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Factors Limiting Small-Scale Farmers' Access and Use of Tractors for Agricultural Mechanization in Abuja, North Central Zone, Nigeria

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Abstract
The importance of tractor and its implements in agricultural mechanization necessitated this study. The main objective is to identify factors limiting small-scale farmers' access and use of tractors for farm mechanization in Abuja, Nigeria. To effectively cover the study area, a simple random technique was adopted for sample selection while semi-structured questionnaires were used for data collection. A total of 337 farmers were randomly selected from four local government areas (Kule, Kwali, Abaji, Gwagwalada) and used for the study. Data were analyzed using descriptive statistics. Results indicated that the major factors limiting the farmers from using tractors to work on their farms were high cost of tractor hiring services (64.09%) and inadequate sources of hiring points (19.29%) resulting in poor access to tractors and its implements. The farmers that hired tractors spent an average of ₦11,543 on land tillage alone hence majority (49.85%) of them adopted local implements like hoes, spades and shovels for land tillage while 10.39% planted without land tillage (zero tillage). In addition to land tillage, majority of the farmers (62.31%) indicated that, they also hired tractors for the transportation of their farm produce. Private ownership (NGO, Cooperative societies and private individuals) were the major (67.95%) sources of tractor for hiring while only 13.65% of the farmers accessed government-owned tractors. Based on the findings, the paper recommended that more tractor hiring points should be established in the study area and, in addition, the cost of hiring tractor should be regulated by government in order to encourage farm mechanization.

Key words: Cost of tractor hiring, land tillage operation, transportation of farm produce**,** sources of tractor hiring

1. Introduction

Nigeria is one of the countries in the World that is blessed with both human and material resources (UKAID, 2012). In terms of human resources, Nigeria has an estimated population of about 163 million people (NBS, 2012) that are engaged in

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agricultural and non-agricultural activities. It occupies an estimated land mass of 92.4 million hectare that has tremendous potentials for crop production. Out of the total land mass, the arable land area was 79 million hectare (Federal Ministry of Agriculture and Natural Resources (FMANR, 2010) and out of the 79 million hectares, only about 32 million hectare is usually cultivated (FMANR, 2010) living an excess of about 47 million hectare uncultivated. This implies that land availability is not a major limiting factor in agricultural development but despite the available land and human resources, Nigeria is one of the poorest countries in the world that is battling with food insecurity (Khan, 2000) even when 80 percent (Dauda, Musa and Ahmad, 2012) of her population is said to be engaged in agriculture. As a country, Nigeria is neither in the front row of food producing nor exporting countries of the world (Okereke, 2000). In fact, Nigeria is one of the major importers of food items in the Sub-Saharan Africa. Report by FAO (2013) indicated that Nigeria was the highest importer of rice in the Sub-African region. To worsen the situation, most of the young and able-bodied men who are supposed to adopt farm mechanization easily are continuously leaving the rural areas for urban cities in search of jobs with better remuneration. This ugly scenario calls for a serious concern because the inability of Nigeria to feed her teeming population that has been estimated to be growing at the rate of 3.2 percent per annum (NPC, 2006) is a pointer to national calamity. This should be addressed because the index for measuring the independence of any nation is her ability to feed her population.

In order to improve food production, Nigerian farmers have to adopt farm mechanization because it is a means of enhancing human productivity and often with the intention to achieve results beyond the capacity for human labour (FAO, 2008). Advanced countries in the World that have made remarkable and enviable progress in food production adopted farm mechanization through the use of modern technologies like tractors and its implements. For instance, in America 95 percent of her agriculture is mechanized with only 24 percent of her population engaged in agriculture (Indian Ministry of Agriculture, 2013) yet they produce enough to the extent that they export their outputs to other countries of the World. This is at variance to what is obtained in Nigeria where less than 2 percent of the agricultural production is mechanized (Faborode, 2001). This portrays the importance of farm mechanization hence it has been globally virtualized as the pivot to agricultural transformation. This is based on the fact that it has contributed immensely to the increase in food production and other agricultural raw materials (Akande, 2009). Because of the importance of farm mechanization, food experts have argued that Nigerian farmers are unable to produce enough food for her growing population and raw materials for agro-industries due to the use of local or crude implements that are manually operated (Dauda, Agidi and Shotunde, 2010). Hence, for Nigeria to develop her agricultural sector and be relatively self sufficient in food production, agricultural mechanization remains one of the best options if not the only option.

To embrace agricultural mechanization, one of the most important agricultural technologies that Nigerian farmers must have access to is tractor and its implements. Although farm mechanization according to Maharjah and Cheltin (2006) encompasses, in its widest sense, hand tools, draught animals and mechanical technologies, tractor is one of the most important mechanical power because it is a major element in farm

mechanization (Ishola and Adeoti, 2004). To emphasize the importance of tractor, Dauda, Musa and Ahmad (2012) stated that agricultural mechanization is synonymous with tractorization. It is a critical input for agricultural mechanization and a major indicator for assessing level of agricultural development in any country (NAERLS and NPFS, 2011). Using tractor and its implements for agricultural mechanization have been adopted and its impact on agricultural development has been impressive in many parts of the World. For example, some rice exporting countries like Vietnan and Thailand have mechanized rate of 0.7hp/ha while South Korea and Japan had mechanized rates of 4hp/ha and 7hp/ha respectively (Manila Bulletin, 2013). Japan, UK, Italy, France and India had 461, 211.08, 88.14, 68.5 and 15.75 tractors respectively per 1000ha (Indian Ministry of Agriculture, 2013) but in Nigeria, the story is different. In a survey conducted by NAERLS and NPFS (2011), it was revealed that about 28 states including Abuja had a total of 1,579 functional tractors in 2011. Abuja, where the study was conducted had 77 public-owned tractors. Although information on private-owned tractors could not be accessed, it is clear that the number of tractors available was insignificant when compared to the farming population and available land resource in Nigeria.

Since Nigerian farmers have been advised to embrace agricultural mechanization as a way of increasing food production and report by NAERLS and NPFS (2011) indicated that most states in Nigeria including Abuja had some functional tractors, there is every need to identify the factors limiting small-scale farmers access and use of tractors for farm mechanization for farm mechanization in Abuja, Nigeria. This is very important because if tractors are not affordable to farmers or available in public and private offices but not accessible, it makes no meaning to a farmer who needs it for production purposes. Again, it is necessary because documented evidence revealed that tractors were introduced in Nigeria in the 1950's (Dauda et al 2010) implying that this is not a new technology in Nigeria. Since 1950s till date, the level of adoption and diffusion of farm mechanization should be very high enough for the Nigerian farmers to operate mechanized farms. In view of this, the questions are: 1) What are the factors limiting small-scale farmers access to tractor hiring services in Abuja, Nigeria? 2) Do the farmers have adequate access to tractor and its implements for farm mechanization?

2. Objectives of the study

The broad objective of the study is to identify factors limiting small-scale farmers' access and use of tractors for farm mechanization in Abuja, Nigeria. Specific objective are to:

1. Identify the factors limiting farmers' access to tractor hiring services in the study area,
2. Identify the major sources of tractor hiring for farm mechanization in the study area,
3. Determine farmers' level of access to tractor hiring services,
4. Determine the major uses of tractor by farmers in the area, and
5. Assess the socio-economic characteristics of the farmers in the study area.

3. Methodology

3.1: Study Area

This study was conducted in Abuja north central zone, Nigeria. Abuja is the Federal Capital Territory and it is located between latitudes 8^0 25` and $9^0$ 25` North of the equator and longitudes 6^0 45`and $7^0$ 45` East of Greenwich. The territory covers an area of 8,000 square kilometers, lying in the centre of the country. It is bordered on all sides by four states namely: Niger, Nasarawa, Kogi and Kadunna (Dawan, 2000). It lies in the transitional zone between the savannah vegetation in the North and forest zone in the South which is blessed with tremendous resources for supporting agricultural production. The mean annual rainfall is about 1,200mm. The maximum temperatures occur in the month of March varying from 37 ^{0}C in the south-west to about 30 ^{0}C in the north-east (Adakayi, 2000). The choice of Abuja for the study is very important because its good location makes it possible for root, grain and other crops to grow in the area. The data were analyzed using descriptive statistics.

3.2: Sampling technique and data collection

Abuja has six (6) local Government Councils – Abuja metropolitan Area Council (AMAC), Kwali, Kuje, Abuja, Gwagwalada and Bwari. Out of the six (6) local Government Councils, four (4) were purposively chosen because they were predominately rural communities where farming activities take place. To effectively cover the four local Government Councils selected, a simple random technique was adopted for sampling while semi-structured questionnaires were used for data collection. A total of 400 questionnaires were produced (100 for each of the 4 local Government Councils) and they were administered to the farmers through the help of the agricultural extension agents. The agricultural extension agents who were responsible for extension services in those local Government Councils served as enumerators. A total of 337 properly filled questionnaires from Abaji (95), Kuje (50), Kwali (95) and Gwagwalada (97) were used for the study. To access how the farmers generally perceived their access to tractor hiring services in the area, they were asked in the questionnaire to indicated their level of access to tractor services using highly accessible (3), fairly accessible (2), very low access (1) and not accessible at all (0).

4. Results and discussion

Table 1 shows that the major limiting factor to the use of tractor for agricultural mechanization in the study area was the high cost of hiring the tractors. Out of the 337 farmers interviewed, 216 of them representing 64.09 percent reported that it was the major challenge. The second limiting factor was inadequate sources of hiring points which 19.29 percent of the farmers indicated The least limiting factor was attributed to land boundary destruction during farm operation especially during land tillage operation. The zero response does not necessary mean that it is not a limiting factor but it shows that the farmers hardly experience it during tractor operations, especially during tillage operations.

Table 1 *Factors limiting the use of tractor in the farm*

Limiting factors	frequency	percentage
High cost of hiring tractor services	216	64.09
Poor access road to the farm	46	13.65
Inadequate sources of tractor hiring points	65	19.29
Destruction of land boundary	0	0.00
No response	10	2.97
Total	**337**	**100**

***Source**: Field data analysis, 2013*

Table 2 shows the average amount spent by farmers that used tractor to till their farm lands. The mean cost varied from one local government council to another but farmers in Kuje Local Government Council spent the highest amount (₦19,426) while farmers in Abaji Local Government Council spent the least (₦8,188). The grand mean cost was ₦11,543 implying that the farmers that hired tractors for tillage operation in the study area spent an average of ₦11,543. This is relatively high because when the cost of other farm operations like planting, weeding, fertilizer application, harvesting, transportation and other activities are added, the total cost of production will be high for the small-scale farmers. The standard error (SE) is high and in line with the apriori expectation because the values on table 2 showed that some of the farmers paid as much as ₦35,000 for a land tillage operation while some paid as low as ₦800 only. As a matter of fact, the SE also indicated that the charge for a tillage operation depended on the location of the farmer in Abuja and other variables like the size of land, the relationship between the farmer and the tractor owner, access to the farm land, etc.

Table 2 *The mean cost of tillage operation per farmer in the study area*

Location	Mean cost (₦)	Standard error (SE)	Minimum cost (₦)	Maximum cost (₦)
Kuje	19,426	1,532	6,500	35,000
Kwali	8,785	163	7,000	10,000
Gwagwalada	12,885	555	10,000	18,000
Abaji	8,188	463	800	10,000
Grand mean	**11,543**	**447**	**800**	**35,000**

***Source**: Field data analysis, 2013*

The farmers where asked to state their sources of hiring tractors for agricultural activities and the results are shown in Table 3. The major source of tractors for hiring was from private organizations like NGOs/cooperative societies and individual owners (73.29%). Government organizations like Abuja Agricultural Development Programme (AADP), Federal Ministry of Agriculture and Rural Development (FMARD), Local Government Councils, Federal Capital Development Authority (FCDA) (Agric unit) constituted only 8.31 percent. The few tractors in the government-owned institutions is contrary to the apriori expectation because it was expected that government-owned institutions would have enough tractors to hire out to farmers more than the private sector. This may be attributed to the fact that tractors owned by government institutions may not be

functioning well because Dauda, Agidi and Shotunde (2010) stated that tractors owned by government institutions are not properly maintained even with good finance. It could also be that the tractors were there without implements because report revealed that in 2003, Osun State Government in Nigeria purchased more than three hundred tractors with few implements (Osun State Diary, 2005). This portrays the weakness of the government-owned institutions in making tractor accessible to the farmers yet they were established to promote agriculture and rural development in Nigeria. A total of 62 farmers representing 18.40 percent could not give the sources of the tractors they hired for farm work. This could be attributed to the literacy status of the farmers as most of them had at most primary school education (see Table 7).

Table 3 *Sources of tractor hiring in the study area*

Sources of tractor	frequency	percentage
Agricultural Development Programme (AADP)	18	5.34
Private owners (NGOs/Cooperative societies/individuals)	247	73.29
Fed. Ministry of Agric and Rural Development	3	0.89
Local Government Areas	2	0.59
Federal Capital Development Authority (Agric Unit)	5	1.49
Unknown sources	62	18.40
Total	**337**	**100**

Source: *Field data analysis, 2013*

Table 4 shows the responses of the farmers on the uses of tractors outside land tillage operation. Majority (62.31%) stated that, outside land tillage, they used tractor for the transportation of farm produce while 37.69 percent stated that they used tractor only for tillage operations. Out of the 337 farmers interviewed, none of them used tractor for planting, weeding or fertilizer application. This agrees with the findings of Dauda, Agidi and Shotunde (2010) which revealed that most of the tractors in Nigeria were bought for the purpose of ploughing and transportation. It also supports the findings of Dauda, Agidi and Shotunde (2010) which indicated that tractor owners were reluctant to use their tractors for non-ploughing activities. A critical look at the rural settings where the data were collected shows that the farmers may not be aware that tractor can be used for weeding, planting or fertilizer application This calls for the creation of awareness of the uses of tractor and its implements in the study area because farm mechanization does not end in land tillage only

Table 4 *Uses of tractor outside land tillage*

Operations	frequency	percentage
Planting	0	0.00
Weeding	0	0.00
Fertilizer application	0	0.00
Transportation of farm produce	210	62.31
None outside land tillage	127	37.69
Total	**337**	**100**

Source: *Field data analysis, 2013*

Table 5 shows the technologies which the farmers used in tilling the soil before planting. The results showed that 168 of the farmers representing 49.85 percent used local implements like hoe, spade and shovel in tilling the soil and these are implements that are manually operated. This is consistent with the report by Dauda, Agidi and Shotunde (2010) which showed that hand-made tools like hoes and cutlasses are still widely used in Nigeria. A total of 134 farmers representing 39.76 percent used tractors to till their soil during production. None of the farmers reported using animal force implying that it was not a common practice in the area, while 10.39 percent planted without tillage (zero tillage).

Table 5 *Technology used in land tillage operation*

Technology used	frequency	percentage
Tractor	179 (134)	39.76
Hoe/spade/shovel	225 (168)	49.85
Zero tillage	47(35)	10.39
Animal power/force	0 (0)	0.00
Total	**451 (337)**	**100**

Values in parentheses are proportionate frequencies
Values outside parentheses are multiple frequencies
***Source**: Field data analysis, 2013.*

Table 6 shows the farmers' responses on their access to tractor hiring services in the study area. Only 31 out of the 337 farmers representing 9.20 percent said it was highly accessible to them. If the percentage of those who said it was not accessible to them at all (15.13%) is added to those who said that access was very low (37.09%), we will have 52.22 percent. This means that farmers who had very low access to tractor hiring services and those who had no access at all were greater than those who said it was highly and fairly accessible to them. This is a clear indication that access to tractor in the study area was poor. This may be attributed to bureaucracy because in Osun State, Nigeria, Lamidi and Akande (2013) reported that tractor hiring from public institutions was hindered by bureaucratic bottleneck. Again, NARLS and NPFS (2011) revealed that in many states in Nigeria, tractor procured for farmers were not distributed to the agencies that should hire them out to the end users. This is discouraging because the Indian Ministry of Agriculture (2013) listed the merits of farm mechanization to include among others, improvement in the utilization efficiency of inputs (seeds, chemicals, fertilizers and energy) Savings in seed and fertilizer according to the report were 15-20 % each.

Table 6 *Farmers' level of access to tractor hiring services*

Level of access	frequency	percentage
Highly accessible	31	9.20
Fairly accessible	130	38.58
Very low access	125	37.09
Not accessible at all	51	15.13
Total	**337**	**100**

Table 7 shows the socio-economic characteristics of the farmers. The results revealed that majority of the farmers (85.16%) were male. This does not mean that male farmers dominated agricultural production but it is a reflection of the difficulties of interacting with women in the study area because of religious belief hence the enumerators interviewed men that were easily accessible. Greater proportion (47.18%) of the farmers were married with 5-8 persons per household. In fact, 80.42% of the farmers had at least 5 persons per household. Farmers with large household sizes may not be interested in hiring tractor because the able and grown-up ones can be used as farm labour. The age distributions of the farmers showed that majority of the farmers were within the age limits of 41-50 years. This tallies with the findings of Dauda, Musa and Ahmad (2012) which showed that farmers in Kwara State, Nigeria were within the same age limits. It is necessary to understand the age distribution of the farmers because in peasant agriculture, the age of a farmer can be used to measure his/her ability to do some manual operations in the farm. On social capital organizations, majority of the farmers (67.36%) belonged to cooperative societies and had enough farming experiences because 94.96 percent of the farmers had at least 11 years of farming experiences. With these years of farming experiences, the farmers would have known the benefits of adopting farm mechanization. With respect to education, 58.76 percent of the farmers had at most primary school education. This agrees with the report by Lamidi and Akande (2013) which showed that greater proportion (76.7%) of farmers in Osun State, Nigeria had at least primary education. This could constitute a hindrance to the use of tractor in the farm because illiterate farmers are conservative in behavior and may deliberately resort to the use of local tools.

Table 7 *The socio-economic characteristics of the farmers*

Socio-economic characteristics	Frequency	Percentage
Gender		
Male	287	85.16
Female	50	14.84
Marital status		
Married	270	80.12
divorced	18	5.34
separated	**22**	6.53
Widow	12	3.56
Single	15	4.45
Household size		
1-4	66	19.58
5-8	159	47.18
9-12	84	24.93
> 12	28	8.31
Age distribution		
< 20	3	0.89
21-30	61	18.10
31-40	65	25.22
41-50	116	34.42
>50	72	21.37
Years of Farming experience		

1-10	17	5.04
11-20	111	32.94
21-30	117	34.72
> 30	92	27.30
Cooperative membership		
Member	227	67.36
Non-member	110	32.64
Literacy status		
No formal education	114	33.83
Primary school	84	24.93
Secondary school	91	27.00
Post secondary school	48	14.24

Source: *Field data analysis, 2013*

Conclusion

Nigeria as a nation has almost all the natural and human resources that will make it self-reliant in food production but ironically the country is threatened by food insecurity. The inability of Nigeria to produce enough food has been attributed to the country's failure to accept farm mechanization to the extent that the greater proportion of the farming population are peasant farmers that depend on manually operated implements. Since tractor is one of the major elements in farm mechanization, this study was conducted to identify the factors limiting farmers' access and use of tractors and its implements for agricultural mechanization. The findings indicated that the major limiting factors to farm mechanization were the cost of hiring tractor services and inadequate sources of hiring points resulting in poor access to tractors and its implements. On average, farmers that hired the services of tractor for land tillage spent an average of ₦11,543 per farmer. Access to public-owned tractors was poor and contrary to expectation. To improve the farmers' access to tractor hiring services, the paper recommended that government should purchase more tractors and increase the number of hiring points. In addition, the cost of hiring tractor should be regulated by government to make them more accessible to farmers.

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