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Assessment of Farm Machinery Utilization Level and its Determinants among Private and Government Organization of Southern Regional State of Ethiopia

Takele Mebratu
Sothern Agricultural Research Institute, Hawassa Agricultural Research Center, Hawassa, Ethiopia

Corresponding Author: **Takele Mebratu**

Abstract
Farm machinery utilization improves the quality of field operations. The objectives of study were to describe mechanization status and assess determinant of farming machineries utilization level among private and government organizations in Southern Ethiopia. Purposive and snowball sampling technique was employed to select target area and respondent. Structured questionnaire, focused group discussions, literature review and field observations were used to produce the necessary data. A total of 126 participants were selected from research center, seed producing union, private sector and institution. The results showed that 97, 96, 94, and 92% challenges were high price, transmission problem, and poor maintenance of farm machinery and lack of skilled operators found constraints affect utilization of farm machinery. About 77% was no access to farm machinery spare parts. In SNNPRS, 82%, 6% and 6% of power sources for land preparation were farm machinery, animal and human, respectively. Furthermore, sowing 67%, weeding, 90%, spraying 74%, harvesting 70%, winnowing 55% and sorting 61% were performed by manpower. Logistic regressions revealed that five variables significantly influenced the decision of the enterprise to utilize farm machinery are number of farm machinery, farm size, number of operators, access to training and access to maintenance service. Generally, farm machinery maintenance center, low level skilled operators, high price of farm machinery, lack of genuine spare parts, unavailability of sufficient credit and dollar exchange were great challenges for seed enterprises in southern Ethiopia. Hence, government should provide spare parts, maintenance service center, training, a long-term loan and tax relief for importer.

Keywords: Assessment, Enterprise. Farm machinery, Mechanization, Utilization, Union

1. Introduction

Farm machinery utilization improves the quality of field operations (e.g., row planting, more precise plant population, seed and fertilizer placement, efficient utilization of soil moisture) (Rabe, 2017) [11]. It comforts and reduces hard labor, relieves labor shortages, improves productivity and timeliness of agricultural operations, increases resource-use efficiency, enhances market access and contributes to mitigating climate-related hazards.

The use of farm mechanization technologies is equally important in improving agricultural outputs as that of other biological technologies (Gebiso, 2016) [14]. Agriculture is crucial to Africa's development, but only 60% of population depends for job & livelihood, contributed only 21% of GDP in 2016.

Whereas, Africa has 202 million ha of uncultivated land which is 50% of the global total and yields are only 56% of the international average (AfDB, 2016 and Jerome, 2017) [1, 6]. This is because of African farming household may be far more dependent on labor markets than commonly assumed, and thus far more motivated to employ mechanization services.

According to FAO & AUO (2018) [4] doubling agricultural productivity and eliminating hunger and malnutrition in Africa by 2025 will be no more than a vision unless mechanization is afforded utmost importance.

The former of Chairperson of (from 2012 to 2017), African Union Commission Dr. Nkosazana Dlamini Zuma, said that "Our goal is to send the hand hoe to the museum and liberate the African farmers from the back breaking drudgery of tilling the land by hand." Cited in (FAO & AUO, 2018) [4]. Development partners have also begun to promote mechanization, and the world's leading agricultural machinery companies recognize Africa as an emerging market (FAO, 2016) [3].

Ethiopia's is one of African country whose economy is transforming rapidly, mostly driven by growth in the agricultural sector. This growth has led to significant poverty reduction, given the large share of the country's population that lives in rural areas with livelihoods that depend on agriculture.

Among the mechanisms through which agricultural growth has been achieved is through intensifying land use and increasing labor productivity, including mechanization. Governments of Ethiopia clearly understand that mechanization is very essential component in food production effort. Ethiopia also has policy instruments that address multiple dimensions of sustainable mechanization (the 2014 "Ethiopian National Agricultural Mechanization Strategy" (MoA, 2014) [8].

Sheahan and Barrett (2017) [13] research finding also had shown that in Ethiopia, Malawi, Niger, Nigeria, Tanzania, and Uganda 1% of all households across the six countries own or hire tractors. They found that mechanized ploughing was most widespread 5.5%, while mechanized threshing and harvesting was reported by 3 and 2 % of households, respectively. There are considerable numbers of agricultural mechanization technologies that have been developed, modified and adopted by different mechanization research centers and imported by technology dealers.

Even though a variety of new machines have been developed and/or introduced to mechanize various operations in agricultural production, utilization of such technologies lags behind or sometimes not found at all. As a result the amount of yields and benefit from this sector is low.

Farm machinery is beneficial technology multiplication and maintains the quality seed production and supplies. Farm machinery like tractor, plough disc, harrow, threshing and winnowing are important for different farm practices. Beside on time land preparation is enabled when there is adequate farm machinery. Knapsack sprayer and planters are important to grow better crop. However, seed multipliers and enterprisers in SNNPRS did not utilize at list optimum level of farm machinery.

In addition, private and government organizations utilize different farm machinery for land preparation, planting, weeding, and chemical application harvesting threshing and for grading of seed. So, in order to intensify farm mechanization research and to solve the constraints of unions, cooperatives and organizations in relation to utilization of machinery, this research activity would have significant contribution.

In addition, before testing and releasing different machinery design in our region, first it should be necessary to identify the level of utilization and assess factors affecting utilization of farm machinery. However, private and government organizations utilization status and associated constraints were not well studied so far. Therefore, the objectives of this study were describing mechanization status and to assess the determinate of farm machinery utilization level among private and government organizations of Southern Regional State of Ethiopia.

2. Methodology

2.1 Types and Sources of Data

The types and sources of data were both primary and secondary. The major primary sources of data were structured questionnaires, informant interviews. Most of the primary data were collected from each of randomly selected private state, farmers association of seed multiplier who have or not have farm machinery and government organizations by using structured questionnaire. The required secondary data were collected from regional, zonal and woreda level of Agriculture and Natural Resource Bureau, relevant published and unpublished reports, journals, books, and websites.

2.2 Research Design

A cross-sectional research design was carried out on randomly selected private state, union and government organizations of seed multiplier. Quantitative data were collected and appropriate analysis method were employed to meet the objectives of the study.

2.3 Sampling Method

To select sample of the respondent's multistage sampling technique was followed. In the 1st stage, the two sectors or bureaus (Agricultural Research Institute and South Seed quality control) were selected purposively based on farm machinery related issue. In the second stage from the zones research center and farmer-based seed interpose and private sectors in which farm machinery were distributed. Purposive sampling technique was used based on the extent of farm machinery utilization.

In the third stage from the selected zones and research center famer-based seed multiplying unions and privet sectors were identified by the collaboration of regional seed quality control agency after that the association, private sector and government organization were randomly selected. Finally, from the all selected five agricultural research centers research work process sources technology seed multiplication researchers' technical assistants and farm machinery operator were selected.

2.4 Target Population

The survey was targeted on seed multiplying enterprises like research centers union's private sectors and institutes actively participating in 2021. Seed multiplying enterprises both who have farm machinery and have no farm machinery but who were using by rent were selected and participated in the study.

2.5 Sample Size Determination

Table 1: Sample Distribution by SNNPRS, Zone and woreda level

SNNPRS Bureau	**Zone**	**Woreda**	Number of respondent	Source of respondent
Agricultural Research institute	Research Center	All research center	44	Source technology seed multiplication process
Seed quality control agency	Union	20 union	39	Coordinator and committee of the union
	Privet	14 private	34	Privet owner
	Institute	2 institute	9	Seed multiplication expert
Totally 126 respondent were selected for survey the prepared questioners purposely				

Source: Secondary data (2021/2022)

2.6 Method of Data Collections

This study was using a combination of both primary and secondary data collection methods. The primary data were collected through individual structured interview by explaining the objective of the study to the sampled respondent. And prepared questionnaires were distributed to randomly selected respondent from different associations private and government organizations which were using farm machinery. The characteristics of the organizations and

their relationship with utilization of farm machinery were associate constraints regarding to effective utilization of farm mechanization technology would be identified. Structured.

2.7 Methods of Data Analysis

The data were analyzed by using a combination of descriptive statistics, inferential statistics and binary logistic regression model through STATA version 15 software and charts, graphs, and Tables were used to present the data.

2.7.1 Descriptive Statistics

Descriptive statistics like percentage, frequency, mean, minimum, maximum, and standard deviation, inferential statistics like T-test and chi-square test, and binary logistic regression model by STATA version 15 software. Charts, graphs, and Tables were used to present the data.

2.7.2 Binary Logistic Regression Model

Logistic regression has acquired advantage over others in the analysis of dichotomous outcome variables i.e., users and nonusers of farm machinery. There are two primary reasons for choosing the logistic distribution. The first one is from a mechanical point of view and it is an extremely flexible and easily usable and the second reason is that it lends itself to a meaningful interpretation. The model is simpler in estimation than the probit model (Rubinfeld, 1981, Gujarati, 2003, Gujarati, 1995) [10, 2, 9].Therefore, a binary logistic regression model was used to study the decision behavior of farm machinery utilizing enterprises and why binary is the dependent variable (enterprise decision on farm machinery utilization versus non-utilizing) has the nature of dichotomous or binary responses. The logistic distribution function for identification of enterprises decision to use farm machinery can be defined as:

$$pi = \frac{1}{1 + e^{-zi}} = \frac{e^{zi}}{1 + e^{zi}} \quad (1)$$

Where, p_i is the probability of utilizing farm machinery,

$$zi = \beta 0 + \sum \beta i Xi + ui \quad (2)$$

Where,

i= 1, 2, 3,----------, n

e = represents the base or natural logarithms.

β_0 = is the constant (constant) term; β_i= are regression coefficients for independent variables.

U_i= refers to the error term which is an independently distributed random variable with a mean of zero.

X_i= pre-intervention characteristics.

The probability that an enterprise belongs to the non-user group is:

$$1 - pi = \frac{1}{1 + e^{zi}} \quad (3)$$

Therefore, by dividing eq 2 by eq 3 so the odds ratio in support of utilization of farm machinery was obtained are as Follows:

$$\frac{pi}{1 - pi} = \frac{1 + e^{zi}}{1 + e^{-zi}} = e^{zi} \quad (4)$$

The left-hand side of equation (4) $\frac{pi}{1-pi}$ is simply the odds ratio in support of utilization of farm machinery. It is the ratio of the probability that the enterprise would utilized in the farm machinery to the probability that he/she would not utilized farm machinery. Finally, by taking the natural log of equation (4) the log of odds ratio can be written as:

$$Li = Ln\left(\frac{pi}{1-pi}\right) = Ln\left(e^{\beta 0 + \sum_{j=1}^{n} \beta j x j i}\right) = zi = \beta 0 + \sum \beta j x j i + ui \quad (5)$$

Where, L_i is log of the odds ratio in support of utilization of farm machinery, which is not only linear in X_{ji} but also linear in the parameters.

Where β_0= the intercept. It is the value of the log odd ratio *Pi*/1 - *Pi*, when X or explanatory variable is zero. β_1= the slope, measures the change in L (logit) for a unit change in explanatory variables (X). Before running the binary logistic regression model, multicollinearity among the explanatory variables was checked. According to Gujarati, (1995) [9]., continuous variables variance inflating factor (VIF) and condition index (CI) and discrete variables coefficient of contingency (CC) were employed to check the colinearity effects among the variables. A VIF value greater than 10 and CC value greater than 0.75 is used as a signal for a strong multicollinearity (Gujarati, 1995) [9].

2.8 Definition of Variables

2.8.1 Dependent Variable: The dependent variable of the study has dichotomous nature**.**

Which it represents the observed use of farm machinery It was represented in the model as yes=1 for the enterprise that uses farm machinery and no=0 for enterprise that did not use farm machinery.

2.8.2 Independent Variables: based on the research's knowledge of the farm machinery.

Utilization of the study area, 8 potential explanatory variables were considered in this study and examined for their effect on enterprises' use of farm machinery. The independent variable like land size, year of establishment, age of operators, educational status of operators and number of operators, availability of spare part, access to training and maintenance service of farm machinery.

3. Result and Discussion

Farm mechanization utilization has been very useful to get nearly a significant change in technology seed multiplication. Thus, there is strong need for farm mechanization of agricultural activities. The timeliness of operations has assumed greater significant in obtaining optimal yields from different seed multiplication, which has been possible by way of mechanization.

3.1 Characteristic of farm machinery utilizer enterprises

Characterization of farm machinery users is essential to understand the level of machinery utilization, number of machinery, year of establishment, amount of annual budget, land size and where the organizations are located. This part represents the results and characteristics of the technology seed multiplication enterprises.

Table 2: Descriptive statistic of seed multiplying enterprises

Variable	Obs.	Min.	Max.	Mean	St. Dv.
Age of operators	126	24	65	29..46	18.44
Educational status of operators	126	4	Degree	8	4.82
Land size of the enterprises	126	0	760	146	214.28
Year of establishment	126	1	60	18.66	17
Number of operators	126	0	10	1.63	1.79
Number of farm machinery	126	0	33	10.46	9.12
Annual Budget	126	50,000	80,000,000	3,379,749	10,600,000

Source: Own survey data analysis (2021/2022)

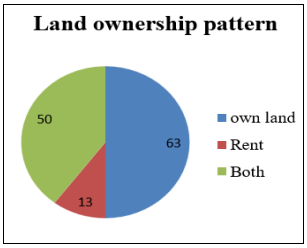
Table 2 indicates that the descriptive statistics of different variables and presented as follows:

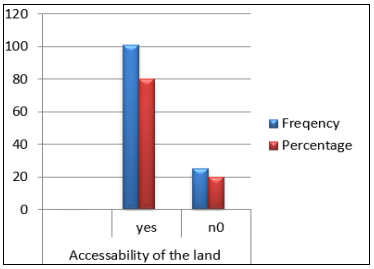
The average age of tractor or farm machinery operators in seed multiplying enterprises and is about 29 years old and 4 months while the minimum and the maximum age is 24 and 60 years respectively. This shows that most of farm machinery operator were adults and in productive age group. Educational status of tractor or farm machinery operators was estimated on average 8 grades with standard deviation 4.78. The uppermost level of education of tractor or farm machinery operators is bachelor degree holder and the minimum level of educational status of tractor or farm machinery operators is grade four. The land size used in seed multiplication in hectare was estimated at an average 214 hectare. The highest land size is 760 and the minimum land size is 3 hectare.

Year seed multiplying enterprises establishment is ranged from a minimum of 1 year to a maximum of 60 years. The average year of establishment for seed multiplying enterprises was 16 years.

The highest annual budget seed multiplying enterprises hold per year is 80,000,000 birr and the minimum annual budget per year is 50,000.00 birr. The average annual budgets for seed multiplying enterprises were 3,379,749.00 Ethiopian birr.

The number of farm machinery which was available for seed multiplication purpose is ranged from 0.0 ha to 30. The average number of available farming machinery is 10 with standard deviation 9.84. So, this indicates that seed multiplying enterprises have sufficient number of farm machinery.





As it shown in the above pie chart: half of the enterprises multiple their seed on their own land and 40% by both own land and rent, only 10% used rent. As it is shown in the Tables 4 below, 90% of the research centers multiply their source technology in their own land when some time during shortage of land they might take rent. Whereas 59% of the unions multiply seed on both farmers land and rent because they are out growers. They also take land for rent to increase their amount of seed production. According to the bar chart, 80% of the respondents have suitable land for farm machinery utility.

Table 3: Land ownership pattern of seed multiplying enterprise

Enterprise	Own land	Rent	Both	Total	
	freq	freq	Freq	Freq	%
Research center	40	0	4	44	35
Union	9	7	23	39	31
Private sector	7	12	15	34	27
Institute	3	0	6	9	7
Total	59	19	48	126	100
Chi-square value=46.04 and p-value=0.000					

Source: Owen survey data 2021/2022

As it is shown in Table 3 above research centers multiply their seed by using 90% of their own land and 10% of their own and rent, 18% and 31% of unions multiply their certified seed on their own land and rent land respectively. Whereas 59% of unions multiply their seed both on their own land and rent.

3.2 Source of Farm Power used for different farm activities in SNNPRS

The Agricultural operation will be done by different sources of power namely: humans, animals and machines are all used as sources of power in agriculture production. When undertaking different operations on a farm, a certain amount of work is required to complete the task. As this work is undertaken over time, so that it is then said power.

In southern region of Ethiopia there are different types of agricultural activities and technology seed multiplications and the main sources of power for land preparation are sowing, weeding, pesticide and fungicide spraying, harvesting, threshing winnowing and sorting, packing was done by human muscle, oxen draft and mechanical power.

As Table 5 below shows that 82% of seed multiplication enterprises used mechanical power for land preparation, the remaining the same 6% are by human power, draft animal, human and draft animal respectively. The other farm activities like 67% of sowing 90% of weeding, 74% of chemical spray, 70% of harvesting, 42% threshing, 55% of winnowing and 61% of sorting are carried out by using human power and only 32% of seed multiplying enterprises used farm machinery for seed production. Whereas, 56% is by using human power and7% is using mechanical and human and the remaining 4% is by human and animal draft. Therefore, majority of seed multiplying enterprises were using human power for seed production.

70% seed multiple enterprises have farm machinery like tractor, harrowing, disc plough, planter, chemical sprayer, harvester, thresher, winnower but level of utilization is low. The problem of tractor breakdown dose most frequently occurs 88% during farm ploughing and 12% row preparation.

In southern region there are two categories of farm machinery users: out growers and in growers. Out growers are seed multiplying enterprises who grow agricultural crop on land of different farmers group and who have common interest. The farmers produced improve seed by receiving from union with in their own land and bring seed to the union with discount of 30% and share from the profit are known as in growers. The union provides agricultural inputs like tractor, combined harvest with rent and improved seed, fertilizer and so on.

Table 4: Source of farm power used for different farm activities in the region

Farm activities	Mechanical Power		Human power		Draft animals		Mechanical & Human		Human & Draft animals	
	Fre.	%	Fre.	%	Fre.	%	Fre.	%	Fre.	%
Land preparation	104	82	7	6	8	6	0	0	7	6
Sowing	13	10	85	67	4	3	17	14	7	6
Weeding	13	10	113	90	0	0	0	0	0	0
Spraying	4	3	93	74	0	0	29	23	0	0
Harvesting	13	10	88	70	0	0	10	8	15	12
Threshing	49	39	53	42	0	0	14	11	10	8
Winnowing	53	42	69	55	0	0	4	3	0	0
Sorting	45	36	77	61	0	0	4	3	0	0
Packing	62	49	49	39	0	0	4	3	11	9
Total	356	32	634	56	12	1	82	7	50	4

Source: Owen survey data 2021/2022

3.3 Causes for low Level of farm machinery utilization

The level of farm machinery utilization was affected by different factors across agricultural farm enterprises and research centers. As the statistical data analysis result indicated in Table 6 below, the cause of farm machinery breakdown or failure in the study areas. Lack of genuine spare parts, low skilled operators, poor maintenance, obsolescence, over-loading and poor-storage are ranked as 1st, 2nd, 3rd, 4th, 5th and, 6th, respectively.

Table 5: Causes of farm machinery under utilization

Constraints	Rank						
	1st	2nd	3rd	4th	5th	6th	Index*
Lack of genuine spare parts	20	24	28	18	0	2	0.54
Low skilled Operators	13	34	24	6	13	0	0.51
Poor-maintenance	24	16	15	8	20	1	0.46
Obsolescence	22	7	5	29	15	9	0.41
Over-loading	9	5	10	28	35	3	0.32
Poor-Storage	0	4	2	4	4	78	0.16

*Index=[(6 for rank 1)+(+(5 for rank 2)+(+(4 for rank 3)+(3 for rank 4)+(2 for rank 5)+(1 for rank 6)] divided by sum of all constraints mentioned by respondents.

Source: Owen survey data 2021/2022

The causes of farm machinery underutilization were stated in the table above. Of these factors lack of genuine spare parts and accessory of farm machinery was found the first leading causes of underutilization of farm machineries with its index 0.54. So, provision and availability of genuine spare parts and accessories were indispensable actions.

The second cause for underutilization farm machinery is low level of skilled operators with its index 0.51 and this is true for all farming enterprises and research centers which results in low productivity and net-profit. This needs a great effort of the organizations decision to recruit skilled operators and train the existing farm machine operators to up lift the profit and productivity of those farming enterprises and research centers

The third rank that caused underutilization of farm machinery was poor maintenance of farm machinery its index was 0.46 which means it has significant effect on the underutilization of farm machinery within farming enterprises. This can decrease the productivity of the target crop commodity and in turn will affect the return of farm per unit area.

To sum up, the obsolesce can affect the utilization of farm machineries with its cause of underutilization and its index was 0.41 which indicated that it can affect the utilization of farm machineries across farming enterprises and research centers in SNNPRS. Obsolescence of farm machinery reduces the efficient working of farm operation. Repairing farm machinery on time is very essential to save the life of the machines to increase their efficiency.

3.4 Farm mechanization constraints

The farm machineries utilization affected by different factors in private agricultural investors, farmers union, and research centers. These factors can reduce the efficiency and productivities of the machines in the process of crop production. There were different challenges of farm machinery were evaluated to describe their effect. The Table 3 below is indicated the evaluation result of the respondents in respect to factors affecting farm machinery.

Table 6: Constraints of farm machinery utilization

S. No	Problem faced by center/gov't/private sector	Yes		No		Rank
		Fre.	%	Fre.	%	
1	Small farms and Fragmented land holding	97	77	29	23	13
2	High price of agricultural machinery	122	97	4	3	1
3	Inadequate loan distribution/lack of fund/capital short	106	84	20	16	10
4.	lack of small, suitable and cost wise machinery	113	90	13	10	7
5	Low price/demand of harvested agricultural production	78	62	48	38	15
6	Lack of skilled machinery operators	116	92	10	8	5
7.	Lack of maintenance/Poor maintenance	119	94	7	6	3
8.	Poor transportation service in rural area	74	59	52	41	16
9	Lack of regional strategy for agricultural mechanization	104	82	22	18	11
10	Ineffective linkage of research, and agriculture industry	108	86	18	14	18
11	Lack of motivation to capitalize in agriculture sector	101	80	25	20	12
12	Lack of common understanding about mechanization	108	86	18	14	8
13	Transmission problem of new farm machinery	120	96	6	4	2
14	Lack of agents by mechanization expertise at rural area	71	57	55	43	17
15	Problem of topography	80	63	46	37	14
16	Perception of low quality of machinery produced inside	118	93	8	7	4
17	Weak state support for manufactures and distributors	116	92	10	8	6

Source: Owen survey data 2021/2022

In the first place among various factors high price of machines was found the leading factor that affected the farm machinery utilization. As the descriptive data analysis results shown that 97% of respondents ensured that high price is the top in affecting factors; and 3% of the respondents replied that the price has not effect on farm machinery utilization.

Transmission problem of newly generated farm machine was the second ranked challenge for farm machinery utilization. As the respondents' statistical data analysis result described 96% of the respondents were replied it is serious constraints in utilization of farm machinery and can reduce the efficiency of the productivity of machines. The rest of 4% were responded as transmission of a machine was not a problem in reduction of productivity of machine. Besides this based on the Table 5 described above, lack of farm machinery maintenance is one of the challenges on farm machinery utilizations.

The result indicated that 94% of the respondents were answered as it was challenge that affecting the efficiency of machinery. And on the other hand 6% of the respondents were not recognized the effect of transmission as a problem. Also manufacturing of low quality standardized machine affected the potential efficiency of farm machinery. As the computed data result revealed that 93 % of the respondents assured the low quality of machines can affect machinery utilization of the enterprises, but 7% of the respondents didn't confirm the negative effect of farm machineries in different enterprises. This didn't because now a days newly innovated farm machinery supported by non-governmental organizations without permission of bureau of agriculture and feasibility and efficiency test by research institutions without any training how to utilize them. So that the machinery simply put in the shade of seed multiplying enterprises without giving any function.

Finally lack of skilled operators and weak state support for the enterprises were equally considered as a challenge of the utilization of farm machinery in the sampled seed multiplying enterprises. The computed data result shown that 92% of respondents ascertained that these factors affected utilization of farm machinery and 8% of the respondents didn't ascertained the effect of the two factors on farm machinery utilization.

Farm machinery operators

Trained operators were not available in different farm organizations as the key informant interview and focus group discussion. The farm machinery operators began their work without any training and on the other hand farm machineries become computerized and fitted high hydraulic systems. Even in our nation Ethiopia there are not operators of modernized farm machineries in those farming enterprises. The great challenges were complexity of farm machineries and untrained farm machineries operators.

Farm machinery maintenance center (garage) and spare parts

The machinery experts were not available to maintain the damaged and stacked machines. Because they were not well educated and trained in the field of farm machineries. And on the other hand lack of spare parts even in the country, and it needs a considerable volume of dollars to purchase the spare parts. Most of the time farm organizations enforced to purchase/import the spare parts which demands significant volumes of dollars which is difficult to get easily because of the dollar exchange in Ethiopia.

Access to genuine spare part of farm machinery

Importers of agricultural machinery import different machines without spare parts. This is because they are allowed and licensed to import only farm machinery. On the contrary, in southern Ethiopia there were no tractors and their spare parts importers to tackle the problem. The problem is persisted in research centers, seed multiplication enterprises and they have been travelling long range distance like Addis Abeba, Adama, and Debreziet which creates delay of farm machinery maintenance and timely based farm operation. Due this farm plough lags behind and which result in time pulverization of soil, poor circulation of air, poor absorption of water in the soil.

3.5 Future opportunities for utilization of mechanization

The farm machineries' availability at research centers, unions and private sectors good opportunity to utilized it and produce more improved seed for the farmers. Availability of farm land for seed multiplications has good advantage to produce more improved seed by combining farm machinery and other inputs. Now days the initiation of farmers and expansion of cluster farming in the region have good opportunity to produce seed by using farm machinery. Establishment of Agricultural mechanization director at Bureau of Agriculture and natural Resource and research system at Southern Agricultural Research institution a stream set up. Newly emerging mechanization oriented seed enterprises and good government focus and direction to the sector are some of good opportunities to utilize farm machinery in the region.

3.6 Determinant of farm machinery utilization

Before analyzing binary logistic regressions model, assumed independent variables were tested for possible presence of multicollinearity problem among the explanatory variables were tested on the regression and the analysis explanatory variables were highly correlated among themselves. Yet, fitting important variables in the model multicollinearity test among variables used in the model was performed by using variance inflation factor (VIF). There were no serious problems of multi collinearity in regressor variables (Table 7).

Whereas in order to check for the possible existence of heteroskedasticity problem a Breusch-Pagan test was applied and showed the absence of the problem. Therefore, all the model outputs were estimated using robust standard errors to correct for heteroskedasticity results of the analyses are presented below near to Table 7.

Table 7: Variance inflation factor

Variable	VIF	1/VIF
NoFM	2.06	0.484629
AgeOperat	1.86	0.538459
Education	1.23	0.810299
LandSize	1.39	0.720109
YearEstab	1.65	0.606931
NoOpera	1.51	0.662906
Mean VIF	1.62	

Source: Own computation of STATA

Heteroscedasticity Test Result

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance
Variables: fitted values of FMU2
chi2(1) = 0.22
Prob>chi2 = 0.6391

As shown above the heteroscedasticity was tested by using Breusch-Pagen test. It tests whether the estimated variance of the residuals from a regression are dependent on the values of the independent variables.According to the above heteroskedasticity test this result is found inrejection of the existence of heteroscedasticity hypothesis as (p= 0.6391) and there was noneed to make the standard error robust. Because the high p-value indicates that heteroskedasticity is not a problem here.

As shown in Table 9 below estimated coefficients of the logistic regression revealed that the explanatory variables 'Land size', 'number and age of operator', 'training', 'and 'maintenance 'positively and significantly influence the enterprise decision to use farm machinery. On the other hand, 'number of farm machinery' has significant and negative impact on the decision of the enterprises to utilize farm machinery.

Land size was also found to have a positive and significant influence on enterprises likelihood to utilize farm machinery at 1% significant level. The result indicates that, a one hectare additional land the enterprise allocated for improved seed multiplication/or production would increase the enterprise likelihood of farm machinery utilization by 0.5%. This might be due to access to more arable land and will encouragement of enterprises to multiple or produce more improved seed which leads to surplus production for the market. The result concedes with study of Schmitz and Moss, (2015) [12] the introduction of new farm machinery technologies has resulted in an increase in both farm size and agricultural output.

Table 8: Determinants of farm machinery utilization

Avosold	Coef.	Std. Err	Z	P>/Z/
NoFM	-.1268542	.051184	-2.48	0.013**
YearEstab	.0167051	.0214865	0.78	0.437
Landsize	.0056169	.0026834	2.09	0.036**
NoOperat	.865047	.3472154	2.49	0.013**
AgeOpera	.0329774	.0186639	1.77	0.077
Education	.0671056	.0859272	0.78	0.435
Training	1.885539	.8484814	2.22	0.026**
Maintenance	1.32088	.7151764	1.85	0.065*
SparePart	.3377654	.6252919	0.54	0.589
_cons	-3.24945	1.106807	-2.94	0.003
Log-likelihood= -48.99, Number of obs= 126, LR chi2(9)= 60.99Prob>chi2 = 0.0000, Pseudo R2 = 0.3836				

Source: Computed from own survey data collected in, 2021/2022
***and ** Significant at p<1% and 5% level

Number of farm machinery was negatively affected enterprises' likelihood to utilize farm machinery and statistically significant at 5% level. An increase in the number of farm machinery that the enterprises would have to produce improved seed would decrease the probability of the enterprises to utilize farm machinery. This because of the increment or availability of farm machinery by itself does not indicate the utilization of farm machinery. Because some of the machinery planters donated from non-governmental organizations are simply damped in garage and done without knowledge how to utilize them.

Furthermore, the number of tractors or farm machinery operators significantly and positively determines the extent of seed enterprises' utilization of farm machinery. Thus, the number of operators is among the significant factors explaining seed enterprises' decision regarding the extent of farm machinery utilization in the study area.

Access to training in particular to farm machinery handling, and operation, it is known to positively affecting farm machinery utilization. While the researcher found evidence that having more training positively and significantly contributed to farm machinery utilization. As the farm machinery operators got more training in regard to how to handle and operate tractors, planter combiners and threshers: the probability of utilization of farm machinery would be increased.

Access to farm machinery maintenance service in study area increased, it is known to positively affecting farm machinery utilization. While the researcher found evidence that giving more maintenance service for broken farm machine, it has positively and significantly contributed to farm machinery utilization.

4. Conclusions and Recommendations

4.1 Conclusions

The farm machinery utilization is a very essential practice in agricultural production and technology seed multiplication which enhances the timely utilization of agricultural practice. Also it ensures on time implementation of different levels of farm operations in the field of agriculture. It can cover the areas beyond human power capacity.

Farm mechanization coordination directorates were established as a country seven years as a region in bureau of agriculture and natural resource since 2018GC and as Agricultural Research Institute source technology multiplication seed research process on farm management and mechanization research since 2020GC.

As the study data analysis results shown that, for seed multiplying enterprises the source of power was 82% of land preparation with mechanical power, the reaming 18% was manpower, draft animals, mechanical and human and human and draft animal. In general source of farm power used in different activities such as only 32`% was by mechanical power, 56% by human power, 7% by mechanical and human power, and 5% animal and draft animals. These results, it was concluded that majority of technology seed multiplication activities were done by human power. Hence, the farm enterprises should give emphasis on the utilization of farm machinery 70% of seed multiplying enterprises have farm machinery like tractor, harrowing, disc plough, planter, chemical sprayer, harvester, thresher, winnower. So, the main cause for low utilization of farm machinery was lack of genuine spare part with rank index 0.54, low skilled operators with the rank index of 0.51, poor maintenance with the rank index of 0.46, obsolescence, over-loading with rank index of 0.41

There were various farm machinery utilization constraints during enterprises survey in different agro ecologies in the region. The first leading constraint was high price of agricultural machine. According to the data analysis results it was covered about 97% of the utilization challenges was contributed by high price of farm machinery. So, that

stakeholder should provide appropriate farm machinery in affordable price. The second challenge was transmission problem of new farm machinery which it took a share of 96% of the whole challenge. And the third challenge for farm machinery utilization was lack of farm machinery maintenance garage which covered 94% of the challenges. Finally among the constraints of farm machinery utilization, the low perception on machinery produced in Ethiopia which covered 93% of the challenges.

Binary Logistic Results shown that factors that affect significantly the utilization of farm machinery among seed enterprises were a number of farm machinery, farm size, number of operators, access to training and maintenance services.

In research centers, improved seed multiplying unions, and private enterprises there are different farm machineries which were new but dysfunctional before operations in farm practices and also damaged machines. Hence, the enterprises should maintain the damaged farm machinery on time and the newly introduced machines should be checked and let them to operate in farm practices.

As the data analysis results shown that, there are various causes of underutilization of farm machinery; lack of genuine spare parts, low level skilled operators, poor maintenance and machine obsolesce were the major causes of farm machinery utilization. Therefore importers of farm machinery spare parts should be encouraged.

4.2 Recommendations

Regional government and concerned stakeholders should give short and long terms skill updating trainings for experts of farm machinery. The trainings should focuses on utilization and proper handling of farm machinery.

Operators should be holders of technical school certificate and to increase the life of a machine and enhance product of per unit area. The farm machinery coordinating units should be established across the research centers and large scale farm and at the woreda agricultural development offices. For cluster farm practitioners, the farm machinery maintenance centers should be established at average point of distance to reach all cluster farm dimensions.

Agricultural cooperatives, farmers' unions, private sectors and large scale agricultural units should establish standard shade to shelter farm machinery. Because, if there is no shade for malfunctioning farm tools, it is exposed to depreciation, damage and stack that will reduce the efficiency and productivity of farm machinery.

As the smallholder farmers' farmland is very fragmented and scattered, it is difficult to introduce the farm machinery in individual farm level. To tackle such serious problem in the regional level, smallholders' farmers should be organized into cluster farm basis. The government should provide land for seed producing and multiplying unions, private sectors and investors with all access of road and electricity. Government should provide long term loan and on the other hand give tax relief for certain period of time to encourage private investors and importers and exporters of machinery with their spare parts

At the end of each budget year and off season, there should be supervision of the well-being of existing farm tools that allowed the agricultural institution repair and maintain the damaged tools on time. Such practices help operating the plough and other field operations without delay. If there is damage it should be reported to the concerned body of the farm machinery by farm tool experts and tractor operators.

High price of modern farm machinery is one of the challenges for underutilization of farm machinery seed enterprises and unions. To tackle this problem, the government should support these seed multiplier, union and private sectors through availing credit and dollar exchange.

Seed multiplication enterprises in collaboration with farm machinery manufacturing unite should provide training for machinery operators and expertises. In addition to these enterprises, Agricultural research institute, Agriculture and natural resource and seed quality control agency should work coordinately to avail seed supply for farmers.

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