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RESEARCH ARTICLE

ASSESSMENT OF SMALL SCALE FARMERS NEED AND UTILIZATION OF MECHANIZATION IMPLEMENTS IN WESTERN OROMIA, ETHIOPIA

***Gemechisa Yadeta**

Oromia Agricultural Research Institute, Bako Agricultural Engineering Research Centers

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Corresponding author:* **Gemechisa Yadeta

ABSTRACT

Utilization of appropriate agricultural mechanization is expected to enhance the Ethiopia GTP II program implementation. Therefore, this study was proposed to identify the existing improved farm implements and powered machineries for agricultural operations and to survey small holder farmers need for mechanization implements in western oromia National regional state, Ethiopia. Primary and secondary data were used to obtain the target of the objective of the study. Multi-stage sampling procedure was used to select ten districts and twenty sample Peasant association (PAs). Survey data was collected from 185 sample respondents through structured questioner. Only descriptive analyses were employed for the study. The result of the study indicated that, out of the 185 household heads, more than 36% of the smallholder farmers owned either one or no oxen. The average size of land holding possessed by sample households was 2 ha (at least more than the national holding level) during the survey was conducted. In addition, only 22% of sampled respondents own one or more non-farm enterprises income. The results of the survey confirm, mostly 43% the respondent's labor shortage happened during harvesting, while 31% said occurred during threshing time. According to the time series between 1998 and 2008 crop year's different implements distributed thorough the center were decreased and totally 67%, 55%, and 18% of respondent heard, seen and used(either by hire or own as an asset) either one or more improved implements respectively.

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INTRODUCTION

Ethiopia is currently at its GTP II program implementation years. Utilization of appropriate agricultural mechanization is expected to enhance the transformation of rural Ethiopia (Dagninet and Wolelaw 2016). As noted by Brian.s. and Josepj.k. (2016) for sustainable development goal mechanization is agricultural inputs which are very essential to raise labor and productivity. They showed the land and labor productivity remain at low level without farm power and mechanization which show a continuing cycle of poverty from which is difficult to escape. If demand for mechanization can be increased then a more positive cycle of events will take place. The resulting improved productivity will raise levels of savings, which intern will lead to greater demand for productivity enhancing inputs including mechanization. In addition mechanization is application of inputs like tools, implements and powered machinery used for the quality of life of people engaged in agriculture in general. Although agricultural mechanization is an essential input for agricultural production, it is difficult to place it alongside other inputs because it is not a single input like seed and fertilizer, but rather a series of production tools which are used in almost all phases of production (Karim *et al.,* 2013). Especially agricultural mechanization is the application of mechanical technology and increased power to agriculture, largely as means to enhance the productivity of human labor and often to achieve result well beyond the capacity of human labor include tractors, animal or human powered implements and tools, internal combustion engines, irrigation system, food processing and related technologies (Marilyn, 2010). However, according to Karim *et al.* (2013) particularly in developing countries, agricultural mechanization covers all levels of technology from the simplest and most basic (hand tools) to the most sophisticated and powerful. In other words, increasing levels of mechanization doesn't necessarily mean big investments in tractors and machinery, but involves shifting to an alternative combination of the use of land, capital and labour, which results in improved farm incomes either through increased output or through reduced costs, or through a combination of both. Additional other, non-monetary benefits such as a reduction in the drudgery of farm work must also be considered. According to World Bank (2007), the average farmer in sub-Saharan Africa produces only one ton of cereal per hectare – less than half of what an Indian farmer produces, less than a fourth of a Chinese farmer's production, and less than a fifth of an American farmer's production. The cropping systems like multiple and relay cropping can also possible with the help of improved farm implements. Itmeans that, with proper use of improved farm implements farmers can produce more with minimum labour cost (Sanap, 2016). The appropriate choice and subsequent proper use of mechanized

inputs into agriculture have a significant effect on agricultural production and productivity, the profitability of farming, and on the environment. In most cases, the benefits achievable by using advanced and improved inputs such as irrigation, better seed, fertilizer and pesticides cannot be fully realized without an increased application of farm power (Adrianus). So survey of what the farmers have and need was the essential instrument to undertake the GTP II program and future research strategies implementation.

Objective

- To identify the existing improved farm implements and powered machineries for agricultural operations.
- To survey small holder farmers need for mechanization implements in western oromia.
- To provide information for further research program

MATERIALS AND METHODS

Description of the study area: The survey was conducted in western oromia, Ethiopia in five five zone (West Shawa, Horo Guduru Wollega, East wollega, West Wollega and Kelem Wollega). Secondly the study held in 10 district (Ambo and Bako Tibe from West Shawa, Jarte Jardaga and Horo from Horo Guduru Wollega, Gida Ayana and Diga from East Wollega, Guliso and Ginbi from West Wollega and Sayyo and Dale Sadi from Kellem Wallaga zone). Thirdly two PAs from each district totally twenty were selected taking in to account the accessibility to conducting survey and representing different ecologies.

Sampling techniques and type of data: A multi stage procedure was used to select small scale household. From each PAs 8-10 household totally 185 were selected randomly. Both primary and secondary data were collected for this study. Primary data was collected from sample respondents through a structured questionnaire, via face to face interview. These are including household head education level, age, sex, marital status, family size, household asset ownership, household land size, household livestock holding, type of the farmer see, heard and hire/have the improved implements etc were collected for data analysis. Descriptive like tables, percentages, and frequency were used. The most common source of secondary data was annual report of the Bako agricultural engineering research center (BAERC) and concerned zone and woreda agricultural office.

RESULTS AND DISCUSSION

Socio economic characteristics of the household: House hold's socio economic characteristics directly or indirectly influence the amount of and type of agricultural mechanization implements used. The socio economic characteristics of sample households are given in Table 1.The majority of respondents 165 (89 percent) were males. The education figures revealed that 146 (79%) had received formal education and 21% were illiterate. More than half (53%) of the respondents indicated that their age were between 35 and 65 years. and the sample respondent below 35 years were 55(30%). The family age distribution, in general, shows that the population is young. Those who are under 15 years old account for nearly half of the total population of the respondent's family (47%).

Table 1.Socio economic characteristics of the household

	Categories	Frequency	Percentage
1	**Sex**		
	Male	165	89
	Female	20	11
	Total	185	100
2	**Education level**		
	Illiterate	39	21
	Literate	146	79
3	**Age group**		
	Below 35 years	55	30
	35-65	99	53
	Above 65	31	17
4	**Age group of respondents' families**		
	Below 10 years	52	28
	10-14	35	19
	Male 15-65	43	23
	Female 15-65	46	25
	Above 65	9	5
5	**Family above 15 years engaged on agriculture with full time work**		
	Two person only	146	79
	Three and above	39	21

Source: Own survey, 2014/15

On the other end of the age distribution are persons aged 65 and above account 5 percent of the total population of the respondents. The working age population (15-64 years) makes up 48 percent of the respondents families. From these 15-64 years 89 (48%) families who regularly engaged on agriculture by full time basis were 24% persons only. Other engaged by part time or not on agricultural production. As reveled by Adrianus G. R. (nd) the type of supply of technology including farm power will be decided by the farmer's farm house hold composition. The number of families engaged on agricultural activity with their full time above 15 years was to be quickly reduced to only house hold head and its spouse. From this figure we can ask the question where is youth either completed school or not attending schools. The numbers of youth finding work of daily labor or government employments at road side in each capital city of the zone may have effects in decreasing participation on agricultural activity engaged under small scale. This gap need strongly associated with the need of mechanization implements like has occurred in China before some decades (Mc Erlean and Wu, 2003).

Household's Resource Status (Land Holding, Livestock and Income)

As indicated by Sanap *et al.* (2016) land holding, had significant relationship with adoption of recommended improved farm implements by the farmers. The average household's land holding at national level was 1.34 hectares (ERSS, 2013).

Table 2. Household's resources status (land holding, livestock and income)

No.	Categories	Mean	Frequency	Percentage
1	**Total land**	**2he**		
	Below 1.35 he		39	21
	Above 1.35		146	79
2	**Total live stock in (TLU)**	**7**		
3	**Number of oxen**			
	Null		37	20
	Only one		30	16
	Two and above		118	64
4	**Non-farm enterprises income**			
	Yes		41	22
	No		136	78

Source: Own survey, 2014/15

But as indicated in Table 2, the average size of land holding possessed by sample households was 2 ha (at least more than the national holding level) during the survey was conducted. The 0 and 25 hectares were the minimum and the maximum land holding of the respondents respectively. The average livestock in tropical livestock unit was 7. Plowing in the Ethiopian is traditionally done using paired oxen; but surveys showed that more than 36%of the smallholder farmers owned either one or no oxen. So developing a yoke and harness and modified version of the local wooden plough, the *maresha*, suitable for use by a single ox will be needed from agricultural engineering research centers to reduce the problem of these amounts of farmers in the study area. In addition, household members were also asked whether they engaged in off farm activities or not, 22% of sampled respondents own one or more non-farm enterprises income.78% have no any off farm activities rather than agriculture work. Lack of off farm showed there was no surplus of cash to purchase farm machinery.

Specific farming operations and its labor shortage: This study examines the labor requirements associated with different farming operation in order to guide the prioritization of investments in mechanization in the study area. As indicated in table 3, the respondents were asked to prioritize the farming operation they face labor shortage.

Table 3. Specific farming operations and its labor shortage

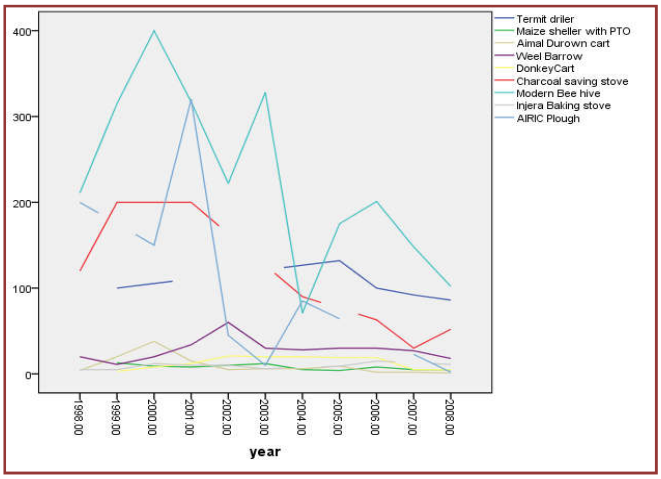
Type of activity on which they face labor shortage	Frequency	Percent
No labor shortage	8	4
Weeding	34	18
Harvesting	79	43
Threshing	57	31
Others	7	4

Source: Own survey, 2014/15

The labor requirements were particularly high for harvesting and threshing time consecutively. The results of the survey showed mostly (43%) the respondent's labor shortage happened during harvesting time. In all districts farmers use sickle for the harvesting all cereal crops, there is no any combine harvester exercised like any other parts of Ethiopia. As indicated by Adrianus G. R. (nd) mechanization technology is required to eliminate labor shortage bottlenecks and to reduce the cost of agricultural productions. Agriculture is characterized by seasonal labor peaks, where large numbers of workers may be hired for relatively short periods (EUAE 2013).From post harvesting activities threshing especially finger millet is a tidies work raised by respondents particularly in area the crop was mostly produced as main crop Gida Ayana and Dale Sadi districts. Thirdly the labor shortage was followed by labor requirement of weeding. Hand weeding is an operation in the recent time substituted by chemical control of weeds (herbicides).Targeting these activities and answering the question may increase the farmer's productivity and decrease the gap of labor shortage than doing what we are feeling to more specific problems in the centers research activities. Cropping practice of each farm operation and labor requirement for major crop may be important topics for future studies for specific choice of appropriate mechanization implement and for further strategic plan in the study area.

Agricultural production constraints in the study area: In Bako Tibe, Diga, Gimbi and Sayo districts the respondents revealed that the primary major constraints was shortage of oxen. High cost of fertilizer was considered as most important production constraints in Ambo, Jarte Jardega, Horo, Gida Ayana and Guliso districts. Especially in Dale Sadi and Gimbi districts, their constraint in increasing their production and productivity were the problem of infestation of wild life and lack of land were appointed as major constraints (see Table 4). Numbers provided out of brackets and inside brackets are respective score and rank; xx = represent it is not included as constraint in rank 1-3.

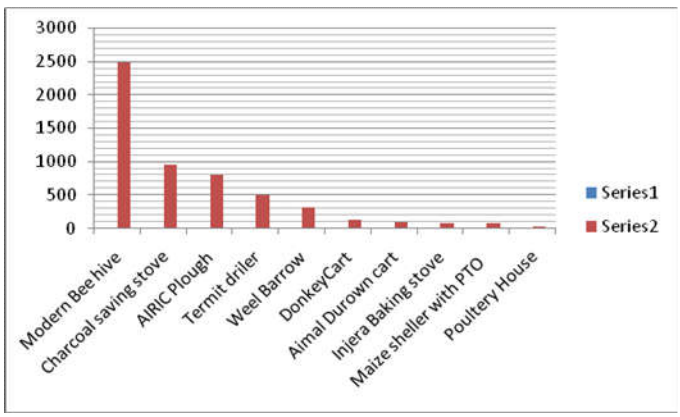
Implement Multiplication and Supply at BAERC: Farmers' access to use of improved farm implements could make a significant difference in increasing adoption of the implements and productivity. According to secondary data obtained from the center annual reports, between 1998 and 2008 crop years, the supply of the implement for eleven year was illustrated by using a graph below



Source: BAERC (Annual report 1998-2008 E.C)

Graph 1. Implement multiplication and distributed by BAERC

In general the graph shows a decrease in number of supply year after year and completely stopping of manufacturing of some implements. For instanc,e normal size engine operated maize shelers. These dawn ward may be due to the research center should not actively involved in the manufacturing and distributing unless mandated only on providing technology (new implements) may lead the above supply graph down ward. In addition the centers assist manufacturer by delivering spare part like frame of beehive to different IMX and biter shaft, ogre shaft, insenteric shaft key way slotting and other spare part of PTO maize shelers to private manufacturer established in Nekemt and Bako town. The total of top ten leading implements of eleven years with high numbers were supplied from modern beehive to poultry house in that descending orders (Graph 2).



Graph 2. Quantity of improved implement produced and supplied *by BAERC in 11 years*

Table 4. Matrix scores and ranking for agricultural production related constraints

Constraints	Districts									
	Ambo	Bako Tibe	Jarte Jardega	Horo	Gida Ayana	Diga	Guliso	Gimbi	Sayo	Dale Sadi
Shortage of oxen	3(2nd)	5(1st)	**	**	4(2nd)	6(1st)	**	4(1st)	5(1st)	4(2nd)
Shortage of labor	**	**	**	2(3rd)	**	**	2(2nd)	**	**	**
Shortage of livestock feed	**	**	**	**	**	**	**	1(3rd)	**	**
Weed problem	**	**	2(3rd)	**	**	**	**	**	**	**
Lack of required quality and quantity seed supply	**	3(3rd)	**	**	**	**	**	**	**	**
Decrease of crop price	**	**	**	**	**	**	**	3(2nd)	**	**
High cost of fertilizer,	10(1st)	4(2nd)	7(1st)	5(1st)	8(1st)	**	5(1st)	**	3(3rd)	**
Disease and Insects problem	**	**	**	**	**	**	**	**	**	**
Soil degradation problem	**	**	**	3(2nd)	**	**	1(3rd)	**	**	**
Lack of improved implements	2(3rd)	**	3(2nd)	**	**	3(3rd)	**	**	**	2(3rd)
Others (shortage of land, wild life problem)	3(2nd)	**	**	5(1st)	3(3rd)	5(2nd)	2(2nd)	4(1st)	4(2nd)	8(1st)

Numbers provided out of brackets and inside brackets are respective score and rank; xx = represent it is not included as constraint in rank 1-3

Table 5. Type of implements displayed by name to respondents during interview

Type of implements	Categories	% of respondent hear/sea/have the implements		
		Heard	See	Have/Hire
Maize Shelers(Engine/PTO)	Yes	55	32	10
	No	45	68	90
Modern beehive	Yes	78	70	16
	No	22	32	84
Modern charcoal stove	Yes	49	36	7
	No	51	64	93
Animal drawn cart	Yes	91	84	40
	No	9	16	60
Mirxi Injera stove	Yes	63	52	15
	No	37	48	85
Total	Yes	67	55	18
	No	33	45	82

Source: Own survey, 2014/15

Status of different improved farm implements in the center to the respondents: There are more than 47 different types of the implements in the display room of the center (Bako Agricultural Engineering Research Center). From those about 5 type of implement's (Maize Sheller, Engine/PTO Operated Maize Shellers, Modern Beehive, Animal drawn cart and Mirx injera stove etc) were exposed by the name of implements to each of 185 respondents through questionnaires whether they were heard, seen it, hired and used it (have as own assets). From those 5 known implements were displayed, on average totally 67% respondent heard either one or more of implements, and these respondents who got a chance to saw by their eye was 55%. As the survey indicates the most area they saw the implements for most respondents was Bako Agricultural Engineering Research Center, especially these who has been gotten chance to participate on any training in the center. On the average 18% of the respondents can used the implement either by hire or own as an asset until this survey's carried out. The type of mechanized farm implements hired and used it was animal drawn carts and Shelers. Things are not wealth until they are in hands of someone who values them (James, 1993) different technologies were only in the hand of research centers. In addition, the farmers have no any chance to hear the economic advantage of technologies to value because there is no implements of which their economic profitability have been done properly in the centers until now, which is the most important factor the farmers need to hear. More than natural resources, more than cheap labor, more than financial capital, knowledge is becoming the key factors of production (Nallusamy, 2008). He indicated the sudden boost of green revolution for increase of production and productivity was created because of quick dissemination of technological information from the agricultural research system to the farmers in the field and reporting of farmer's feedback to the research system is one of the critical inputs in transfer of agricultural technology. For any technologies to be adopted it must be relevant to the needs and aspiration of the end users (Fniae, 2009). The economic advantage of new technology and economic profitably of adopting would attract farmers towards these improved technologies (Mesfin, 2005) and as indicated by (John, nd**)** The criteria for selecting a technology to promote are based, ideally, on the following.

- It must be a very profitable business model that allows entrepreneurs to recover their costs in 3 – 6 months.
- The technology must be affordable to very poor investors (its price be less than 3 month's gross disposable income).
- The technology must be capable of increasing target-group family income.
- The technology must be sufficiently durable to last at least two years without major maintenance.
- The technology must use the local available raw materials.
- The technology must operate efficiently enough to be competitive with other alternatives
- Operation of the technology must be simple.
- The technology must be environmental friendly

So, lack of these the above qualities may tells us the implements stored in exhibition room of the center rather than in the hand of the end users

Conclusion and Recommendation

The study was conducted to assess small scale farmers need and utilization of mechanization implements in western oromia with main objective to identify the existing improved farm implements and powered machineries for agricultural

operations, to survey small holder farmers need for mechanization implements and to provide information for further research program. The data used for this study were both from primary and secondary sources. Primary data was administered to 185 farm households drawn randomly from five zones, ten districts and twenty KAs. The primary data were collected using semi structured questionnaire and the secondary data were obtained from BAERC and related districts. According to the time series between 1998 and 2008 crop year's different implements distributed thorough the center were decreased. Totally 67%, 55%, and 18% of respondents were heard, seen and used (either by hire or own as an asset) either one or more improved implements respectively. The other implements stored in exhibition room of the center were below that status. In addition the surveys showed that more than 36%of the smallholder farmers owned either one or no oxen. This may require either development of harness for one ox or promotion of donkey plow to alleviate the problem. The results indicate mostly 43% the respondent's labor shortage happened during harvesting, while 31% said occurred during threshing time

The fallowing was the recommendation for the study

- Implement used for harvesting have to get priority to be answered to increase the farmer's productivity and decrease the gap of labor shortage
- Displaying the implements on each zone in established display room will increase the linkage between the users and manufacturer with engineering research centers
- Technical institution or dealers should have to target on training hire services especially for high initial cost of the machinery
- Ways of multiplication and distribution of implement until to the stage of commercial demand is generated should considered as especially of mechanization

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