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## **FORWARDED FROM THE PROGRAM DIRECTOR**

The Agriculture Machinery Centre (AMC), Department of Agriculture is pleased to bring out its Annual Report for the financial year 2015-2016. The report summarizes on the activities carried out by the AMC Head Quarter and its four regional centers. It is our responsibility to present the efforts put in by all our researchers, engineers, support staff, the collaborating agencies, individuals and farmers through this annual report.

This year, we have seen remarkable changes in the field of Bhutanese farming with the coming up of hiring services for power tillers, at gewog level by the center as well as distribution of the power tillers to the gewogs for hiring activities.

Through the support from technical project “Strengthening Farm Mechanization Phase II (SFaMP-II)”, the center was able to move forward in the research activities followed by the inspection and quality control section, and in hiring activities.

We would like to thank the, Dzongkhags, Central Agencies, JICA, JICS and all other individuals for supporting to promote farm mechanization. Our gratitude also goes to the people and the Government of Japan for their assistance in all the agricultural sectors. Our sincere thanks to the Ministry of Agriculture and Forests, staff of AMC and other contributing bodies that are not included here.

Tashi Delek

## Table of Contents

FOREWORDED FROM THE PROGRAM DIRECTOR .....	1
1. Introduction .....	4
2. Organizational Set up .....	6
3. Human Resource .....	7
3.1 Staff Strength .....	7
3.2 Training & study tour .....	8
4. Special Features and Visits .....	9
5. Geog Power tiller handing over .....	9
6. Finance, Budget and Expenditure .....	10
7. Adapt, develop and promote appropriate technologies through Research and Development.....	11
8. Innovation and invention of farm mechanization technologies .....	12
8.1. Development of Hedge Cutter .....	12
8.2. Development of Potato Digger .....	12
8.3. Development of Potato harvester cum collector.....	13
8.4. Development of Reversible Plough.....	13
8.5. Development of Cardamom Dryer.....	14
8.6. Development of farm machinery and spare parts.....	14
8.7. Sudy on Rice mechanization cost analysis .....	14
9. Developing quality standards of farm machines and tools for certification.....	15
9.1. Standardization of farm machines .....	15
9.2. Safety & quality farm machines .....	16
9.3. Tests, Evaluate and adaption of farm machines .....	16
9.4. Result of Oil recovery & machine capacity test .....	17

9.5. 7.4 Inspection of farm machines & implements .....	17
10. Farm Machinery Service Centres (FMSC).....	18
11. Training of farmers, extension and entrepreneurs for effective and efficient utilization .....	19
12. Promotion and Encouraging small enterprises .....	21
13. Sales proceeds for the year 2015-2016.....	22
14. Micro-enterprises encouraged through Regional Agriculture Machinery Centers .....	22
15. Encouraging micro-enterprises in all dzongkhags .....	23
16. Revenue generated through backup services.....	24
17. Subsistence farming to commercial farming through farm mechanization.....	24
18. Activities and Progress through Hiring services .....	25
19. Awareness meetings on Hiring .....	26
20. Conclusion.....	27

## 1. Introduction

The Agriculture Machinery Center is aligned to contribute through enhanced effectiveness and efficiency in Bhutanese farming practices by mechanization of Bhutanese agriculture through use of appropriate farm machinery, equipments and tools.

Farm Mechanization has been placed one of the priority areas by the Ministry of Agriculture and Forests and AMC is targeting a 20 percent increase in farm mechanization. Currently, only around two percent of arable land or around 65,000 acres is considered partially mechanized. This percentage and definition of farm mechanization only takes into account the land preparation achieved using power tillers. Given that more than 3,000 power tillers have been provided by Japan so far, a two percent rate seems relatively low.

Achievements in mechanization of farms in Bhutan is mainly with the help of the 2 KR grant in the form of farm machinery like power tillers, harvesters etc. Other farm machinery like post-harvest machines are purchased from countries like India, Thailand etc and supplied to the farmers with free transportation. This year, 2 KR Grant (2013) with 239 numbers of power tillers and implements amounting to 110 Million Yen were received as the last 2 KR Grant from the Government of Japan.

The Government and People of Japan have been receiving this 2 KR grant since 1984 and Bhutan has received grant assistance for 25 times including 2 KR Grant of Japanese financial year 2013 which amounts to Nu. 1803.32M and 3,186 units of power tiller. The Government of Japan hopes that this grant assistance would strengthen capacity of farmers and help mechanization and modernization of agriculture in Bhutan, and also contribute to further strengthening of the relationship between the two countries.

Aside the Grant from the Japanese Government, the Center is mandated to:

- Promote appropriate farm mechanization in the country.
- Creation and innovation of indigenous farming tools and implement suitable to Bhutanese farms.
- Promotion of improved Farm Mechanization technology in the country.
- Effective and efficient distribution of agriculture equipments and farm mechanization (hiring) services to the farmers
- Capacity development of the farmers in the use of improved technology and farming practices.

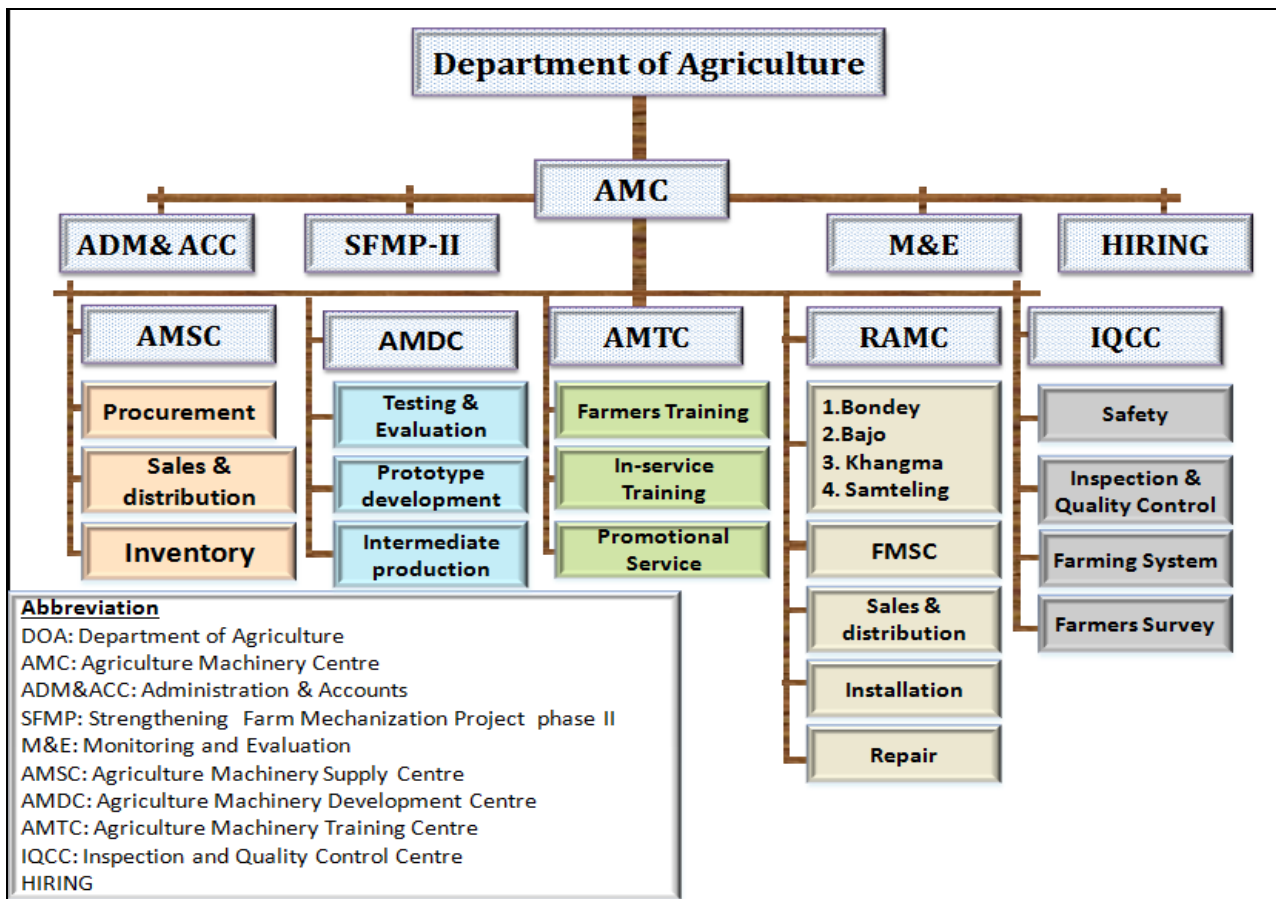
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- Capacity development of the local fabricators in manufacturing appropriate farm machinery.
  - Act as the regulatory body for quality and standardization.

For fulfilling the above mission or the objectives, the following strategies were developed as a guideline for the Farm Mechanization Programme:

- Adapt, develop and promote appropriate technologies through Research and Development.
- Ensure access to safe and quality farm mechanization goods and standard services.
- Training of farmers, extension and entrepreneurs for effective and efficient utilization.
- Privatize the manufacture, delivery and supply of goods and services in a phased manner.
- Subsistence farming to commercial farming through mechanization.

## 2. Organizational Set up

For achieving the above mentioned mandates and for the way forward, the Agriculture Machinery Centre has set up different sections according to the different activities required and demanded by the end users especially farmers. There are four Regional Centres for effective and efficient service delivery. Furthermore, activities like research and development, inspection and testing, training etc. for effective and efficient delivery of farm mechanization services in Bhutan are all taken care of by setting up different sections accordingly. Following figure gives a broad overview of the Farm Mechanization Programme as an overview:



Organogram of AMC

### 3. Human Resource

With the workload of AMC, the office has 102 staffs. Fifty four are technicians; seventeen are in general categories, twenty two are operators and drivers and nine are ESP.

The detailed lists of staff in different sections are shown in the table below:

#### 3.1 Staff Strength

	Regular				Contract Expert/JOCV (Technical)	Temporary GSC,ESP &NWF	Total
	Technical	Operator /Driver	General	Total			
Adm & Accts, Paro	2	4	9	15		3	18
M&E	2	1	0	3		0	3
AMDC, Paro	11	1	0	12	2	2	14
AMSC, Paro	3	3	1	7		1	8
IQCC, Paro	6	0	0	6		0	6
AMTC, Paro	4	2	0	6		1	7
NHC, Paro		0	0	0		0	0
RAMC, Paro	7	2	2	11	1	0	11
RAMC, Bajo Wangdue	4	4	2	10		1	11
RAMC, Khangma Trashigang	8	4		12		1	13
RAMC, Samteling Sarpang	7	2	2	11		1	12
<b>Total</b>	<b>54</b>	<b>23</b>	<b>16</b>	<b>93</b>	<b>3</b>	<b>10</b>	<b>103</b>
<b>Over all Total include of Expets</b>							<b>106</b>

### 3.2 Training & study tour

For the year 2015-2016, 32 staff availed study tours and training outside country, out of which one staff have completed long term training and resumed duty. The details are as follows:

#### Ex-country training, study tour, seminar & workshop

SL.	No. of Participants	Course Title	Location	Start Date (dd/mm/yy)	End Date (dd/mm/yy)	Duration (day)	Source of funding
1	1	Development & Extension of Agriculture Machines	Japan	8/3/201	25/11/2015	9months	SFaMP-II
2	2	Development of farm machinery for small scale farmers	Japan	6/3/2016	12/11/2016	8months	SFaMP-II
3	4	Technical discussion on farm machines	India	14/10/2015	20/10/2015	7days	SFaMP-II
4	1	Business meeting on hiring service practice	Sri-Lanka	16/11/2015	24/11/2015	9days	SFaMP-II
5	6	Training on Engine testing	Indonesia	22/1/2016	31/1/2016	10days	SFaMP-II
6	9	Study Tour for study of hiring practices	Sri-Lanka	6/2/2016	14/2/2016	10days	SFaMP-II
7	2	Power tiller business corporation trip to Yanmer	Indonesia	20/2/2016	29/2/2016	10days	SFaMP-II
8	7	Study visit on Agro-Industries Manufacturing & Food processing Machines	India	2/5/2016	15/5/2016	14days	DoA

Details of in-country training /workshop availed by staff of AMC from 1<sup>st</sup> July 2015 – 30<sup>th</sup> June 2016:

SL	No. of Participants	Course Title	Location	Start Date (dd/mm/yy)	End Date (dd/mm/yy)	Duration (day)	Source of funding
1	All AMC staff	Awareness workshop on farm machinery standards	Paro	24/12/2015	25/12/2016	2days	SfaMP-II & RGOB
2	5	Training on Tally ERP9 at CMI	Phuntsholing	6/5/2016	18/6/2016	13days	SFaMP-II
3	8	Training on training of trainer(TOT) at AMTC	Paro	1/6/2016	14/6/2016	14days	RGOB



## 4. Special Features and Visits

To commemorate the 60<sup>th</sup> birth anniversary of his majesty the fourth Druk Gyalpo, Agriculture Machinery Centre organized & provided the free servicing of farm machines to the farmers for the period of three days w.e.f. 6<sup>th</sup> to 8<sup>th</sup> of November, 2015. The opening was chaired by Dasho Dzongrab, Dzongkhag Administration, Paro.



Farm machines providing free servicing

## 5. Gewog Power tiller handing over

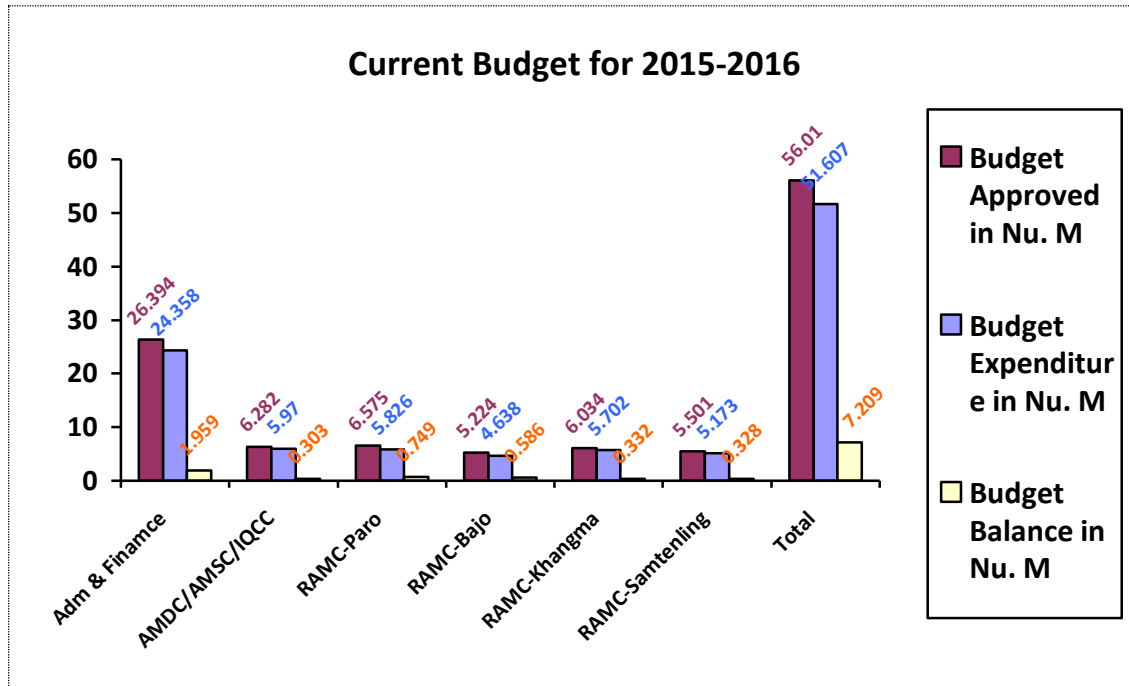
His Excellency the Minister of Agriculture and Forest Handed over the Geog power tillers to the gewogs under Samtenling & Bajo region. His Excellency also briefed on the background of the supply of the power tiller, which is to optimize the mechanization to increase the agriculture productivity. All the Agriculture Extension officials were explained on the guidelines to implement the gewog Power tillers operation by the National Hiring Coordinator and Regional Manager.

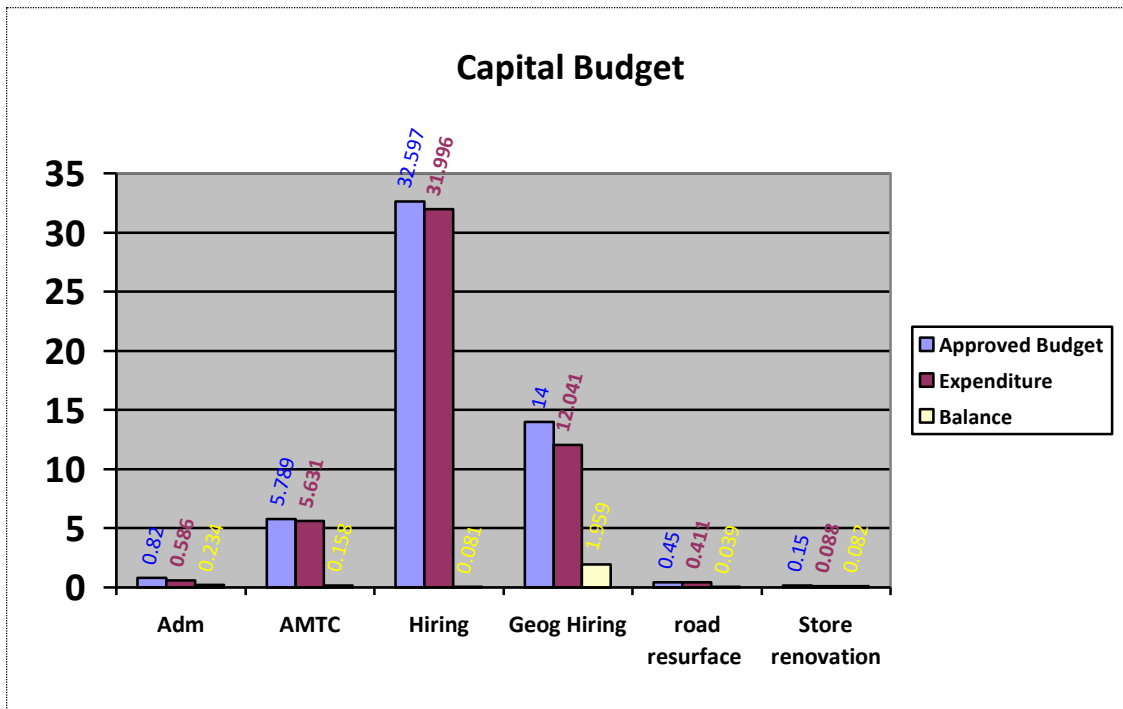


His Excellency briefing the beneficiary

## 6. Finance, Budget and Expenditure

The following graphs show the approved budget and expenditure along with the balance at different regions for both current and capital. The total current budget that was approved for the year was Nu.56.01M with the expenditure amount of Nu.51.607M., while the total capital budget approved was Nu.53.806M. with expenditure amount of Nu.50.753M.





## 7. Adapt, develop and promote appropriate technologies through Research and Development

Research and Development in farm mechanization includes innovation and creation of indigenous farming practices and technologies adaptable to the Bhutanese farming conditions. In line with the important commodities and priorities set by the Department of Agriculture, the research and development centre has developed few technologies which were promoted in the fields. Technologies which were appropriate were fabricated in mass numbers for promotional and hiring activities.

Technical cooperation with the private sectors and other relevant organizations like Vocational Training Institutes etc. was vital for proper linkages and exchange of knowledge and experiences. Some of the technologies that were designed, promoted and fabricated in the year 2015-2016 are as follows:

## 8. Innovation and invention of farm mechanization technologies

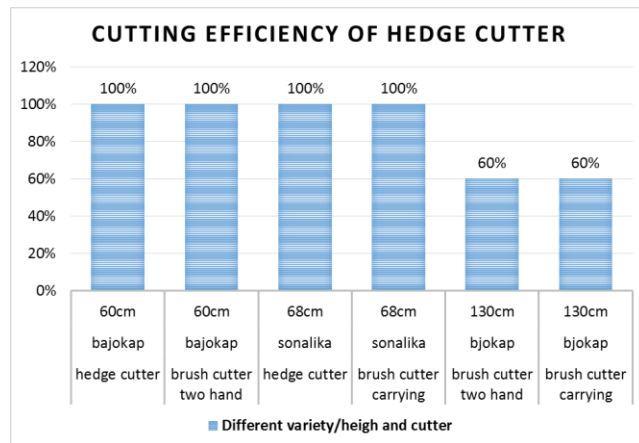
### 8.1. Development of Hedge Cutter

Hedge cutter is a portable reaper for hilly field, marginal farmers and small fields was develop and conducted series of test on wheat harvesting at Paro, Wangdue, Punakha and Haa for performance evaluation. The hedge cutter was modified and made interchangeable with available grass cutter.

The hedge cutter will be tested on paddy harvesting and cardamom weeding in coming season for its performance and feedback collection from users.



*Pic: 1; Wheat harvesting at farmers field*



*Fig: 1; Cutting efficiency of hedge cutter*

### 8.2. Development of Potato Digger

Potato digger is simple implements basically for digging potato using power tiller. Harvesting potato is very tedious and time consuming when manually carried out. Series of modification and field test were conducted for improving its performance.

The implement will be thoroughly test in the field in coming seasons and modify based on the test observation and user views.

Few sets will be developing for performance test and collecting feedback.



*Pic: 2; Potato digging in farmer's field*

### 8.3. Development of Potato harvester cum collector

Potato harvesting cum collection implements is designed for large plain field and commercial farmers. The implement is attached with tractor which will dig potatoes, separate soil, stone and collect potato. This implement has high potential in reducing labors and cost on potato harvesting.

Series of laboratory and field test at Paro and Wangdue Phodrang were conducted on various existing method and models. The implement will be developed and performance test will be conducted in the field.

However this implement was found effective in stone picking.



*Pic: 3; Potato harvester cum collector*

### 8.4. Development of Reversible Plough

Reversible plough is widely used with Power tiller across the country for land development. To encourage in-country manufacturing and to make parts available at cheap prices the reversible plough was studied, modified and developed 4 sets from existing Japanese plough.

These ploughs were tested in the field for its performance and modified based on the observation and feedback. The plough will be simplified by changing plough finger to mold board types and conduct the test in the field.



*Pic: 4; AMC made reversible plough*

### 8.5. Development of Cardamom Dryer

Cardamom is widely grown cash crop by the farmers in the southern Bhutan. The traditional drying is most difficult methods. The Cardamom dryer is to improved quality and reduce firewood use in drying process.

The dryer was modified from Indian Cardamom Research Institute (ICRI) design and installed at Sarpang, Dagana and Tsirang. The comprehensive test shall be conducted for all dryer in coming season.



*Pic: 5; Cardamom dryer installation at Dagana*

### 8.6. Development of farm machinery and spare parts

The Power paddy thresher, power tiller trailer, Corn Sheller, cage wheel, hitch adaptor and plough shear was developed to make farm machinery and spare parts available to the farmers.

*Table:1; Shows the different farm machines developed*

Sl.No.	Farm machines/spare parts	Quantity (Nos.)
1	Paddy power thresher	35
2	Power tiller trailer	239
3	Corn Sheller	10
4	Reversible Plough	5
5	Cage wheel	239
6	Hitch adaptor	239



*Pic: 6; Power paddy thresher*

### 8.7. Study on Rice mechanization cost analysis

The study was carried out to know the actual cost of operation for rice mechanization. The finding will be used for need assessment in research activities and accordingly planned for prototype development. The study will also help organization to promote new technology.

The studies on rice mechanization for Paro and Sarpang dzongkhag have been completed and similarly conduct the study for Wangdue Dazongkhag.

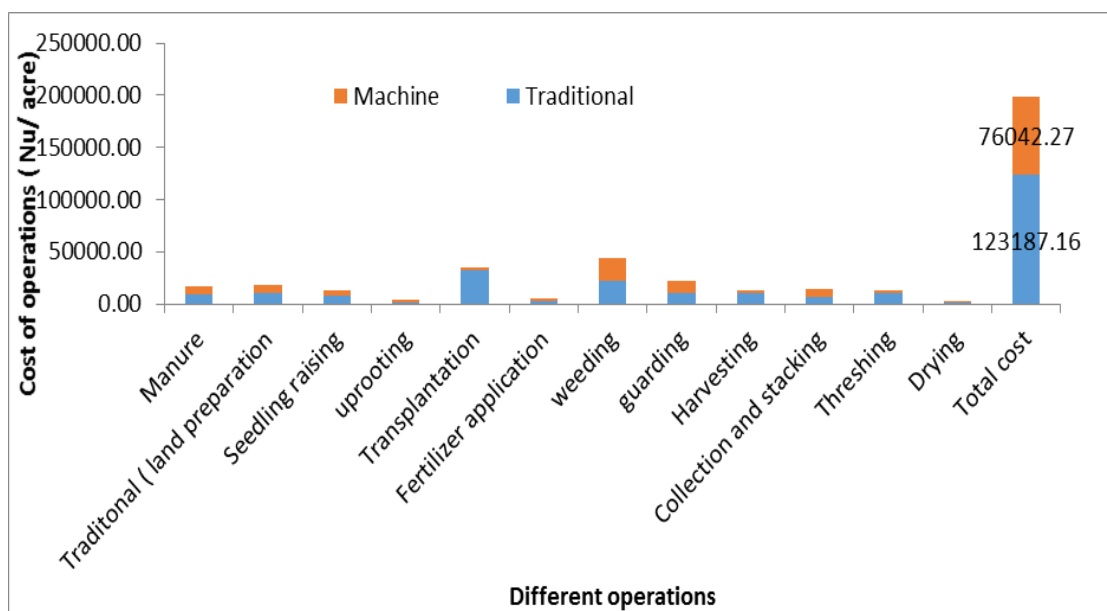


Fig: 2; shows the study on rice mechanization

## 9. Developing quality standards of farm machines and tools for certification

To ensure standard quality of farm machines & tools in the country, Agriculture Machinery Centre shoulders the responsibility in development of standards for safety & quality farm machinery in the country. Quality were inspected through physical inspection, laboratory & field testing in line with test code, Tools and implements are physically inspected for physical damages before procure and further supply.

### 9.1. Standardization of farm machines

The centre developed standards for farm machinery in collaboration with the Bhutan standard Bureau. Where BSB is only a competent authority to endorse the standards set within the country by any agencies. In the initial stage centre have drafted and developed National standard, Test code & test procedures for the following farm machines.

1. Power tiller (10.5hp-14hp)

2. Power Reaper
3. Rice mill
4. Corn flake machines

## 9.2. Safety & quality farm machines

Safety being one of the priorities to end users, ensuring access to safe and quality farm machines the centre developed safety pamphlets in operation of power tiller for safety operating in fields & roads as well. Ensuring access to safe and quality farm mechanization good and standard services is one of the important strategies for farm mechanization in Bhutan. With the support of the SFMP –Phase II, the Inspection and Quality Control Centre, developed the safety pamphlets and distributed to different sections and the regional for further distribution to the farmers.



## 9.3. Tests, Evaluate and adaption of farm machines

The centre conduct test for farm machines in the centre to observe the feasibility, efficiency and effective in the Bhutanese geographical condition; however following are some of the farm machines tested in the centre as well as in the field.

Machines were tested in two different categories.

- (a) New farm machines tested
- (b) Testing in accordance with standard and test code drafted

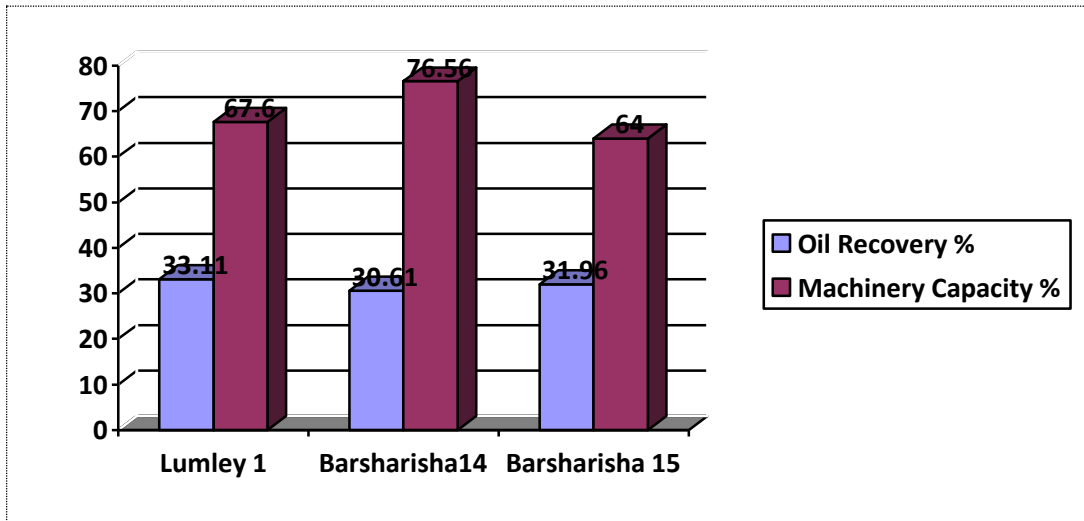
Testing of oil expeller were performed after arrival of new stock for the efficiency, functionality, oil recovery and machine capacity.





New machines tested for functionality, oil recovery, & machine capacity

#### 9.4. Result of Oil recovery & machine capacity test



#### 9.5. 7.4 Inspection of farm machines & implements

Upon the arrival of the new stock of farm machines, the centre conducted thorough inspection for the physical damages & working mechanisms to ensure the good quality of the imported machines and in-country manufacturing product as well.



Details of machinery & implements inspected

Sl. No	Description	Received qty	Inspected qty
1	Flour mills	50	50
2	oil expellers	19	19
3	Electric motor 7.5 hp	50	46
4	Tractor trailer	7	7
5	Paddy wheel	239	239
6	Corn flake machine	5	5
7	Grinding Stones	75	75

Sl. No	Description	Received qty	Inspected qty
8	Yanmar power tiller	239	239
9	Rice mills	100	40
10	Rice mill spare parts	2015	574
11	Flour mill spare pars	300	127
12	Hitch adaptor with pin set	239	239
13	Power tiller trailer	239	239

## 10. Farm Machinery Service Centers (FMSC)

For efficient services delivery to the farmers at grass root level Farm Machinery Service Centers (FMSC) were established at different strategic locations with mandate to monitor by respective RAMCs. The centre have eight Farm Machinery Service Centers established earlier as follows

(Phuntsothang in Samdrupjongkhar, Menbi in Lhunsi, Kilikhar in Mongar, Nobdhing in Wangdiphodrang, Drakteng in Trongsa, Chuzergang in Sarpang, Buli in Zhemgang and Yoeseltse in Samtse) & in addition one more has established at Lhamoyzingkha under Dagana, which total up to Nine FMSCs. The establishments of all the FMSCs have been started since 2008 with Drakteng being the first FMSC.

Some of the progresses in FMSCs are as follows:

- a. Phuntshothang, Samdrupjongkhar: The construction was completed in 2012 and was inaugurated in 2013. The backup services have been carried out since then with the sales of spare parts. Total amount generated through the spare parts is Nu.7675.00
- b. Menbi, Lhunsi: The construction completed on 2013. The backup service like sales of spare parts have been carried out with the generation of Nu.24375.
- c. Kilikhar, Mongar: This FMSC uses leased building of RNR and has been providing backup services like sales of spare parts and repair and installation of farm machines. Workshop facilities amounting to Nu. 3,37,318.00 have been provided to facilitate the backup services. A total of Nu. 110634.00 have been generated by selling of spare parts by repair and maintenance of farm machines.



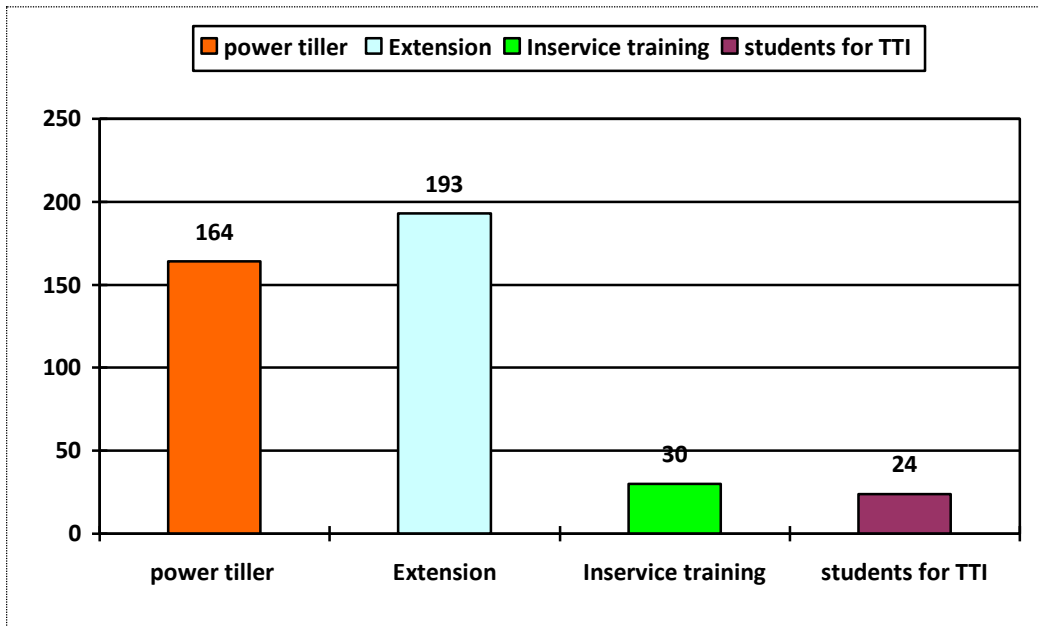
*FMSC Lhamoizingkha*

- d. Lhamoizinkha. This service centre has completed construction this year with RGOB financing and will be availing services in sales of spare parts, repair and maintenance of farm machines. The structures have completed including construction of compound fencing.

## 11. Training of farmers, extension and entrepreneurs for effective and efficient utilization

With the objective to enhance the technical capacity of the end users mainly farmers and also school drop outs and to encourage the people to take up farming by enhancing their skill and knowledge, the Agriculture Machinery Training Centre has been intensely carrying out different training activities according to different levels. The trainings are basically in operations and maintenance of the farm machines and mechanized farming practices.

Trainings were conducted to various stake holders in different courses as follows



*Power tiller Operator training*



*Extension officer training*



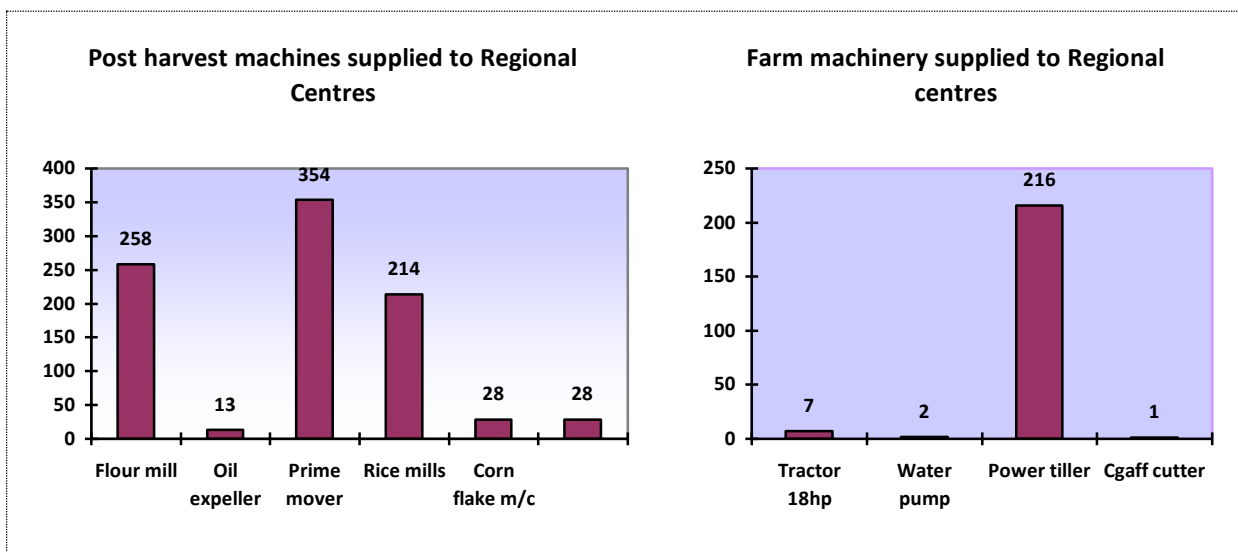
*In-service training*



*TTI Trainees*

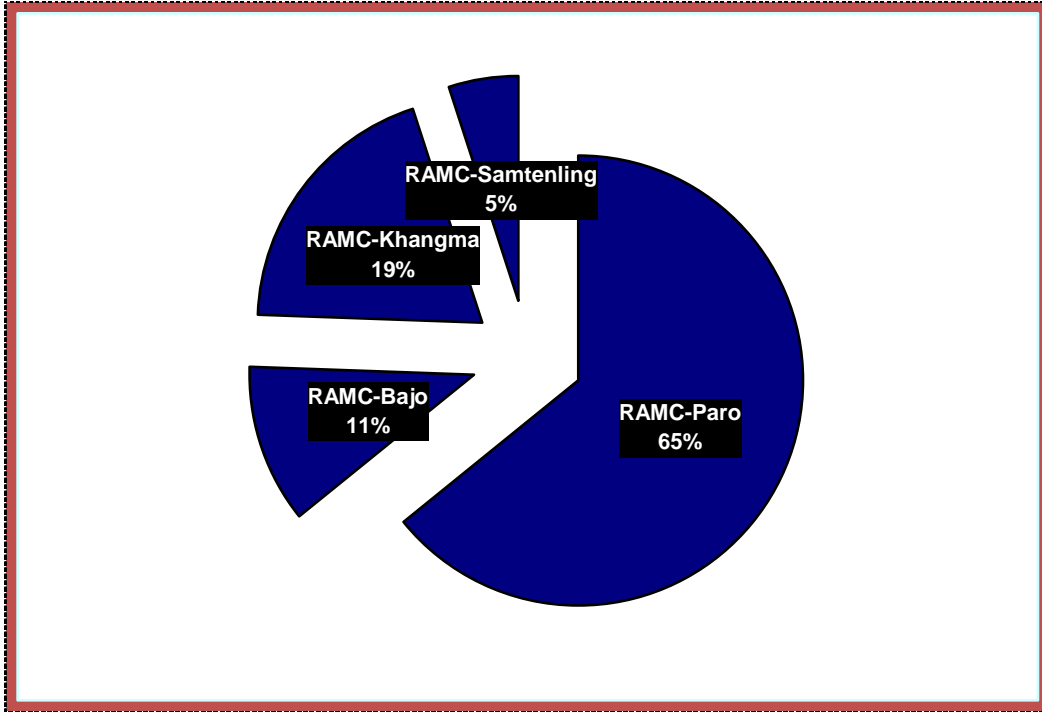
## 12. Promotion and Encouraging small enterprises

For effective and efficient farm mechanization services to public, four regional centers have been established. The Regional Centers maintains adequate facilities to provide services such as sales of spare parts and farm machinery, installation of machines, after sales services, maintenance and repair works and also trainings. The following figure shows the supply statement of post harvest machines & farm machineries in 2015-2016 by the Agriculture Machinery Supply Centre to the Regional Centres, which is further sold to the farmers.



### 13. Sales proceeds for the year 2015-2016

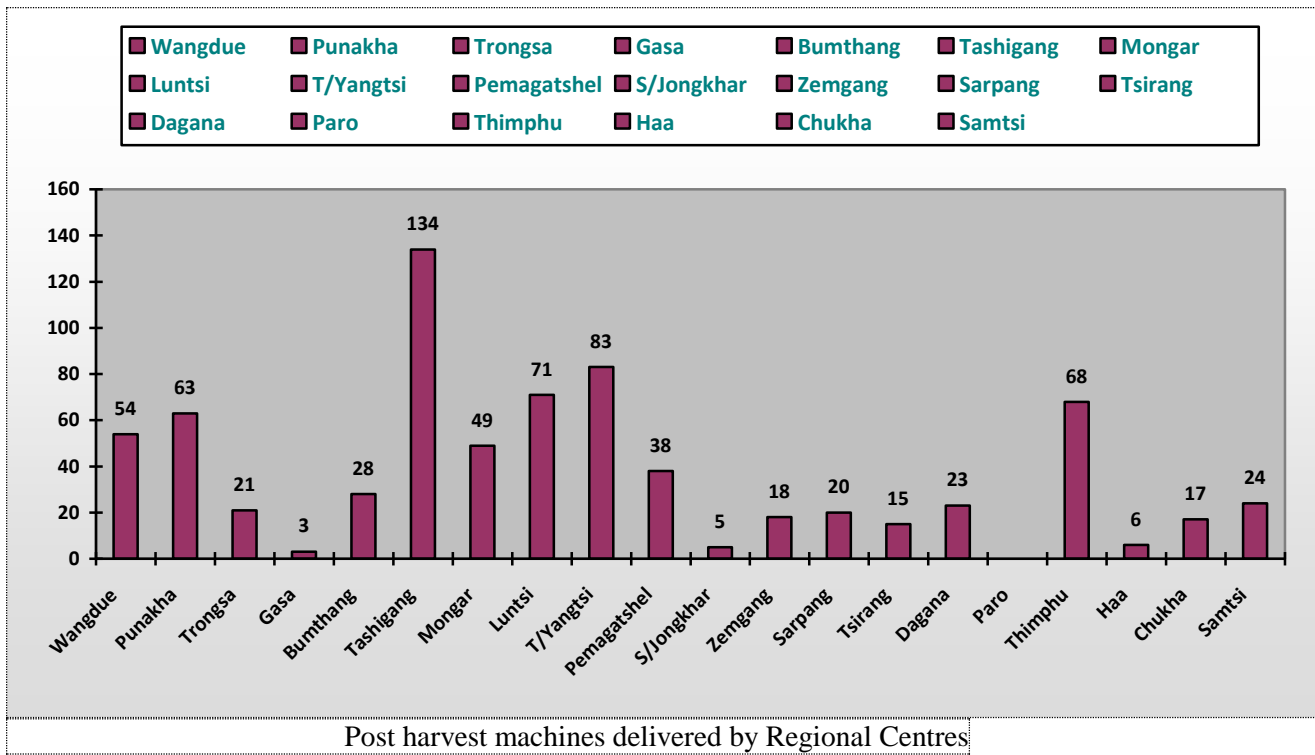
The sales of farm machines & the spare parts to the end users are made from the respective regions upon the need and demand basis by the farmers. Every Region have the sales proceeds to provide services to the farmer. The report for sales of farm machines & spare parts were compiled and observed highest sales proceeds is from RAMC, Paro being power tillers were sold only from this centre followed by RAMC, Khangma and then by, RAMC, Bajo and the least by RAMC, Samtenling.



*Sales proceeds from RAMCs*

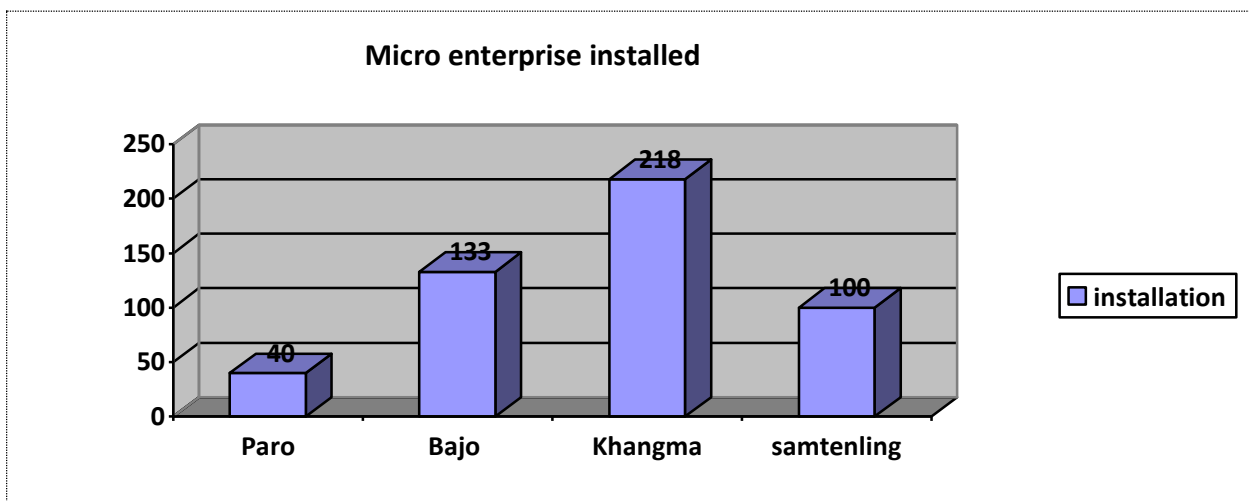
### 14. Micro-enterprises encouraged through Regional Agriculture Machinery Centers

Besides the supply of different farm machines like water pump, manual seeder, rice transplanter, power tillers, combine harvesters, paddy reapers etc. The centre also encourages in establishment of micro-enterprises in Bhutan. The machines supplied mainly the post harvest machines to various Dzongkhags for the year 2015-2016 are as follows:



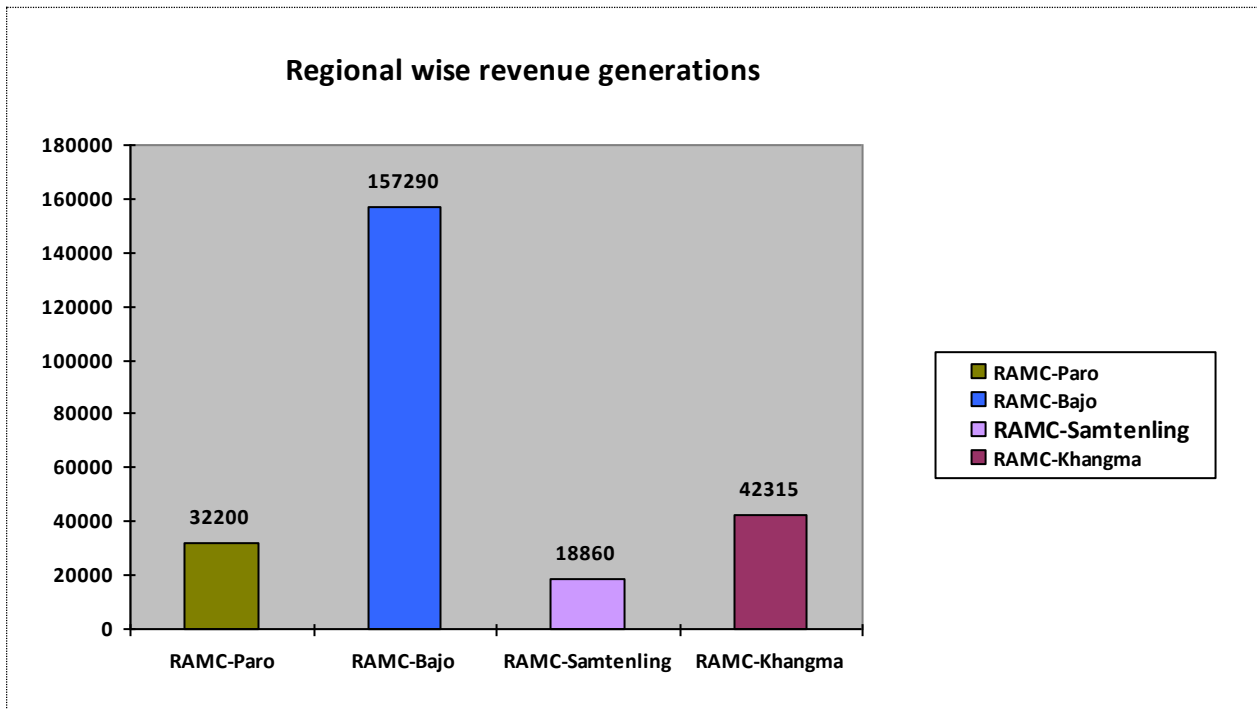
## 15. Encouraging micro-enterprises in all dzongkhags

After the sales services of farm machinery, installations & testing were carried based on the machinery supplied. The transportation charges were fully subsidized from the centre to the nearest road point and also the installation and testing were another full subsidy component. The Regional Centres have completed installation of post harvest machines in total of 491 Nos. and detail report by respective regional are as follows



## 16. Revenue generated through backup services

Repairing of farm machines is a part of backup services to farmers which is the mandatory activity, so revenue generation in total of Nu. 250605.00 has generated for the Government from repair and maintenance of farm machines from respective each regional centre is shown below. Regional Agriculture Machinery, Bajo has generated the highest revenue from repair and maintenance as compared with the other regional centres.



## 17. Subsistence farming to commercial farming through farm mechanization

For the promotion of commercial farming through mechanization, hiring services with proper support has been prioritized by the Ministry of Agriculture and Forests. Machinery hiring have been provided by AMC with mandates to benefits the under privilege farmers. Besides this, geog power tiller hiring services have initiated by the present Government, which is implemented by EA with supervision of AMC. The progresses of hiring activities are shown below:



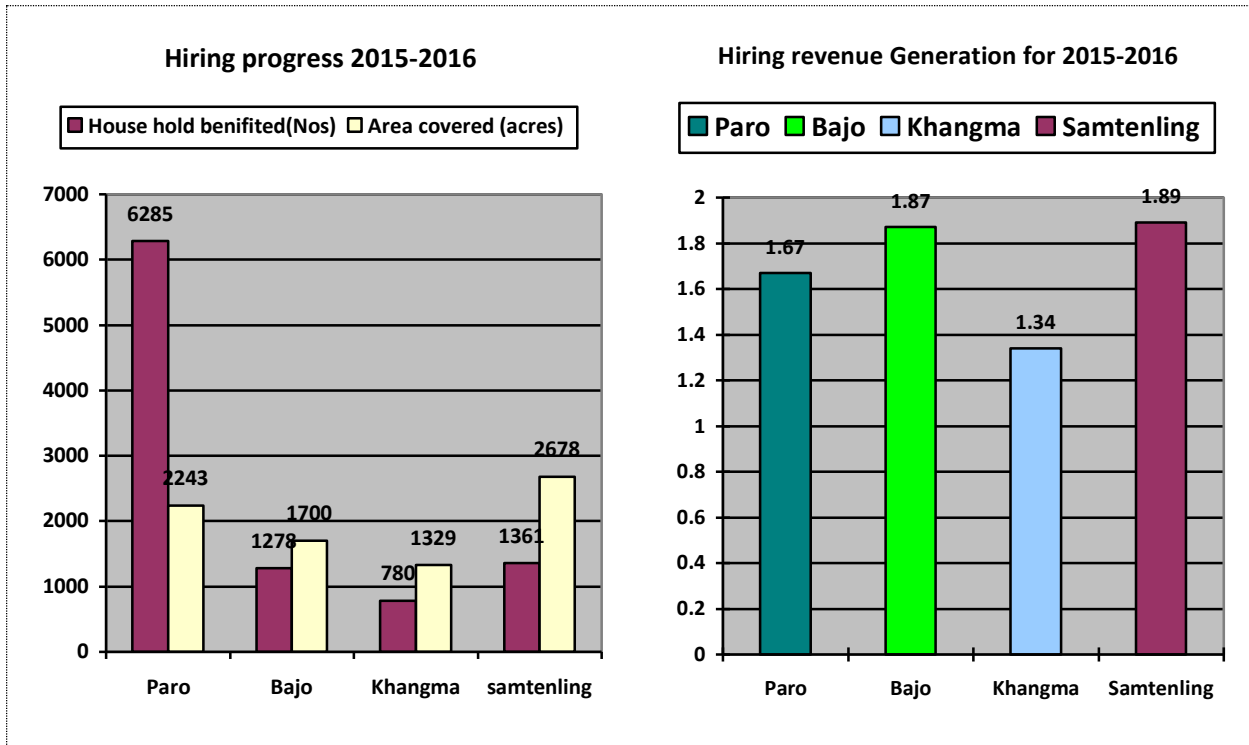
## 18. Activities and Progress through Hiring services

The activities and progress achieved by the centre in providing hiring services to the farmers level for the year 2015-2016. The hiring services were provided to various Dzongkhags as follows, Paro, Thimphu, Samtse, Wangdiphodrang, Gasa, Trongsa, Punakha, Sarpang, Zhemgang, Dagana, Tashigang, Mongar, Samdrupjongkhar and Lhuntse covered in total of 14 Dzongkhags. The total area covered was 7950 acres, benefiting 9704 households.

Various types of machines are available & implemented in the fields for hiring programmes as specified as follows. Power tiller, tractor, transplanter, power reaper, combine harvester, water pump etc.



Machinery hiring activating in fields



Hiring progress reflected in figures

## 19. Awareness meetings on Hiring

Hiring services were provided to the farmers in form of two components one AMC hiring services and another through geog power tiller hiring services implemented by EA of respective geog. The implementing procedures maintain the same standard throughout the country and the meetings were conducted & attended by DAOs & EAs of 20 dzongkhags and farmers for sensitization of the beneficiaries in utilization of the farm machines under hiring programmes. .



Awareness meeting for sensitization on hiring programmes

## 20. Conclusion

An effort of publishing the annual progress report annually presenting the main achievements of the Agriculture Machinery Centre is made to provide and disseminate information on the activities focusing mainly on the key achievements.

Agriculture Machinery Centre has completed the planned activities for the fiscal year 2014-2015 with the available resources and facilities provided. The major events that was seen in this year were the handing taking over ceremony of 2KR 2013 amounting to 110 Million Yen which was graced by His Excellency, Lyonchen Tshering Tobgay, the Prime Minister of Bhutan and the Honored Official Representative of the Japanese Government, Mr. Kikuta Yutaka, Hon'ble Minister and Deputy Chief of Mission, Embassy of Japan, New Delhi, power tiller distribution at geog level, implementation of hiring system in different Dzongkhags, in-country manufacturing of the Bhutanese plough, starting off of training in farm machinery operation and maintenance for all extension officers on station as well as on mobile. This year has also seen a major strengthening of the Farm Machinery Service Centers whereby activities like installation and repair, and also hiring are being carried out through the FMSCs.

We hope to carry out and improve for the upcoming years.

The significant achievement of the centre for the fiscal year was the process of delinking the commercial nature of services to the corporation. The cabinet sanctioned the hiring services to be segregated as autonomy corporation to state owned enterprise (SOE). By the end of the year closing, series of meetings were held at all the levels to develop the new way forwards of AMC and the detailed fragmentation of staff with assets, machineries, land, equipment and facilities to be handed over to the new corporation namely Farm Machinery Corporation Limited (FMCL) were carried in all the sections and regionals. The launching of the FMCL was targeted by the start of next financial year. However, official handing-taking were scheduled by 19<sup>th</sup> of August, 2016.