the farmers in the study area highlighted that they following farming equipment where available in their area and farms; tractors (69%); sprayers (55%); and ploughs (61%). With the farmers highlighting accessibility as follows; tractors (61%); sprayers (54%) and ploughs (59%) respectively. It was unfortunate to see that only 32% of the farmers highlighted that harvesters were available in the area, with accessibility to harvesters only at twenty-four percent. According to Ferris et al., (2006), if smallholder farmers have access to telecommunications, such as mobile or public phones, internet and email, they could communicate with potential buyers and negotiate prices without going to markets searching for buyers (Ferris et al, 2006).

Table 6.2: Availability and Accessibility to agricultural infrastructure

Variables	Availability		Accessibility	
	Yes	No	Yes	No
Physical Infrastructure				
Transport (Roads)	142 (95)	8 (5)	74(49.3)	76(50.7)
Storage (e.g. Silo's)	70 (46.7)	80 (53.3)	70 (46.7)	80 (53.3)
Irrigation infrastructure	53(35.3)	97(64.7)	79(52.7)	71(47.3)
Abattoirs	80(53.3)	70(46.7)	74(49.3)	76(50.7)
Coldstore	19 (12.7)	131 (87.3)	19(12.7)	131(87.3)
Packhouse	108 (72.0)	42 (28)	94(62.3)	56(37.2)
Dipping tanks	82 (54.7)	68 (45.3)	77(51.3)	73(48.7)
Milking Parlor	43 (28.7)	107 (71.3)	27(18.0)	123(82.0)

Fencing	93 (62.0)	57 (38.0)	93 (62.0)	57 (38.0)
Chicken house	51 (34)	99 (66.0)	39(26.0)	111(74.0)
Auction center	95 (63.3)	55 (36.7)	82 (54.7)	68 (45.3)
Feedlot	73(48.7)	77(51.3)	69(46.0)	81(54.0)
Mills	82(54.7)	68(45.3)	76(50.7)	74(49.3)
Boreholes	96(64.0)	54(36.0)	74(49.3)	76(50.7)
Piggery (sow unit)	89(59.4)	61(40.7)	70(46.7)	80(53.3)
Livestock handling facility	109(72.7)	41(27.3)	105(70.0)	45(30.0)
Feed mixing plant	121(80.7)	29(19.3)	94(62.3)	56(37.2)
Social Infrastructure				
Health and education facilities	117(78.0)	33(22.0)	77(51.3)	73(48.7)
Electricity and water supply	109(72.7)	41(27.3)	95(63.3)	55(36.7)
Institutional Infrastructure				
Cooperative societies	89(59.3)	61(40.7)	72(48.0)	78(52.0)
Farmers' unions	93(62.0)	57(38)	91(60.6)	59(39.4)
Financial institutions	90(60.0)	60(40.0)	55(36.7)	95(63.3)
Agricultural research facilities	51(34.0)	99(66.0)	103(68.7)	47(31.3)
Agricultural extension	129(86.0)	21(14.0)	69(46.0)	81(54.0)
Trading facilities	91(60.7)	59(39.3)	66(44.0)	84(56.0)
Agricultural markets	93(62.0)	57(38.0)	75(50.0)	75(50.0)
Equipment				
Tractor	103(68.7)	47(31.3)	92(61.3)	58(38.7)
Harvester	48(32.0)	102(68.0)	36(24.0)	114(76.0)
Sprayers	83(55.3)	67(44.7)	81(54.0)	69(46.0)
Ploughs	92(61.3)	58(38.7)	89(59.3)	61(40.7)

Source: Data survey

Smallholder farmers' infrastructure satisfaction and functionality of their agricultural infrastructure

Table 6.3below, presents the smallholder farmers satisfaction with their agricultural infrastructure and the functionality of their infrastructure. The results in table 6.3 revealed that among the smallholder farmers in the study area (50.7%) of the farmers indicated that the transports (roads) infrastructure was functional, only (35.3%) of the farmers indicated that they are satisfied with the transport (roads) infrastructure. Majority of the farmers (58.0%) storage facilities were functional although only 42% of the farmers indicated that they were satisfied with the storage infrastructure. The farmers indicated that abattoirs (50%) were functional, with only 40.7% of the farmers indicating that they were satisfied with the abattoirs infrastructure. Also, 52.7% of the farmers indicated that their fencing was functional with 52.7% of the farmers indicating that they were satisfied with their fence. About 56.7% of the farmers indicated that the auction centres were functional, with 50% of the farmers indicating that they were satisfied with the auctions centres. There were 62.7% farmers who indicated their packhouses were functional, 62.0% of the highlighted that they were satisfied with their packhouses infrastructure. Farming requires a lot of access to water, in particular under the recent drought. The farmers indicated that they were satisfied with their boreholes (50.7%), with only 30.0% of the farmers indicating that their irrigation infrastructure was functional, furthermore, with 48.7% and 24.0% of the farmers respectively highlighting their satisfaction with the infrastructure. Only 5.3% of the farmers indicated that they were satisfied with their cold stores.

In terms of social infrastructure functionality and satisfaction about 73.3 percent of the farmers indicated that health and education facilities were functional is the study area, with 59.3% of the farmers being satisfied with the facilities. The farmers (40.7%) who were not satisfied with the health and education facilities indicated that this was due to the distance to these facilities, furthermore due to the fact that the facilities close to their surrounding were not in good condition. It is pleasing to see that social infrastructure in the study is functional and that the farmers indicated satisfaction towards the facilities available in their surroundings. This indicates that the social welfare of the farmers in the study area is satisfactory, this assisting to increase the productivity of farmers. Furthermore, with factional school's family members can gain knowledge which can late on be applied on the farms. According to Chaminuka et al (2008), good infrastructure services are necessary for agriculture and rural development, and differences in regional economic development have been linked to differences in infrastructure investment (Fan & Zhang, 2004; Chandra & Thompson, 2000).

The table below further, shows functionality of the institutional infrastructure and satisfaction of farmers with the infrastructure. From the results below it can be deduced that 52% of the cooperative societies are functional, with only 47.3% of the farmers being satisfied with the cooperative societies. Furthermore, only 49.3% farmers indicated that farmers' unions were available in the study area and with only the 49.3% of the farmers being satisfied with the farmers' unions. Results in table 4.8 also revealed that financial institutions are functional (56.0%), while only 48.7% of the farmers indicated that they were satisfied with the financial institutions. The dissatisfaction of the farmers with the financial institutions was due to the fact that most of the farmers indicated that it was difficult to receive credit from the financial institutions in the study area. This was due to funding criteria, used by the institutions in the study, which are mainly commercial banks. The farmers indicated that development funders like the Land Bank, NEF and SEDA, should play a critical role in assisting smallholder farmers in the study area. In terms of institutional infrastructure functionality, the results further revealed that only 34% of the agricultural research institutions were functional, 58% of the agricultural extension functional, 52% of the trading facilities were functional and with 52.7% of the agricultural markets were functional in the study area. Furthermore, in terms of satisfaction with institutional infrastructure the indicated the following; only 34% of the farmers were satisfied with agricultural research facilities, 46% with agricultural extension, 42.7% with trading facilities and only 48% of the farmers were satisfied with agricultural markets. Deficiencies in rural infrastructure services result in poorly functioning domestic markets with little spatial and temporal integration, low price transmission, and weak international competitiveness (Pinstrup-Anderson &Shimokawa, 2006, Chaminuka et al, 2008).

The non-satisfaction with agricultural research institutions could be linked to the fact that the farmers who participated in the study did not have access to these institutions. This is mainly due to the distance to these institutions and the costs associated with usage of these institutions. The farmers further highlighted non-satisfaction with agricultural which was linked to the distance to formal markets and furthermore, it was linked to the fact that the farmers indicated the market requirements made it difficult for them to access the markets. According to Mthembu (2008), investment in good infrastructure may encourage smallholder farmers to participate effectively in markets.

In terms of farming equipment, the farmers highlighted the following; 56% of the farmers indicated that the tractors were functional and that they are satisfied with the tractors (56.0%). The farmers also highlighted that majority (76.0%) of the harvesters are not functional and only (46.0%) of the farmers are satisfied with the harvesters. Majority (54.0%) of the farmer indicated their sprayers are functional and they are satisfied (54.0%) with them. Furthermore, it was highlighted that only 37.4% ploughs are functional and with only 21.4% of the farmers satisfied with the ploughs. The fact that majority of the farmers indicated that they are not satisfied with the harvesters is due to the fact that majority of the farmers indicated that harvesters are expensive and they cannot afford them, furthermore the farmers have to hire them. Due to the demand for the harvesters in harvesting season the farmers struggle to gain access to them, and end up harvesting beyond the anticipated period.

Tobit Regression Model results on smallholder farmer factors influencing agricultural infrastructure availability

The results from the Tobit Regression Model are presented in table 6.4 of smallholder farmers' factors influencing agricultural infrastructure availability. The model is appropriate given its significant chi-square ($P<0.01$). This shows that the model appropriately fits the data. The Pseudo adjusted coefficient of determination shows that the model explained 0.3556% of variation in the probability. The results from the study showed that the coefficients of most of the variables hypothesized to influence the availability of agricultural infrastructure have the expected signs. The results in table 6.4 show that excluding the constant term, out of the 11 variables that were included in the

model, the coefficients of eight variables were statistically significant at 1% and 5% in influencing agricultural infrastructure availability.

Table 6.3: Agricultural infrastructure satisfaction and functionality

Variables	Functional		Satisfaction	
	Yes	No	Yes	No
Physical Infrastructure				
Transport (Roads)	76(50.7)	74(49.3)	53(35.3)	97(64.7)
Storage (e.g. Silo's)	87(58.0)	63(42.0)	63(42.0)	87(58.0)
Irrigation infrastructure	45(30.0)	105(70.0)	36(24.0)	114(76.0)
Abattoirs	75(50.0)	75(50.0)	61(40.7)	89(59.4)
Coldstore	16(10.7)	134(89.3)	8(5.3)	142(94.7)
Packhouse	94(62.7)	56(37.3)	93(62.0)	57(38.0)
Dipping tanks	58(38.7)	92(61.3)	58(38.7)	92(61.3)
Milking Parlor	25(16.7)	125(83.3)	24(16.0)	126(84.0)
Fencing	79(52.7)	71(47.3)	79(52.7)	71(47.3)
Chicken house	39(26.0)	111(74.0)	36(24.0)	114(76.0)
Auction center	85(56.7)	65(43.3)	75(50.0)	75(50.0)
Feedlot	64(42.7)	86(57.3)	59(39.4)	91(60.6)
Mills	77(51.3)	73(48.7)	76(50.7)	74(49.3)
Boreholes	76(50.7)	74(49.3)	73(48.7)	77(51.3)
Piggery (sow unit)	74(49.3)	76(50.7)	71(47.3)	79(52.7)
Livestock handling facility	94(62.7)	56(37.3)	93(61.3)	57(38.7)
Feed mixing plant	106(70.7)	44(29.3)	84(56.0)	66(44.0)
Social Infrastructure				
Health and education facilities	110(73.3)	40(26.7)	89(59.3)	61(40.7)
Electricity and water supply	79(52.7)	71(47.3)	74(49.3)	76(50.7)
Institutional Infrastructure				
Cooperative societies	78(52.0)	72(48.0)	71(47.3)	79(52.7)
Farmers' unions	74(49.3)	76(50.7)	74(49.3)	76(50.7)
Financial institutions	84(56.0)	66(44.0)	73(48.7)	77(51.3)
Agricultural research facilities	51(34.0)	99(66.0)	51(34.0)	99(66.0)
Agricultural extension	87(58.0)	63(42.0)	69(46.0)	81(54.0)
Trading facilities	78(52.0)	72(48.0)	64(42.7)	86(57.3)
Agricultural markets	79(52.7)	71(47.3)	72(48.0)	78(52.0)
Equipment				
Tractor	84(56.0)	66(44.0)	84(56.0)	66(44.0)
Harvester	36(24.0)	114(76.0)	74(49.3)	76(50.7)
Sprayers	81(54.0)	69(46.0)	81(54.0)	69(46.0)
Ploughs	56(37.4)	94(62.6)	32(21.4)	118(78.6)

Source: Data survey

Household members' assistance in the farming enterprises had a significant positive influence (P<0.01) on agricultural infrastructure availability. The coefficient indicates that household members' assistance in the farming enterprises will result in 0.702 unit increase in availability of agricultural infrastructure. Moreover, farm ownership also had a significant positive influence (P<0.01) on agricultural infrastructure availability. The coefficient indicates that farm ownership patterns will result in 0.962 unit increase in availability of agricultural infrastructure. Investment decisions of farmers are affected by the land / farm ownership partners, farmers owning the land or in long term leases tend to be willing to invest in the farm especially in agricultural production infrastructure, affecting the availability of infrastructure in the farms. Furthermore, household members' assistance in the farming enterprises, can play a critical role in the investment into the farming enterprise, including investing in the infrastructure. This can be attributed to household members with access to capital investing in infrastructure in the farming enterprises.

The coefficient of farm acquisition had a significant positive influence (P<0.01) on agricultural infrastructure availability. The coefficient indicates that the farm acquisition will result in 0.323 unit increase in availability of agriculture infrastructure. The farmers' occupation also shows a significant positive influence (P<0.01) on agricultural infrastructure availability. The coefficient indicates that the farmer occupation will result in 0.785 unit increase in availability of agricultural infrastructure. Farm acquisition plays a critical role in farmer availability of infrastructure, in most of the farms were the land was acquired through land reform, farmers are assisted through government programmes, like RECAP and CASP to increase on farm availability of infrastructure. It can further be deduced that farmers involved in other occupations, apart from full time farming, can cross subsidies the farming enterprises through capital generated from other occupations, this having a positive effect in the invest into infrastructure.

The same high significant positive influence (P<0.01) relationship has been observed between farmer organisation membership and agricultural infrastructure availability. The coefficient indicates that farmers organisations membership, will result in 2.066 unit increase in availability of agricultural infrastructure. Access to agricultural production inputs had a significant negative influence (P<0.05) on availability of agricultural infrastructure. The coefficient indicates that access to production inputs, will result in -0.763 unit decrease in agricultural infrastructure availability. Farmer organisations continue to play a vital role in influencing farmers access to agricultural infrastructure, this is through the sharing of knowledge on grant funding for agricultural and commercial funding for infrastructure. Furthermore, farmer organisations have access to agricultural engineers, which able to determine the needs by smallholder farmers. The negative relationship, between infrastructure availability and access to production can be attributed to the fact that smallholder farmer tend to substitute one resource for another, this is due to lack of capital to invest in all the resources. As farmers spend on production inputs, they tend to not spend on agricultural infrastructure, contributing to the availability of infrastructure in their farms.

Sources of labour had a significant positive influence (P<0.01) on agricultural infrastructure availability. The coefficient indicates that sources of labour will result in 1.283 unit increase in availability of agricultural infrastructure. Moreover, farming experience had a significant positive influence (P<0.01) on availability of agricultural infrastructure. The coefficient indicates that farming experience will result in 0.100 unit increase in availability of agricultural infrastructure. The positive relationship between farming experience and availability of agricultural infrastructure may be explained by the fact that farmers that accumulated farming, over the years can easily differentiate between farming with agricultural infrastructure and farming without agricultural infrastructure.

To estimate the effects of each independent variable on agricultural infrastructure availability, marginal effects of each explanatory variable were estimated. The coefficients of the marginal effect of the explanatory variables showed changes in availability of agricultural infrastructure in the study area with respect to a unit change of an independent variable among smallholder farmers. Among other factors influencing availability of agricultural infrastructure, the following variables played a critical role; household members' assistance in farming enterprise; farm ownership; farm acquisition; farmer Occupation; member of farmer organisations; sources of labour; farming experience and access to agricultural inputs.

Tobit Regression Model results on smallholder farmer factors influencing agricultural infrastructure accessibly

The results from the Tobit regression analysis presented in table 6.5 of smallholder farmers' factors influencing infrastructure accessibility. The model is appropriate given its significant chi-square (P<0.01). This shows that the model approximately fits the data. The Pseudo adjusted coefficient of the determination shows that the model explained 0.5051% of variation in the probability. The results from the study showed that the coefficients of most of the variables hypothesized to influence the accessibility of agricultural infrastructure have the expected signs. The results in table 6.6 show that excluding the constant term, out of the 12 variables that were included in the model, the coefficients of eight variables were statistically significant at 1% and 5% in influencing agricultural infrastructure accessibility.

Table 6.4: Tobit Regression Model on smallholder farmers' factors influencing agricultural infrastructure availability

Variables	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Household mem assit	.7015774	.144971	4.84	0.000***	.414962	.9881929
Farm ownership	.961656	.1239604	7.76	0.000***	.7165797	1.206732
Farm acquisition	.3233585	.1122664	2.88	0.005***	.1014019	.5453151
Farmer Occupation	.7853283	.14636	5.37	0.000***	.4959667	1.07469
Member farmer Org	2.065785	.3423645	6.03	0.000***	1.388911	2.742658
Farmer Age	-.0172163	.0155299	-1.11	0.270	-.0479197	.0134871
Access to Agric inputs	-.7628503	.335712	-2.27	0.025**	-1.426571	-.0991296
Sources of labour	1.282579	.1920119	6.68	0.000***	.9029612	1.662197
Land tenure	.1194556	.1067573	1.12	0.265	-.0916093	.3305205
Education level	.3168494	.223803	1.42	0.159	-.1256211	.7593199
Farming experience	.1004185	.0370753	2.71	0.008***	.0271187	.1737183
_cons	-13.04228	1.4713	-8.86	0.000***	-15.95112	-10.13345

Log Likelihood -300.60893; Wald chi2 (11) = 331.75; Prob > chi2 = 0.0000; Pseudo R^2 = 0.3556; NO.OBS = 150; *Where* ***, ** *and* * *represents significance at 1%, 5% and 10% level respectively.*

The coefficient of farmers engaging in non-farming activities had a significant positive influence (P<0.01) on agricultural infrastructure accessibility. The coefficient indicates that the farmers' engagement in non-farming activities will result in 1.275 unit increase in agricultural infrastructure accessibility. Livelihood options amongst these households would either/or be farm related, off farm (wage employment on other farms) or non-farm (non-agricultural wage employment and transfers) (Ellis, 1998; Perret et al., 2005). Diiro (2013), indicated that off- farm income is expected to provide farmers with liquid capital for purchasing productivity enhancing inputs such as improved seed and fertilizers. The coefficient of farmers contact to extension services also shows a significant positive influence (P<0.01) on agricultural infrastructure accessibility. The coefficient indicates that farmers contact to extension services will result in 1.205 unit increase in agricultural infrastructure accessibility. The contact to extension was an important factor to accessibility to agricultural infrastructure. Infrastructure programmes by government are usually introduced at national level and filtered down to provincial departments, the information is then shared with smallholder farmers. A farmer whose contact with extension officers is very high is expected to be able to apply for assistance from government grants earmarked for infrastructure, through knowledge shared by extension officers.

Farm ownership had a significant positive influence (P<0.01) on agricultural infrastructure accessibility. This coefficient indicates that the farmers farm ownership patterns will result in 0.403 unit increase in agricultural infrastructure accessibility. Moreover, farmers' occupations had a significant positive influence (P<0.01) on agricultural infrastructure accessibility. The coefficient indicates that farmers' occupation will result in 0.456 unit increase in agricultural infrastructure accessibility. Involvement of farmers in other economic activities plays a critical role, in assisting farmer to generate capital to invest infrastructure for their farms and for assistance in accessing off-farm infrastructure, which requires service fees.

Farmer organisation membership had a significant positive influence (P<0.01) on agricultural infrastructure accessibility. This coefficient indicates that farmers organisation membership status will result in 1.111 unit increase in agricultural infrastructure accessibility. Sources of labour also had a significant positive influence (P<0.01) on agricultural infrastructure accessibility. This coefficient indicates that sources labour will result in 0.653 unit in agricultural infrastructure accessibility. Labour sources play a critical role in farming enterprises, hiring experienced labour in a farm, can assist increase the productivity of the farm, contributing to increased income for the farm, which can be invested in the infrastructure for the farm.

Lastly, farming experience had a significant positive influence (P<0.05) on agricultural infrastructure accessibility. This coefficient indicates that change in farming experience will result in 0.045 unit increase in agricultural infrastructure accessibility. Land tenure also had a significant positive influence (P<0.01) on agricultural infrastructure accessibility. This coefficient indicates that change in land tenure system will result in 0.156 unit increase in agricultural infrastructure accessibility. Land tenure system plays a very important role in the production activities, of smallholder famers. The land tenure system can assist farmers, gain access to commercial funding in order to finance their farming activities, especially around inputs. In the study area, majority of the famers had long-terms leases, which can attribute to famers gaining access to funding for productions inputs, to improve agricultural production which directly contributes to agricultural income.

Table 6.5: Tobit Regression Model on smallholder farmers' factors influencing agricultural infrastructure accessibility.

Variables	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Household mem assist	.142071	.0868412	1.64	0.104	-.0296295	.3137715
Non-farming activities	1.275348	.1490564	8.56	0.000***	.9806371	1.570059
Contact to ext services	1.204681	.1830452	6.58	0.000***	.8427683	1.566594
Farm ownership	.4032802	.0708652	5.69	0.000***	.2631671	.5433933
Farmer Occupation	.4559077	.0811837	5.62	0.000***	.2953932	.6164222
Member of farmer org	1.111501	.1846533	6.02	0.000***	.7464087	1.476594
Farmer Age	-.0111628	.0086887	-1.28	0.201	-.0283418	.0060162
Education level	.1923774	.1254279	1.53	0.127	-.0556158	.4403706
Sources of labour	.653148	.1068053	6.12	0.000***	.4419748	.8643211
Farming experience	.0450516	.0203705	2.21	0.029**	.0047756	.0853276
Marital status	.0703298	.0954566	0.74	0.463	-.1184049	.2590646
Land tenure	.1559467	.0563858	2.77	0.006***	.044462	.2674314
_cons	-10.32096	.7678971	-13.44	0.000***	-11.83923	-8.802696

Log Likelihood -203.36498; Wald chi2 (12) = 415.14; Prob > chi2 = 0.0000; Pseudo R^2 = 0.5051; PNO.OBS = 150;
*Where ***, ** and * represents significance at 1%, 5% and 10% level respectively.*

To estimate the effects of each independent variable on agricultural infrastructure accessibility, marginal effects of each explanatory variable were estimated. The coefficient of the marginal effect of the explanatory variables showed changes in accessibility of agricultural infrastructure in the study area with respect to a unit change of an independent variable among smallholder farmers. Among other variables influencing agricultural infrastructure accessibility, the following variables played a critical role; engage in non-farming activities; contact to extension services; farm ownership; farmer occupation; member of farmer organisations; sources of labour; farming experience and land tenure.

Tobit Regression Model results on smallholder farmer factors influencing agricultural infrastructure satisfaction

The results from the Tobit Regression Model are presented in table 6.6 of smallholder farmers' factors influencing satisfaction with agricultural infrastructure. The model is appropriate given its significant chi-square (P<0.01). This shows that the model approximately fits the data. The Pseudo adjusted coefficient of determinants shows that the model explained 0.4832% of the variation in probability. The results from the study showed that the coefficients of most of the variables hypothesized to influence the satisfaction of smallholder farmers with agricultural infrastructure have the expected signs. The results in table 6.8 show that excluding the constant term, out of the 11 variables that were included in the model, the coefficients of nine variables were statistically significant at 1% and 5% in influencing smallholder farmers' satisfaction with agricultural infrastructure.

The organisation were the extension services originates, had a significant positive influence (P<0.01) on farmers' satisfaction with agricultural infrastructure. The coefficient indicates that the organisation where the extension services originates will result in 1.779 unit increase in farmers satisfaction with agricultural infrastructure. Household members' assistance in the farming enterprise was also found, to have a significant positive influence (P<0.01) on farmers' satisfaction with agricultural infrastructure. The coefficient indicates that household members' assistance in the farming enterprises will result in 0.411 unit increase in satisfaction of farmers with agricultural infrastructure. Extension services play a critical role in farming enterprises, more especially the origination of the extension services. In most of the scenarios, extension services originate from government institutions, however the

private section has extension. Extension officers with the knowledge and skills around infrastructure play a critical role in assisting farmers utilise agricultural infrastructure efficiently and are satisfied with the outcomes.

Government agricultural support to smallholder had a significant positive influence (P<0.01) on farmers' satisfaction with agricultural infrastructure. The coefficient indicates that government agricultural support to smallholder farmers will result in 0.419 unit increase in farmers satisfaction with agricultural infrastructure. Farm ownership also had a significant influence (P<0.01) on farmers satisfaction with agricultural infrastructure. The coefficient indicates that smallholder farmers farm ownership will result in 0.464 unit increase in farmers satisfaction with agricultural infrastructure. In a perfect situation, government and the private sector are able to assist smallholder farmer with infrastructure, dependent on the ownership of the farm and the lease term, through CASP, private loans and other grant programs. Furthermore, government support plays a critical role assisting farmers access infrastructure and with inputs, with government support farmers are able to produce efficiently and gain access to infrastructure, contributing to their satisfaction with agricultural infrastructure.

The coefficient of farmers organisational membership had a significant positive influence (P<0.01) on farmers' satisfaction with agricultural infrastructure. The coefficient indicates that the farmers organisational membership will result in 1.011 unit increase in farmers satisfaction with agricultural infrastructure. Also, the coefficient of farmers age had a significant negative influence (P<0.01) on farmers' satisfaction with agricultural infrastructure. The coefficient indicates that change in the farmers age will result in -0.030 unit decrease in satisfaction with agricultural infrastructure. The coefficient of farmer education level had a significant positive influence (P<0.01) on farmers satisfaction with agricultural infrastructure. The coefficient indicates a change in the farmers education level, will result in 0.483 unit increase in satisfaction with agricultural infrastructure. The negative relationship for the farmers age can be attributed, to the likelihood that as farmers grow old, their energy levels decreases contributing to them, being unable to access infrastructure and being unable to utilise infrastructure efficiently. According to Magxinga et al., (2005), as a farmer's age increases, it becomes more difficult to respond to opportunities, including accessing the local market. Mauceri et al. (2005) and Adesina &Zinnah (1993) found that as farmers grow older, there is an increase in risk aversion and a decreased interest in the long-term investment in the farm.

Marital status had a significant positive influence (P<0.01) on farmers' satisfaction with agricultural infrastructure. The coefficient indicates that a change in marital status will result in 0.290 unit increase in satisfaction with agricultural infrastructure. Moreover, Gender of smallholder farmers had a significant negative influence (P<0.01) on farmers' satisfaction with agricultural infrastructure. The coefficient indicates that gender will result in -0.576 unit decrease in satisfaction with agricultural infrastructure. This find does not concur with those of Obisesan (2014) on adoption of technology that, gender had a significant and positive influence on adoption of improved cassava production in Nigeria. The marital status relationship implies as farmers move from being single to married, leads to an increase in agricultural infrastructure satisfaction. The gender was also an important factor in satisfaction of farmers with agricultural infrastructure satisfaction.

Table 6.6: Tobit Regression Model on smallholder farmers' factors influencing smallholder farmers' satisfaction with agricultural infrastructure.

Variables	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Org for ext services	1.778572	.1611294	11.04	0.000***	1.460011	2.097134
Household mem assist	.4114081	.0824664	4.99	0.000***	.2483676	.5744486
Gov agric support	.4193658	.0861036	4.87	0.000***	.2491343	.5895973
Farm ownership	.463902	.0700855	6.62	0.000***	.3253393	.6024648
Mem farmer organ	1.011183	.2010527	5.03	0.000***	.6136914	1.408675
Farmer Age	-.0301818	.0088916	-3.39	0.001***	-.0477609	-.0126027
Education level	.4833261	.1229458	3.93	0.000***	.2402557	.7263965
Farming experience	-.0121718	.0216267	-0.56	0.574	-.0549289	.0305853
Land tenure	-.0570119	.059726	-0.95	0.341	-.1750934	.0610695
Marital status	.2896257	.097724	2.96	0.004***	.0964201	.4828312
Gender	-.5764842	.1870589	-3.08	0.002**	-.9463098	-.2066587
_cons	-6.450838	.7703829	-8.37	0.000	-7.973927	-4.92775

Log Likelihood -220.67109; Wald chi2 (11) = 412.61; Prob > chi2 = 0.0000; Pseudo R^2 = 0.4832; NO.OBS = 150;

*Where ***, ** and * represents significance at 1%, 5% and 10% level respectively.*

To estimate the effects of each independent variable on satisfaction of smallholder farmers with agricultural infrastructure, marginal effects of each explanatory variable were estimated. The coefficients of the marginal effect of the explanatory variables showed changes in satisfaction of farmers with agricultural infrastructure in the study area with respect to a unit change of an independent variable among smallholder farmer. Among other factors influencing satisfaction with agricultural infrastructure, the following variables played a critical role; organisation for extension services; household members' assistance in farming enterprise; farmer receives government agricultural support; farm ownership; member of farmer organisations; farmer age; education level; marital status and gender.

Concluding remarks

The results for the Tobit regression analysis are robust and statistically significant. The factors that had a positive and significant influence on agricultural infrastructure availability were: Household members' assistance in the farming enterprises, farm ownership, farm acquisition, farmers' occupation, farmer organisation membership, Sources of labour and farming experience. The factor that had a negative and significant influence on agricultural infrastructure availability was access to agricultural production inputs.

The factors that had a positive and significant influence on agricultural infrastructure accessibility were: farmers engaging in non-farming activities, contact to extension services, farm ownership, farmers' occupations, farmer organisation membership, sources of labour, farming experience and land tenure. Finally, the factors that had a positive and significant influence on smallholder farmers' satisfaction with agricultural infrastructure were: organisation were the extension services originates, household members' assistance in the farming enterprises, government agricultural support, farm ownership, farmers organisational membership, farmer education level and marital status. The factors that had a negative and significant influence on smallholder farmers' satisfaction with agricultural infrastructure were: farmers age and gender of smallholder farmers.

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