

**Full Length Research**

# **Assessing the constraint and technical evaluation of custom hiring practices of agricultural machineries in major teff, wheat and barley growing areas of Ethiopia**

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The concept of custom hiring facilitates the adoption of improved resource management among the like-minded farmers with commonality in the farming practices by sharing resources at a reduced cost to individual farmers. The aim of this study is to assess technical evaluation of harvest and post-harvest custom hire service in major tef, wheat and barley growing areas of Ethiopia. This assessment was carried out on the potential areas of agricultural machinery custom hire service users and providers. The educational status is varying across the woredas and it has a direct relation with the use of custom hiring services. Most of the time the machines are giving a service relocating from place to place based on request of the farmers. The rate of custom hiring of the farm machines varies seasonally and from place to place. Lack of availability of machinery in time was major constraints. The service has varied challenges and has no well-established support from the government. There is no specific policies and specific guidelines, laws, rules and regulations that guide custom-hiring mechanisms in the country. Farmers very strongly wish to receive custom-hiring services in a timely manner due to lack of service providers and adequate numbers of machines.

**Key words:** - combiner, custom hiring, machinery, rate, tractor, thresher

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## **INTRODUCTION**

Farm power in Sub-Saharan African agriculture mostly relies on human and animal power based on operations that depend on the maresha, hoe and other hand tools (FAO and UNIDO, 2008). FAO estimated that, in the late 1990s, 65% of cultivated area in sub Saharan Africa was prepared by hand, 25% by draught animals and 10% by tractor (FAO, 2013). The percentage of the productive

land that is tilled using motorized traction remains very low. In 2013, Ethiopia imported about 2940 tractors (CIMMYT, 2014). The Ethiopian economy is changing rapidly, mostly from the agricultural sector. This development has brought about significant changes in Poverty reduction in Ethiopia's population Livelihoods depend on agriculture in rural areas. Farm mechanization has been helpful to bring about a significant improvement in agricultural productivity. The quality and precision of

the operations are equally significant for realizing higher yields. The various operations such as land levelling, irrigation, sowing and planting, use of fertilizers, plant protection, harvesting and threshing need a high degree of precision to increase the efficiency of the inputs and reduce the losses (Kiran, 2016). So as to ensure timeliness of various operations, it is quite inevitable to use such mechanical equipment's which have higher output capacity and cut down the number of operations to be performed.

Custom hiring is an emerging concept in farming to facilitate adopting improved resource management among the like-minded farmers with commonality in the farming practices. This system of resource sharing at a reduced cost to individual farmers is in trend in some regions of the country with respect to farm machinery and implements and other (Ranade et al. 2006). Ethiopian agriculture is predominantly in the hand of small farmers working on individual small holdings mainly for house hold consumption. The holdings have remained fragmented and insufficiency (Temesgen et al., 2001). Despite the big potential, agriculture in Ethiopia is characterized by very low productivity. In Ethiopia, out of 85% rural community, farmers holding lands less than 5 hectares were accounted 89.8% (CSA, 2011). The average grain yield for main cereal crops is less than 1 ton per hectare. Mostly farm power is draft oxen and human muscle in the land preparation, planting (CIMMYT, 2014 & Deribes et al., 2014) and post-harvest operations, for main cereal crops, which is the main cause of low productivity. The low productivity in agricultural production has made it difficult to attain food self-sufficiency for the country. The solution to low productivity of agriculture is to improve the traditional farming practices (Azerfeign and kassa, 2008). Agricultural mechanization is an important link in achievement of effective growth in agricultural production. However, the greatest source of farm power in Ethiopia for land cultivation, seed bed preparation, harvesting, and threshing sticks on human and animal power. In general, the majority of small farm holders have been cultivating their lands manually except some parts of wheat growing regions of Arsi and Bale high lands (CIMMYT, 2014).

The farm power availability in Ethiopia is about 0.1KW/ha which is very low compared with other countries power availability (Amana W ,2016). Similarly, since 1997, other Asian countries like Korea, China, India and Bangladesh, farm powers availability were 3.08 kW/ha, 2.91 kW/ha, 0.75kW/ha and 1.17 kW/ha respectively (Agmachin, 1998 & Soni and Ou, 2010). Compared with other developing countries, we have a small amount of farm power availability. There are 111.5 million hectares of land in Ethiopia, 74.5 million hectares of which is suitable for agriculture and 13.6 million hectares of which is currently under production. In

Ethiopia, farmers mostly used traditional implements such as traditional plough tillage called" maresha" (a plough made from a piece of iron and wood), traditional harrowing, manual harvesting (sickle) and animal trampling to thresh the crop. Due to the use of traditional method which causes difficult to complete various farm operations in timely manners which required in production process of crops. Farm mechanization has been helpful to bring about a significant improvement in agricultural productivity and help to complete various farm operations in timely manners. Due to high cost of farm machinery and large agriculture land holding by the farmers; they are not afforded to purchase farm machineries for self-use. Nowadays, farmers are practicing the use of custom hiring of agricultural machineries for varies farm operations. But there is lack of established custom hiring or farm service centers facilitates and polices in the country.

The use of agricultural machinery services is an alternative strategy for food security and sufficiency (ATA, 2014). Many researchers debated on use of tractor for small holder farmers in terms of benefit but the benefit of using tractors is the gain in timelines (Panin,1994), selective use of mechanization technologies could increase the technical efficiency of the smallholder through increasing the labor and land productivity (Dagninet & Wolelaw, 2014). Agricultural machinery Custom hiring system is a solution for small holder farmers compared to owning a tractor due to cost, price and availing non-farm employment opportunities (Mabuza, Sitholeb, Walea, Ortmana, & Darrocha, 2012; Singh, Kingra, & Sangeet, 2013). It is also believed that access of tractors by small-scale farmers through hire services is appropriate option for commercial interests (IFPRI, 2015).

## OBJECTIVE

### General Objectives

The objective of this study is to asses technical evaluation of harvest and post-harvest custom hire service in major tef, wheat and barley growing areas of Ethiopia.

### Specific Objectives

- To determine the existing state of custom-hiring practices for different agricultural operations like combine harvesting, threshing.
- To investigate the technical evaluation and utilization pattern of custom hiring of agricultural machinery.
- To find the constraint in use of custom hiring of agricultural machinery and Suggest suitable measure.

## MATERIALS AND METHODS

### Method of Survey

The questionnaire was developed after reviewing relevant documents and information. This assessment was carried out on the potential areas of agricultural machinery custom hire service users and providers. The survey assessment was taken place in June 2019. Wheat, barley and teff major crop growers' areas were addressed. An 18-page survey questionnaire with 99 questions was prepared to collect primary data from farmers and custom hire providers in the study areas. The first and second stages involved a selection of zones and districts that are representative of barley, teff and wheat growing areas. Kebeles were selected in collaboration with the woreda representative based on their potential. Carefully selected enumerators pre-tested the questionnaire and later collected the data. The 234 respondents were conducted from all kebeles. The analysis of custom hire service was carried out using SPSS software. The study was conducted on Amhara and Oromia selected woredas.

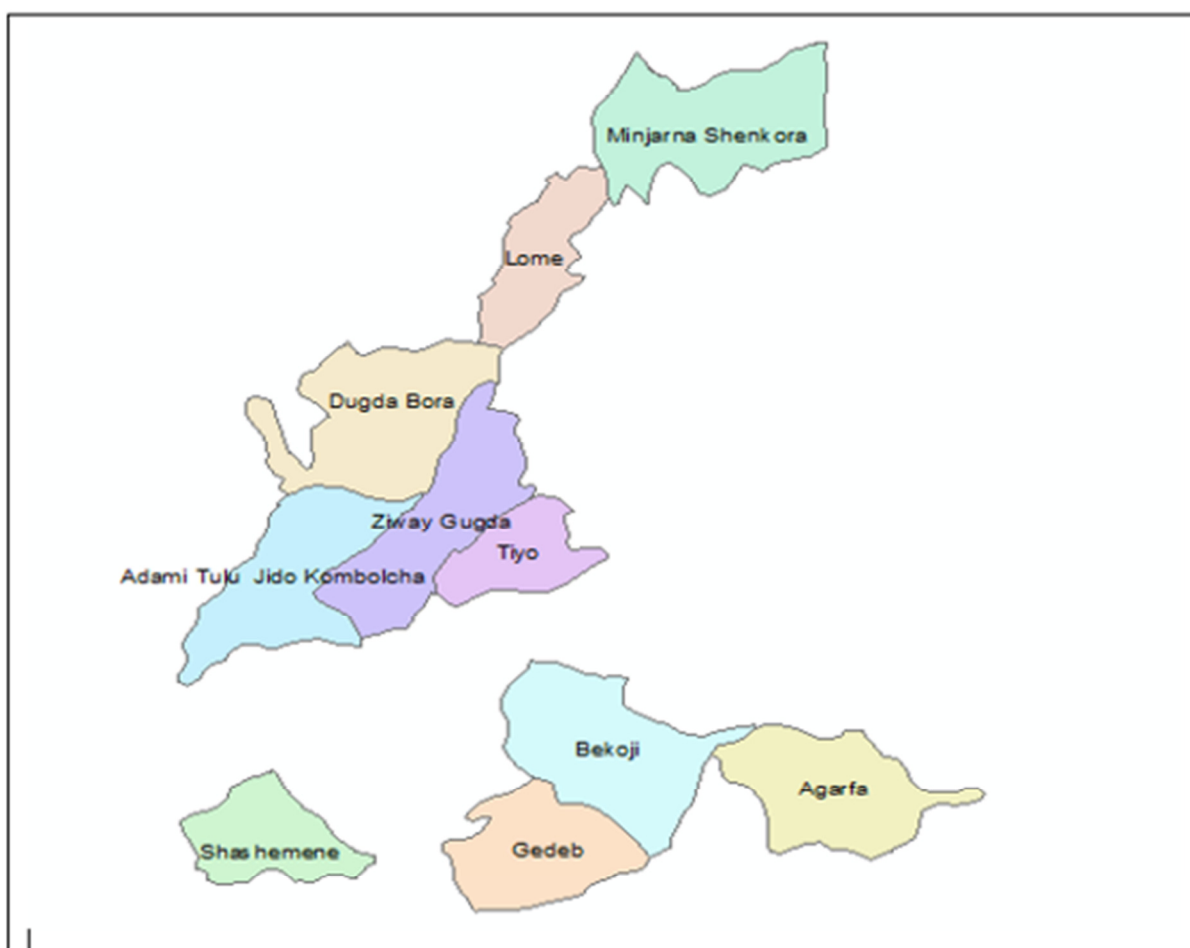


Figure 1. Map of study area

### Selection of Respondents

There is large number of wheat and barley producer farmers in the study area. Though, farmers were selected from each kebele to collect the required information on constraints while using custom hiring of agricultural machines, cost of ploughing and harvesting, pattern of custom hiring, frequent failure of machine in the field, Custom hiring rates and other necessary aspects of crop production. Therefore, a total of 234 respondents were taken into consideration.

## RESULT AND DISCUSSION

The number of the respondents selected from the service provider and the farmers were 234 from different potential locations. The study locations were Agarfa, Gedeb Asasa, Shashemene, Limuna Bilbilo, Tiyo, Batu Dugda, Jido Kombolicha, Dugda Bora and Minjar shenkora woreda. Out of the total respondents 144 were farmers and 90 were service providers were addressed by classifying in to two categories. The general characteristics of the sampled household are presented in the Table 1. The major crop types selected during the survey was teff, wheat and barley. The selected crops selected based on their production capacity in the vicinity. The average land holding size was 1.9 ha from MinjarShenkora wereda and 2.7 ha from Agarfa wereda, Arsi and west Arsi zones. . The average land holding size was 2.5ha. The major crop types are teff, wheat and barley and their productions are 19, 39 & 45 qt/ha respectively

**Table 1.** General characteristics of sampled households

SN	Variable	Locations							
		MinjiarnaShenkora woreda - Amhara Region				Agarfa. Gedeb Asasa. Shashemene. Limuna Bilbilo. Tiyo. Batu Dugda. Jido Kombolicha. Dugda Bora woredas-cromia region			
		N	mean	min	max	N	mean	min	max
1	Age of HHH	45	47	24	77	163	41	24	72
2	Own Land (Ha)	36	1.9	0.25	8	115	2.7	0.25	10
3	Rented Land (Ha)	19	1.5	0.5	4.5	52	2.7	0.5	10
4	Production (Qt/Ha)								
	• 4.1. Wheat	29	35	18	46	163	41	25	52
	• 4.2. Teff	32	22	12	28	25	18	9	22
	• 4.3. barley	NA	NA	NA	NA	53	45	20	60
5	Soil Type	clay loam				black			
6	Land Quality	flat				flat			
7	Major Crop	teff and wheat				wheat and barley			

### Educational Status of the Study Area

According to the study 12.66% are illiterate, 4 0.66% are attended primary school, and others 9.3%, 25.73%, and 11.62% are attended their middle school, high school and college respectively in both study areas. The educational status is varying across the woredas and it has a direct relation with the use of custom hiring services. The educational level of the farmers community has a direct impact on the awareness, use and management of agricultural machineries.

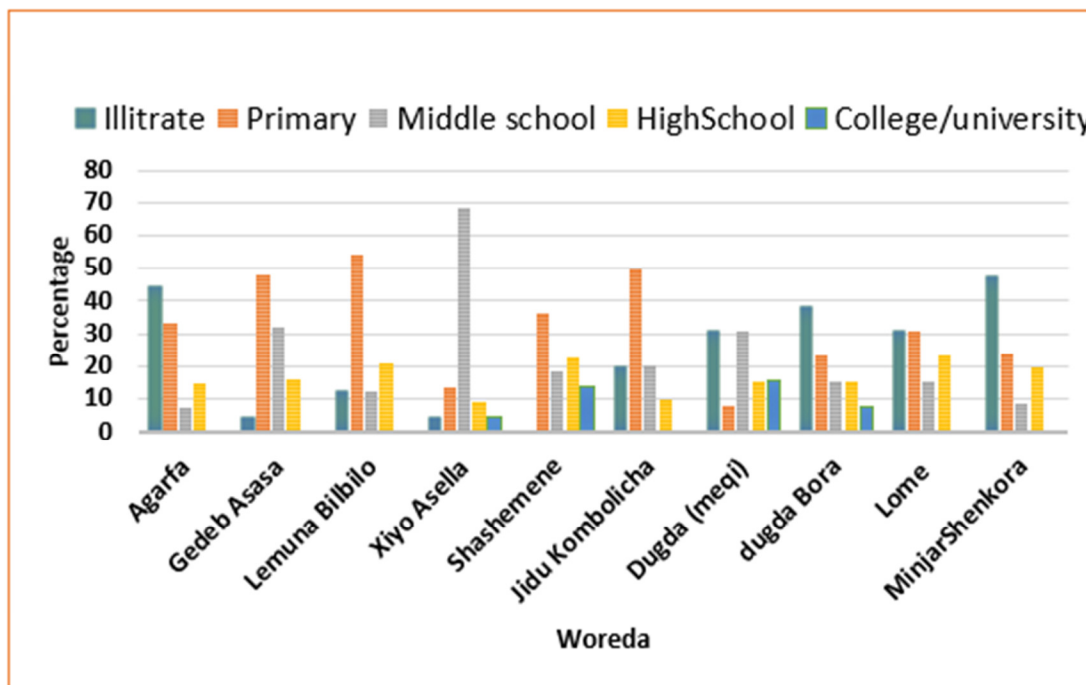


Figure 2. Educational profile by woreda

The study reveals that more educated communities used a custom hiring of agricultural machineries. Unlikely, according to the study sampled areas in Fig 2, reveals that farmers are mostly illiterate. They do not have a formal education experience. These situations create a challenge due to low awareness and information on the benefit of custom hiring service. Due to this factor the service providers are very much disgusting on the service business fate. Farmers are willing to get the service with a cheap price rather than considering other existing phenomena's like purchasing price of the machines, fuel price fluctuation and distance of farm land.

**Status of Mechanization and Operation in the Study Areas**

There is small number of available functional farm machineries in study areas. Most of the time the machines are giving a service relocating from place to place based on request of the farmers. Farmers trusted the service providers through gathering information from friends, relatives and neighboring farmers. Very few farmers consulted with the local agricultural office for information on custom hiring, which was limited to the particular machines offered by government sectors. The service providers are not sharing knowledge and information with anyone due to varies reason. Respondents could not recall any promotional campaigns by either governmental agencies or by the custom-hiring service providers. When asked, the service provider respondents

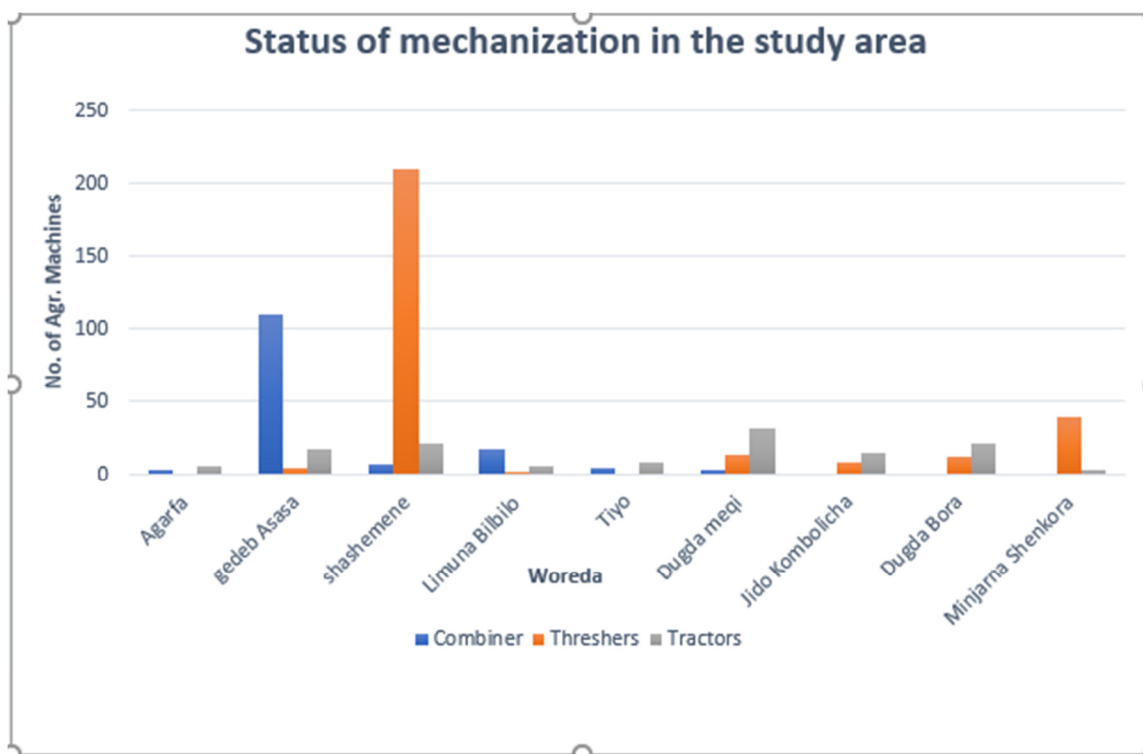


Figure 3. status of mechanization distribution pattern by woreda

Confirmed that their businesses were too small to consider any formal channel of information sharing. Most of these service operators are not full-time workers; they offer machines for hire usually as a secondary business. They recruit operators from the village itself, which allows them to get services on an as-required basis and promote the services by word of mouth among the fellow villagers and through broker. Except few, all of the service providers interviewed claimed not to get any skilled or formally trained operators from the market. Most of the agricultural machineries' operators do not have a driving license. In shashemene and minjarna shenkora woreda, there is high thresher access used for teff and wheat threshing. Likewise, most of combiner harvesters and tractors are widely available in Gedeb Asasa and central rift valley areas respectively.

Table 2. Various agricultural machineries farm operations expenditure

SN	Machines	variables	cost	FC(l/hr.)	Time(hr/ha)	
1	Combine harvester (for wheat harvesting)	Operator	salary	3000 birr	15-20 lit/ha	25-30min/ha
			perdiem	300 birr		
		Grease boy	salary	1500 birr		
			perdiem	150 birr		
		Time keeper	salary	1500 birr		
			perdiem	150 birr		
2	Tractor(for ploughing)	operator	salary	3000 birr	20-25 lit/ha	1½ hr/hr
			perdiem	300 birr		
		wage	salary	1000 birr		
			perdiem	100 birr		
3	Thresher(for teff)	Operator	perdiem	150 birr	1½ lit/ha	5-6 qt/hr.

The combine harvester custom hire service provider hired three workers. The operator has a responsibility of drive and control the crop harvesting situations of the combine harvesters and the grease boy take the responsibility of keeping the technical healthy of the machines by maintain and repairing of the fault parts of the combiner while the time keeper manages the overall tasks like collecting service fee, paying perdiem and other services including tax register machine monitoring. Similarly, the tractor and thresher custom hire service providers have their own concerned hired workers as they do the same functions. The rate of the salary and perdiem of the workers are mentioned in the Table 2. During harvesting of wheat crop using combine harvester 15-20lits of fuel is consumed for one hector(1ha) of land harvesting and it take about half hour to complete a hector of wheat crop. The average time taken to plough a hectar of land using a tractor machine is one and half hour. Besides, 20-25 liter of fuel is consumed to finish a hectar farm. A thresher owner hired only an operator who controls all tasks. A teff thresher consumes a fuel about one and half liter to complete a one hectar pile teff crop.

### Rate of Custom Hiring

The rate of custom hiring of the farm machines varies seasonally and from place to place. The rate of custom hiring is changed very often due to varies factors. Primarily, in collaboration with the service providers and farmers are trying to fix the amount of the rate as shown in fig: 5. But no longer used this fee due to the interference of the broker and lack of timely availability of the machines. Most of the crops reached at maturity stage at the same time the farmers are begun to compete the chance of getting the machines through the broker way. According to the study, the average combine harvesting of wheat crop is about 48birr per quintal. The harvesting fee of combine harvesting rate at GedebAsasa is 45 birr per quintal but this amount increased when the location become far from GedebAsasa. For example, at Agarfa woreda the rate becomes 82birr per quintal. Similarly, primary ploughing rate is also varying from 1400birr to 2000 birr per hectar due to remoteness, location and land situation. The farmers are strongly wished to get a service from government then secondly want from cooperative. The reason is the government service cost is cheaper than the private one. Therefore, government owned custom hire service providers should be encouraged to establish. Besides, government policy should be formulated to organize and regulate a custom hire service in the country.

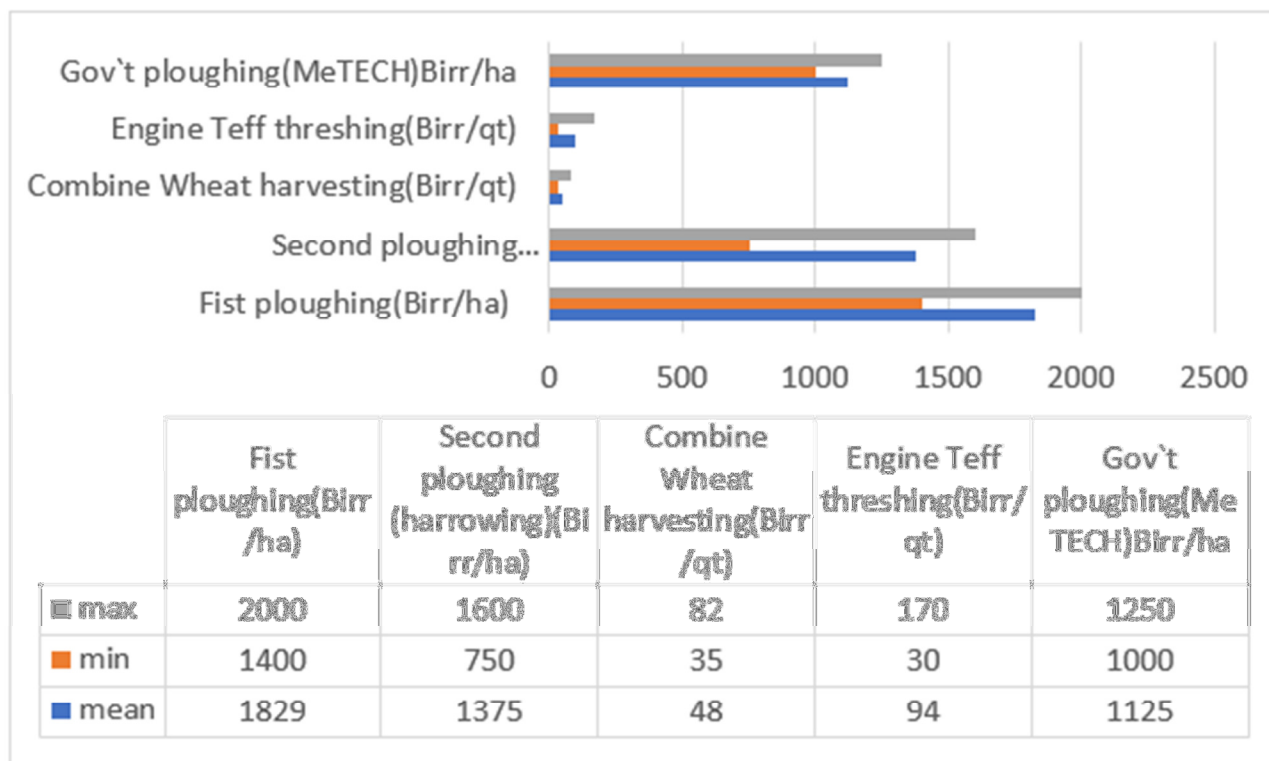


Figure 4. Rate of various farm operations

Commonly, agricultural machineries custom hiring rates are determined by considering based on the following factors. These are: -

- ❖ Engine oil, lubrication oil, fuel consumption for each operation
- ❖ Maintenance and repair cost
- ❖ Value of machines (purchase cost, depreciation, interest rates, etc.)
- ❖ Distance(location) of operation
- ❖ Crop coverage (yield)
- ❖ Harvested crop area coverage

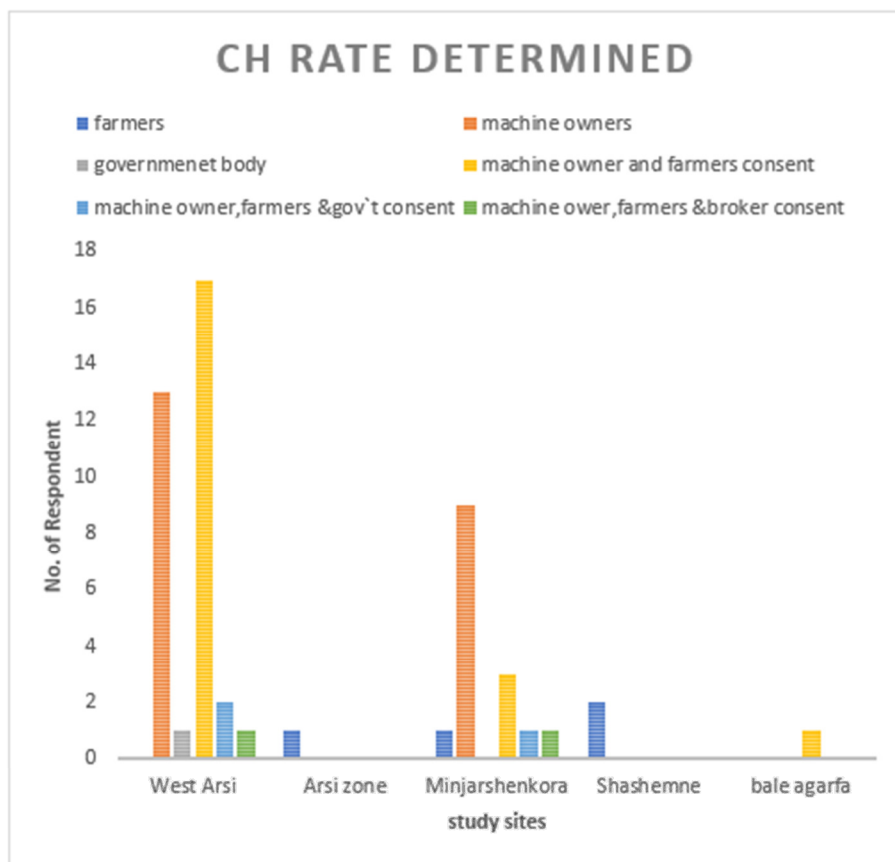
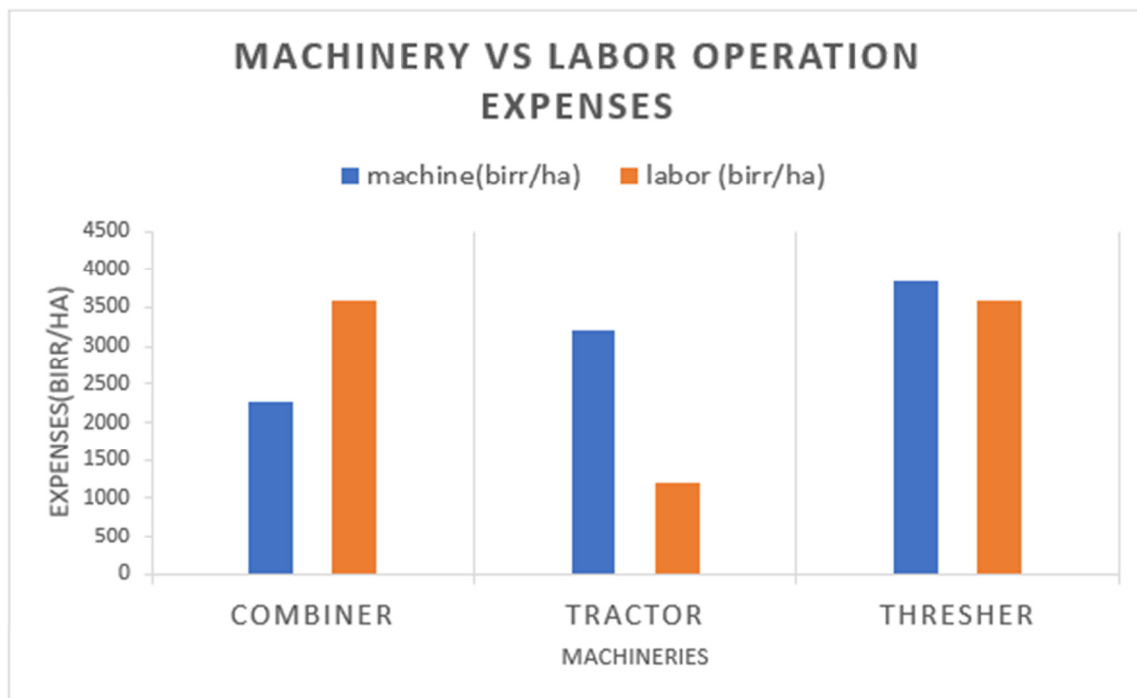


Figure 5. shows the responsibility of deciding custom hiring rate by woreda level

### Machinery and labor expense comparison

In Ethiopia there is abundant labor access. Most of farming operations are performed through traditionally using human and animal power. The farmers have been relying on traditional farming practice which produces poor yield output per hectare. Machinery reducing human drudgery, increasing productivity, and improving timeliness of agricultural operations such as planting and harvesting, and reducing peak labor demands are among the most prominent (Jayasuriya et al., 1986). The study found that the expense of conducting agricultural operations using machine and labor has no a significant difference due to cheap labor price. According to figure 6, Ploughing operation has high expense using tractor machine than plough with pair oxen. Threshing of a crop using a thresher machine and trampling of animal has more or less similar expense. But Fig:6 stated that combine harvester has significant difference than traditional harvesting. Most of the farmers reveal that due to the current migration of the labor to urban areas and demand fluctuation, the use of custom hiring of agricultural machineries is better option. Farming operations are seasonal with fluctuating labor demand. More labor is needed during planting and harvesting than during other periods of plant growth. This fluctuation in labor demand creates labor management problems. With the of mechanization technologies, it is possible to reduce peak labor demand and maintain a more stable labor force on the farm (ASABE, 2011).

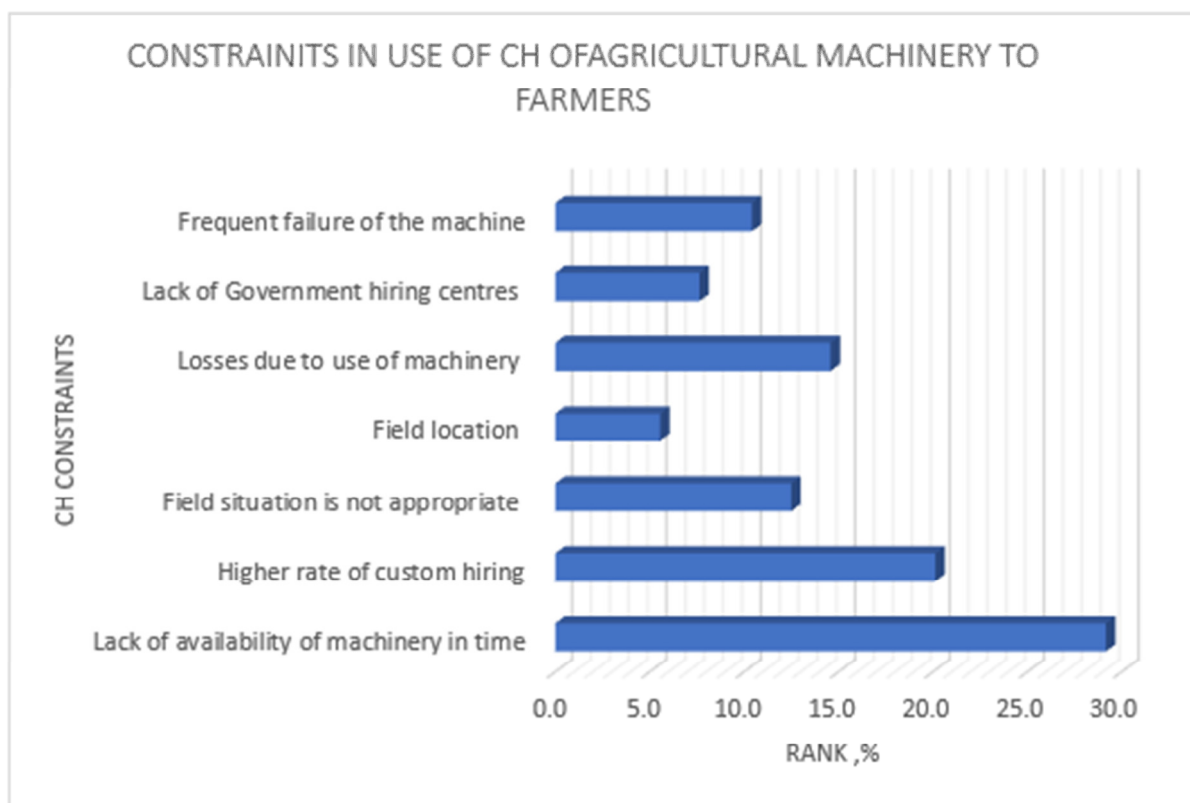




**Figure 6.** Agricultural machinery operations Vs labor operation cost expenses.

**Major Constraints and challenges of custom hiring services**

In figure 7 the survey reveals that, out of 144 farmer respondents, 29.2% number of the respondents reported that lack of availability of machinery in time was major constraints. Higher rate of Custom Hiring of machineries service and high grain loss during harvesting and threshing comes 2nd and 3rd major constraints 20.1% and 14.6% respectively. The respondents raised that, well established infrastructures were needed for the agricultural development in the study area, there was no well-equipped infrastructure facility like transportation road, irrigation access, machinery access and maintenance and repair service center. They could not have access to the farm machinery like tractor and combine harvester for their farm operations on timely basis, supplying mechanization inputs to the farm land and transporting end products from the field due to lack of transportation facility of machinery movement. Besides, the availability of machinery service center was essential for the production development and reduction of drudgery and timely of operation.



**Figure 7.** Agricultural machineries operation custom hiring major constraints

The service has varied challenges and has no well-established support from the government sectors. Commonly, the service providers raised similar problems the study areas as shown in the Table. 3. The respondents listed their problems based on severity. The study reveals that lack of spare part, lack of technician, machine frequent failure, lack of licensed skilled operators and other problems were raised accordingly.

**Table 3.** Challenges of Custom Hire Service Providers.

	Custom hire service major challenges/Problems	%, (N=90)
1	Inaccessibility of spare part	31.1
2	Lack of R&M technician	22.2
3	Over taxation	6.7
4	Machine failure	13.3
5	lack of operator's skill	10.0
6	Rate disagreement with farmers	5.6
7	Security problems	1.1
8	High fuel cost	5.6
9	Shattering due to crop over drying	3.3
10	Machine transportation problem	1.1

Combine harvester are very sensitive machines and it has many bearings and chains for movement. During operation these parts happen a frequent failure. it needs a frequent technical service and repair. Additionally, reel fingers, hydraulic system, injection pump, knife fracture and other parts frequently failed during operations but the respondents highly raised that there is no repair and maintenance facility in the vicinity to give a service immediately while it a problem happens.

**Table 4.** Frequently failed parts of combine harvesters and tractors

SN.		Parts Frequently Failed	% (N=90)
1	Combine	reel finger	16.7
		chain & belt	14.4
		cutter bar(knife)	12.2
		bearing	24.4
		shaft bending	2.2
		body fracture	10.0
		hydraulic system	10.0
		parts wearing and corrosion	3.3
		filter	1.1
		injection pump	5.6
		2	Thresher
welding failure	11		
bolt and nut loosening	31		
engine(piston ring, starter, liner wear, carburetor)	26		

There was no efficient machinery service center which provides technical repair and maintenance services except the local artisans to make minor ones like welding. They are not getting any theoretical and practical training from the concerned government body about the use and management. Each machinery has its own dealer in the country. For example, Reis Engineering was a dealer of Massey Ferguson tractors; Kaleb Farmers House was a dealer of Claas combine harvester and tractors; Gadab Engineering was a dealer of John Deere combine harvesters; government owned Adama Agricultural Machinery Industry was a dealer of URSUS, CHERY and YTO tractors; and MOENCO was a dealer of New Holland tractors and New Holland combine harvesters. Almost all these dealers are located in the capital except Adama Agricultural Machinery Industry. Out of these dealers, some of them provide after sale service only for one year according to warranty period. After one year, the farmers should try to maintain/repair them by themselves. Most of the time combines harvester, tractor and crop thresher/sheller technologies are used for the custom hire service in the study area. Private companies, private farmer machinery owners and different government institutions like government owned Adama Agricultural Machinery Industry and agricultural corporations' company are given a custom hire service to the farmers. The availability of the service and machines are different from location to location based on their crop and land holding size. The survey revealed that there is no agricultural machinery custom hires government policy as of Figure 8 indicated.

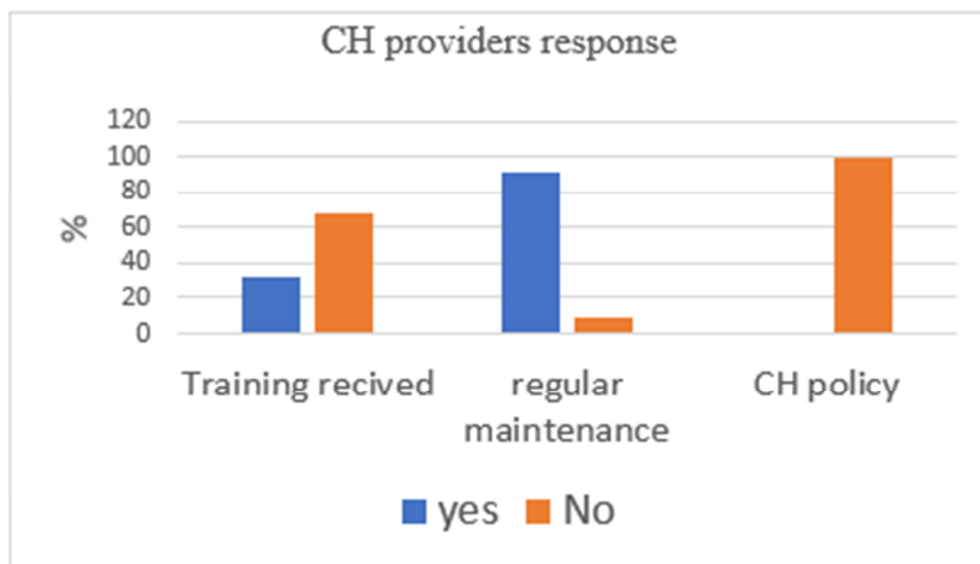


Figure 8. Service providers' facility response

### Gaps Raised from the Farmers and Custom hire Providers

#### Farmers Perspective

There is no specific policies and specific guidelines, laws, rules and regulations that guide custom-hiring mechanisms in the country. Farmers very strongly wish to receive custom-hiring services in a timely manner due to lack of service providers and adequate numbers of machines. The quality of machines they received through custom hiring was poor. The machines were either quite old or inefficient. The farmers who are far from Gedeb Asasa are usually not able to pay for custom hiring at the same rate as others, there is no provision for determining custom hiring tariff. Custom hire rate or tariff is determined arbitrarily. Some conservative farmers do not want to adapt to Custom hire mechanization service. Farmers wish to receive brands and model machines for custom-hiring services in order to protect from grain loss and damage. Farmer's preferences change from place to place and from crop to crop. The farmers are not trust the custom hire service providers because the operators are laying the amount quintals threshed in the tanker to earn extra fee.

#### Custom Hire(CH) Providers Perspective

Among other machines, small tractors and combine harvesters have gained significant popularity in the study areas. These machines widely gave a service in the vicinity. The service providers have raised some problems while they give the service. These are

- ✓ Unavailability of nearby spare parts access and R&M service centers.
- ✓ Lack of coordination among relevant stakeholders.
- ✓ Lack of training centers for the operators and R&M service providers in their vicinity.
- ✓ Lacks of custom hire service awareness creation to popularize the CH mechanization.
- ✓ Frequent failure of the machines.
- ✓ Grain loss occurred during harvesting

### CONCLUSION

The private sector has played an important role in the development of custom hire service. Tractors, threshers and combine harvesters have used widely in the study areas. Custom-hiring services providers rent out combine harvesters for wheat-harvesting activities. Most of combine harvester, threshers and tractors are found in Gedeb Asasa, Shashemene and Dugda woredas respectively. Custom hire Service providers work in their own specific locations and most of them are local people. Usually, a service provider rents only one or two kinds of machine. A few large-scale farmers buy machinery for two purposes. These are to use in their own field activities and to rent out to neighboring farmers to provide extra income. Farmers are restricted to selecting a custom-hiring service provider based on the skill-level of the operator. In the study areas, wheat, barley and teff cereal are the dominant crops. Farm holdings generally range from small to medium size. Climate and environmental stress are among the main drivers of migration of farmers form agricultural sector and it

reduces the availability of labor during peak agricultural seasons. Due to lack of financial resources and technical skills, labor scarcity, climate change drives the farmers prefer to participate in custom hiring of agricultural machinery. According to the study, major custom hiring service providers are: Government sectors (mainly provide machinery for land preparation or tillage); large-scale farmers (mainly provide machinery for land preparation and combine harvesting); and private companies (mainly offer their services for harvesting activities). There are contrasting criteria for selecting machines to purchase for their own. For instance, power tiller customers prefer brands that are relatively inexpensive, whereas four-wheeled tractor and combine harvester customers prefer brands that are more established and considered to be reliable. Based on this, there are different interests on the selection of the farm machines and the study reveals that there is a knowledge gap on selection of farm machines. Custom hiring is a relatively practiced in the study areas. However, the type of machines hired greatly varies according to farm size and farming system. While both small and medium farms tend to use custom hiring at an almost equal scale, they differ in their motivation to do so. The machine operators often lack the knowledge and technical skills necessary to operate the machines which results in inefficient utilization to do the job. The operators and the owners have a problem on practical and theoretical training. Besides, there is deficiency of licensed machine operators in the market. In most cases, the potential efficiencies of the machines are not realized. Appropriate training could be used as a tool to increase awareness of the various stakeholders involved in custom hiring. The rates of custom hiring tend to fluctuate. Furthermore, the machines used are mostly old and need replacing. The machines offered by government agencies are very basic to fulfill the interest of the farmers but they are very limited in number.

## RECOMMENDATIONS

A government custom hiring center should be required and open up. Training on farm machinery and equipment should be given to the farmers and artisans. The use of custom hiring service should be encouraged. Machine operators and those involved in repair and maintenance (R&M) need to be trained for efficient farming operation and machine maintenance. Emphasis should be given to availability and cost of spare parts, R&M service centers. Technical know-how should be provided to the farmers. Standardization and quality-assurance centers of farm equipment should be established. Farmers and stakeholders should be made aware of tariffs of custom hiring at least prior to the start of a cropping season. Custom hiring popularity should be increased by

increasing awareness. Increased awareness will increase demand for mechanization of farming operations. Adequate infrastructure required (e.g. farm roads, electricity, R&M facilities, service centers and training schools). The sector needs better coordination among concerned stakeholders

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