The Republic of the Union of Myanmar

THE REPUBLIC OF THE UNION OF MYANMAR

DATA COLLECTION SURVEY ON AGRICULTURAL MECHANIZATION

FINAL REPORT

JULY 2012

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

TASK CO., LTD

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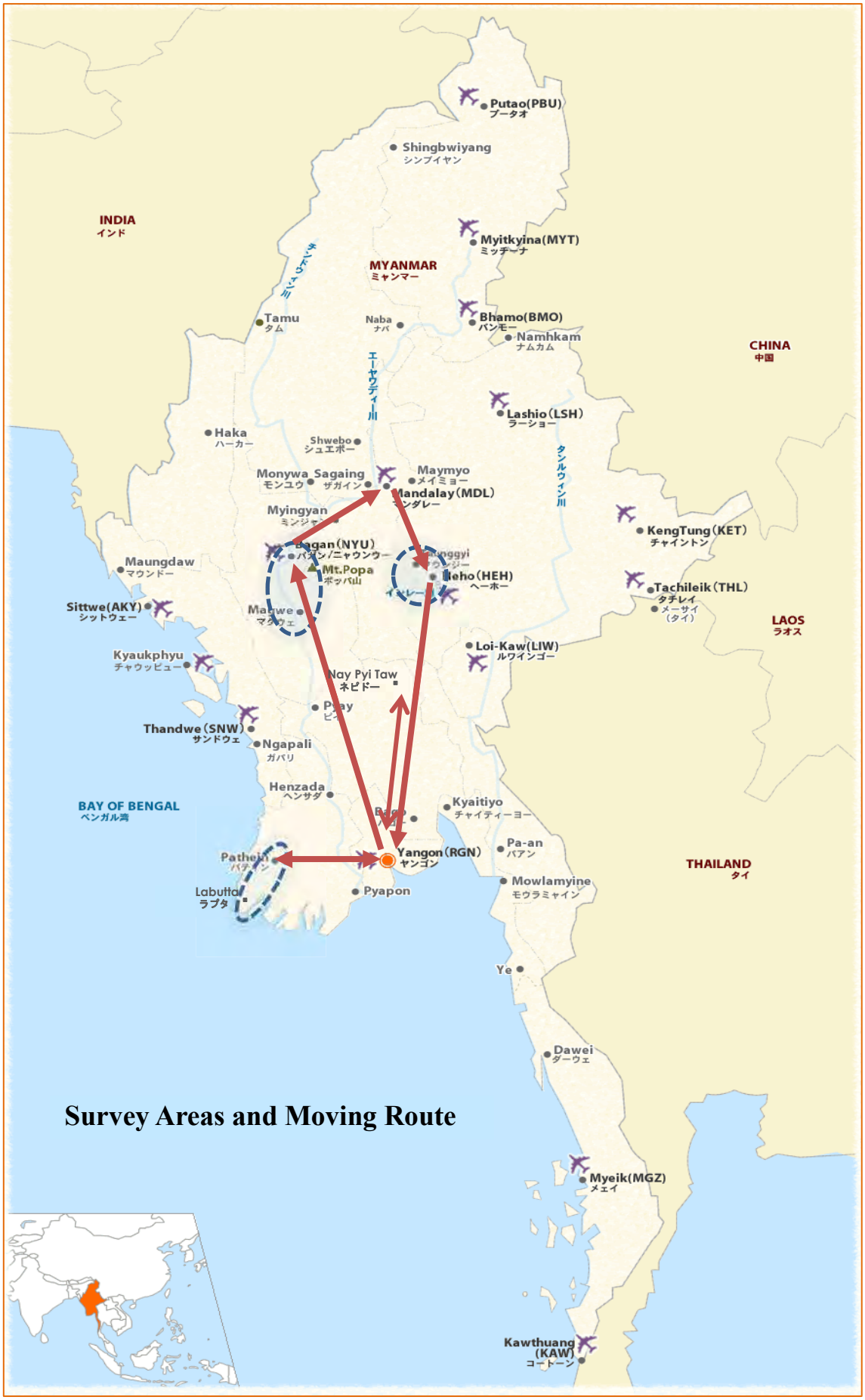


Survey Areas and Moving Route

Agricultural Machinery commonly used in Myanmar

Power Tiller 16/20/22HP

- Made by AMD Farm Machinery Factory
- Engine: Diesel Engine 16hp 20 / 22 hp
- Capacity: Plowing 2 acre/hour 3 acre/hour
- Paddling 3 acre/hour 4 acre/hour

Upland Tiller

- Made by AMD Farm Machinery Factory
- Engine: Diesel Engine 8 - 14hp
- Capacity: 2.5 acre/hour

Mini Tractor

- Made by AMD Farm Machinery Factory
- Engine: Diesel Engine 25hp
- Capacity: Plowing 4 acre/hour
- Paddling 6 acre/hour

Tractor

- Made by Ministry of Industry, No.17 Malun Factory
- Engine: Diesel Engine 40hp

Tractor

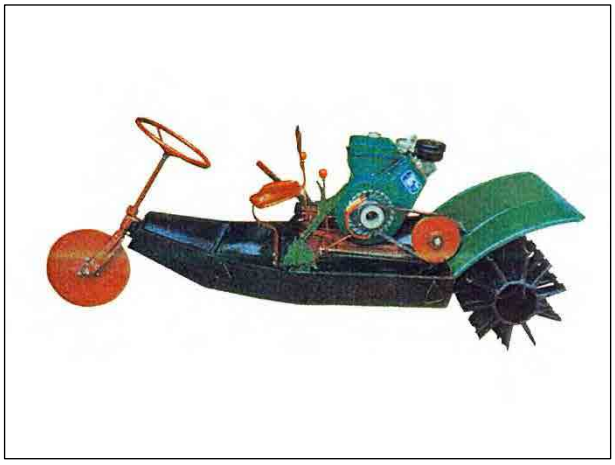
- Made by New Holland in India
- Engine: Diesel Engine 40 hp
- Donation from India

Power Tiller 12HP

- Made in India
- Engine: Diesel Engine 12 hp
- Donation from India

Mono-wheel Tiller

- Made by AMD Farm Machinery Factory
- Engine: Diesel Engine 5-6hp
- Capacity: Plowing 0.2 – 0.3 acre/hour
- Paddling 0.3 – 0.5 acre/hour



Cultivation Roller Boat

- Made by AMD Farm Machinery Factory
- Engine: Diesel Engine 5-6hp
- Capacity: 0.35 – 0.5 acre/hour

8-Row Trans-Planter

- Made by AMD Farm Machinery Factory
- Engine: Diesel Engine 5-6hp
- Capacity: 0.7 acre/hour

Rice Reaper AMR-994

- Made by AMD Farm Machinery Factory
- Engine: Diesel Engine 5-6hp
- Capacity: Plowing 4 - 5 acre/ 8hours

Combined Harvester DSC48

- Assembled by Ministry of Industry, No.18 Inngone Factory
- Manufacturer: Daedong Industrial Co., Ltd.
- Engine: Diesel Engine 48hp

Thresher TH-60 / TH-120

- Made by AMD Farm Machinery Factory
- Engine: Diesel Engine 16hp / 25hp
- Capacity: TH-60 60 basket/hour (about 1.25ton/hour)
- TH-120 120 basket/hour (about 2.5ton/hour)

Pictures for Reference

Cultivation by Cows
[Magway, Magway Division]

Cultivation by Power Tiller
[Magway, Magway Division]

Toraji
Power tiller vehicle equipped with a body.
[Magway, Magway Division]

Paddler for Animal Traction

[Pwint Phyu, Magway Division]

Model Mechanization Farm
AMD staff explains the description board shown in the booth for visitors.
[Nay Pyi Taw]

Model Mechanization Farm
65 acres of farmland belonging to about 20 farmers was reformed and divided into rectangular plots, an acre each.
[Nay Pyi Taw]

Lecture of Mechinery Training Cource for Farmers
4 weeks of O &M and repair training for major machinery.
[AMD Center, Meiktila, Mandalay Division]

Training of Machinery Operation Practice
Power tiller and Reaper (before)
[AMD Center, Meiktila, Mandalay Division]

Hardware Store in Town
Various consumables and parts of machinery are sold. Almost all are third parties' products and vary in quality.
[Kalaw, Shan State]

Newspaper Advertisement
Sales Promotion of machinery conditioned with a new loan from AGD Bank.
[Yangon]

Post-harvest Facilities of Rice Specialized Company
Complex under construction for drying: 300 tons /d, rice milling: 250 tons/d, seed cleaning: 4 tons/d, and storage: 15,000 tons. They plan to operate it, by purchasing rice from contracted farmers.
[Minbu, Magway Division]

Experimental Rice Mill Plant in PTAC
It is not old dated without frequent use.
[Hlegu, Yangon Division]

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Abbreviations and Acronyms

ADB	Asia Development Bank
ADRA	Adventist Development and Relief Agency Myanmar
AFPTC	Agriculture and Food Produce Trading Cooperation
AMD	Agriculture Mechanization Department
AMDA	Association of Medical Doctor of Asia
ASEAN	Association of South-East Asian Nations
AVSI	Association of Volunteers in International Service
BAJ	Bridge Asia Japan
CARI	Central Agricultural Research Institute
CBM	Central Bank of Myanmar
CESVI	Cooperation a Suilupo
CIF	Cost, Insurance and Freight
DAP	Department of Agriculture Planning
DAR	Department of Agricultural Research
DOA	Department of Agriculture
EDA	EDA Rural System
FAO	Food and Agriculture Organization
FOCSIV	Federation on Organization of Charity Service for International Volunteer
GDP	Gross Domestic Product
GRET	GRET Professionals for Fair Development
IDEM	International Development Enterprises Myanmar
ID	Irrigation Department
IRC	International Rescue Committee, USA
JICA	Japan International Cooperation Agency
JETRO	Japan External Trade Organization
K.	Kyat(s)
KOICA	Korea International Cooperation Agency
L/C	Letter of Credit
MADB	Myanmar Agricultural Development Bank
MAPT	Myanmar Agricultural Produce Trading
MAS	Myanmar Agriculture Service
MDG	Millennium Development Goal
MFTB	Myanmar Foreign Trade Bank
MICB	Myanmar Investment and Commercial Bank
MICDE	Myanmar Industrial Crop Development Enterprise
MOB	Myanmar Oriental Bank Ltd.
MOAI	Ministry of Agriculture and Irrigation
MOI	Ministry of Industry
MT	Metric Tonne
NGO	Non-Governmental Organization
NLD	National League for Democracy
ODA	Official Development Assistance
O&M	Operation and Maintenance
PACT	Private Agencies Collaborating Together

PPP	Private Public Partnership
PTAC	Post-harvest Technology Application Center
R&D	Research and Development
RMA	Myanmar Rice Miller's Association
SD	Survey Department
SLRD	Settlement and Land Record Department
SMEs	Small and Medium Enterprises
SPDC	State Peace and Development Council
TS	(AMD)Tractor Station
T/T	Telegram Transfer
2KR	Grant Assistance for Underprivileged Farmers
UMFCCI	The Union of Myanmar Federation of Chambers of Commerce and Industry
UNDP	United Nation Development Program
WRUD	Water Resources Utilization Department
YAU	Yezin Agricultural University

Unit

Term/Sympol	Conversion
Area	
acre/ac	1 ac=0.405ha
hectare/ha	1 ha=2.47 acre
Length	
feet	1feet=30.5cm
inch	1inch=25.4cm
Weight	
ton(s)/t	1 ton=1,000kg
bag	1bag=50kg, 110lb
basket	1basket= paddy 20.9kg, milled rice 34.0kg(=16pyi) meize (seed) 24.9kg sunflower 14.5kg groundnut (husked)11.4kg sesame 24.5kg black gram 32.7kg green gram 32.7kg other beans 31.7kg
viss	1viss=1.634kg, 3.6 lb
pond/lb	1lb=0.454kg
Volume	
gallon/gal	1gal =3.785 m^3 =4.546 litters =6 bottles (beer)
Power	
horse power/hp	
Currency	
United State Dollars/US$	US$1.00=¥79.26 (June, 2012)
Kyats/K.	K.1.00=¥0.096 (June, 2012)

Summary

Background and Objectives of the Study

In the Republic of the Union of Myanmar (Myanmar), approximately two-thirds of the total working population is engaged in the agricultural sector. In 2009, the agricultural sector comprised 39.9 % of Myanmar's total GDP. The proportion of the population engaged in the agricultural sector, is one of the highest in the ASEAN region. In March 2011, Myanmar President Thein Sein, emphasized the importance of the agricultural sector in his inaugural address. Thein Sein noted that Myanmar is a nation largely dependent on agriculture. Under the national development plan, one of the four agricultural development policies is the "promotion of agricultural mechanization".

Agricultural machineries used in Myanmar are not only imported, but also domestically produced by the Ministry of Agriculture and Irrigation, the Ministry of Industry, and private small-to-medium sized companies. Despite such endeavors, agricultural mechanization has not been smoothly achieved. For example, machinery recently imported from China is cheap but of lower quality, while other imported machinery, from Japan, for example, are too costly for most farmers to purchase. Even if farmers obtain agricultural machinery currently available, the price of diesel oil is so high that they are forced to cease their use.

With this backdrop in mind, the study aims to examine the current condition of agricultural mechanization in Myanmar, analyze the subject, and determine the possible fields and directions for Japan's support programs for the promotion of agricultural mechanization in Myanmar.

Overview of the Agricultural Sector in Myanmar

- Recently, the proportion of the agricultural sector contributing to the GDP has decreased slowly, to 31.9 % in 2009/2010. Nevertheless, agriculture is still the backbone industry of the country, since 50.2 % of the total working population remains engaged in the sector.
- Agricultural development policy consists of four issues: (1) to allow freedom of choice in agricultural production, (2) to expand agricultural land and to safeguard the rights of farmers, (3) to encourage the participation of the private sector in commercial production of seasonal and perennial crops, and the distribution of farm machineries and other inputs, and (4) to encourage the research and development of activities to improve the quality and increase the production of agricultural crops.
- The government of Myanmar designated rice, a major export item, as the Principal National Crop, and has focused on expanding its production. The production of rice in 2010/2011 was 32,579 thousand tons, an increase of 1.8 times as much from 1995/1996. However, a stable increase in rice exports has not been achieved.
- On the other hand, the production of beans and pulses, typically green gram, has dramatically increased. Since the introduction of economic liberalization in 1988, they have yielded high profitability due to a high export demand, mainly in India.

Present Condition of Agricultural Mechanization

- There are about 210,000 power tillers and one third of them are used in the Ayeyarwady Division. Tractors are still very limited, with about 10,000 in number, used mostly in the east Bago Division, the south Shan State, and the Yangon Division. Moreover, as for roller boats, one-wheel power tillers, and small tractors, which are mainly used in the swamp area, most are used in the Ayeyarwady Division. As for other agricultural machinery, there are about 180,000 pumps, 130,000 sprayers, and 40,000 power threshers.

Number of Major Agricultural Machines

Machines	Tractor	Power tiller	Pump	Sprayer	Trans-planter	Reaper	Combine harvester	Thresher
No.	10,490	206,263	182,880	126,700	67	1,569	131	41,289
/'000ha	0.87	11.1	14.8	-	-	-	0.01	2.84

Source: AMD

- During from 1995/1996 to 2010/2011, the net sawn area was expanded by 49.9 % from 9,170,000 ha to 13,750,000 ha, and the total sawn area was expanded 83.3 % from 12,884,000 ha to 23,618,000. Moreover, crop intensity increased 31 % from 141 % to 172 %. Simultaneously, new farmland and irrigation systems have been developed and multi-cropping areas have been expanded along the sawing area. While the sawing area and crop intensity rates have increased, the number of drought cattle heads have only increased slightly, to nine heads from 743 per 1,000 ha in 1995/1996. They are mostly leveling off. On the other hand, the use of power tillers has increased remarkably to 11.1 in 2010/2011 from 1.85 per 1,000 ha in 1995/1996.
- The total area under tillage by tractors and power tillers in 2010/2011 was 4,146,000 ha. The mechanization cultivation rate of the total sawn area was 17.6 %, and cultivation using water buffaloes or cows remained in the lead, exceeding 80 %t.

Condition of Organizations related to Agricultural Mechanization

(1) Ministry of Agriculture and Irrigation (MOAI), Agricultural Mechanization Department (AMD)

- There is no synthetic farm mechanization development plan or strategy in Myanmar. AMD under MOAI is solely in charge of promotion for agricultural mechanization.
- There are six AMD roles: i) land reclamation, land consolidation and land development works, ii) provide farm mechanization services on land preparation, harvesting and threshing, iii) production and distribution of appropriate farm machineries, iv) research and development of agricultural machinery, v) implementation of up-land reclamation on hilly regions, and vi) dissemination of technical know-how on utilizing farm machinery to local farmers and production technologies to private industries.

- Although there was specific activity in (i) – (iii) and (v) above, there was no substantial activity in (iv). The farmers' training course for operation, maintenance and repair of agricultural machine technology in (vi) was recently established and began last year.
- AMD has a staff of more than 6,000 across the country, 16 offices at the state and division level, 23 offices at the district level, 99 tractor stations, three agricultural machine production factories, ten repair centers, and two training centers.
- Tractor Station (TS): AMD has TSs in 99 places. The role of TS are (i) to provide mechanization services to farmers, (ii) make sales and after sales machinery services available in AMD factories, and (iii) provide land consolidation and reform service to farmers. Land consolidation and reform services (iii) are undertaken at the farmers' request, but the farmers who pay service expenses cannot generally request it. Since most TS tractors were produced from 1960 to 1990, they are mostly old and will need to be replaced and updated as soon as possible, otherwise the provision of services will be reduced. The total service area of mechanization services in 2011/2012 was 290,000 acres (120,000 ha).
- Workshops: AMD has two central workshops and eight medium workshops all over the country. The workshops perform TS tractor services, the after-sale services of agricultural machines that TS sells, and repair services to neighboring farmers. However, the activities are not sufficiently performed due to a limited budget and equipment. With this backdrop in mind, AMD has established a plan for three medium workshops.
- Model mechanization farms: Farmland reform has not been carried out well in Myanmar. There is no access to farmlands for rice transplanting machines and combine harvesters, even if light machinery such as small power tillers can access land to be used. For this reason, expansion of farmland consolidation and reform work, together with farm road improvements, are indispensable to the promotion of agricultural mechanization. AMD is trying to expand mechanized farmland by forming agreements between farmers at nominated sites in the country. Through this program, AMD will reform and improve the irregular shape of farm plots to rectangle plots of 1 to 2 acre(s), equip them with farm roads, and if necessary, irrigation, and drainage waterways. Additionally, AMD will provide new ridge making and leveling works for each plot. Following the achievement that the "model mechanization farm," the program undertook a total of 2,656 acres in 16 areas, 9 states and divisions in the last year (2011/12), AMD plans to cover 3,500 acres (the number of participating farmers: about 350 houses) in 7 states and divisions this year. It is proposing a budget of US$ 1,800,000 per one site but this total budget has not yet received authority approval.
- Training centers: AMD has two training centers in Meikttilar, in the Mandaley Division and Phayargyi, in the Pegu Division. AMD provides AMD staff training on general business and operation, maintenance, and repair of agricultural machinery that focuses on tractors. In the last year, the center in Meikttilar started the training program for farmers. It provides training on operation, maintenance and repair of major agricultural machines,

over four weeks. In the last year, it carried out the training program six times and trained a total of 252 farmers. AMD has a plan to strengthen training capability. By this plan, AMD will train instructors at the central training center, and choose nine tractor stations in the area with the largest mechanization needs among the 99 tractor stations. Here the trained instructors will conduct training programs for farmers in the same program.

- Agricultural machinery manufacturing factories: AMD has three agricultural machinery manufacturing factories in Mayangore and Dagon, in the Yangon Division, and in Kyaukse, in the Mandalay Division. In 2011/2012, the number of major agricultural machines manufactured included 2,985 power tillers, 775 threshers, 150 roller boats, 102 transplanters, and 50 mini tractors. However, the government is considering a way to fundamentally privatize these factories.

(2) Ministry of Industry

- Ministry of Industry has three agricultural machinery manufacturing factories, in Sinde in the Bago Division, in Maulun in the Magway Division, and in Inngone in the Mandalay Division. In 2011/2012, the number of major agricultural machines manufactured included 5,000 power tillers, 700 tractors, 500 units of reapers, and 240 threshers.
- For these factories, the policy of PPP (Public Private Partnership), involving technical cooperation with private enterprises and long-term leases to private enterprises, had been considered, as well as production in the AMD factories.

(3) Ministry of Commerce, Myanmar Agriculture Products Trade (MAPT)

- Since 1988, the liberalization of agricultural marketing has been actively promoted and the organizational size of MAPT has been reduced dramatically. Almost all tasks related to the marketing of agricultural products, including the monopoly of buying and exporting rice were eliminated. As a result, staff numbers were cut from 10,000 to 2,187 and the main role of MAPT changed, to issuing permission for the trade or construction of rice mills.
- At the time, MAPT (previously the Agriculture and Food Produce Trading Cooperation, AFPTC) was in charge of the R&D sector of post-harvest technology. The Post-harvest Technology Center (PTAC) was established in 1985, supported by the Japanese government.
- Taking MAPT's current situation into account, their original role in the R&D sector is questionable, since MAPT's task of post-harvesting technology ceased.

(4) Myanmar Agricultural Development Bank (MADB)

- MADB is headquartered in Yangon and is in 16 divisions/state levels, and 205 district level branches.
- MADB has two major loan systems, a seasonal loan (shorter than one year) and a mid-term loan. Approximately 90 % of all loans are seasonal loans and it targets

producers of eight specific crops, namely rice, sesame, groundnut, and cotton, etc. The repayment period of the seasonal loan is around eight months and it allows only bullet loans, not installments.

- Recently, the number of MADB users has decreased. In 1996, nearly 2 million farmers accessed MADB's loans, but the number dropped to 1.3 million in 2004. One reason for the decrease is that the loan size is too small to meet the farmers' needs.

Subjects for Agricultural Mechanization by Stakeholders

Subjects for Agricultural Mechanization by Stakeholders, obtained from the survey results, are summarized in the Table below.

Subjects for Agricultural Mechanization by Stakeholders (Private Sector)

Stakeholders	Subjects
Farmers	- Lack of individual financing and adequate loan services to purchase machinery. - Lack of proper information for selection and utilization of machines. - Farmers don't have systematic technology and knowledge for operation, maintenance and repair of machines. - Farmers cannot consider and evaluate economic effects of machine use due to limited economic management knowledge. - Machines cannot access farmlands because of no land reform. - Machines and attachments do not adapt properly to local farming conditions.
Agricultural cooperatives	- Farmers are reluctant of collective purchases and use of machines.
Machine dealers	- Poor development of farmland reform. - Unclear appropriate machine utilization technology. - Lack of economic evaluation for machine use.
Mechanization service providers	- Unclear business profitability - Limited area that machines can access
Repair shops	- Only knowledge through experience without academic technology learning. - No shops with proper and scientific allocation of repair equipment. - Various standards are inconsistent and cause maintenance and repair difficulties.
Postharvest factories and processors	- Unstable supply of electricity. - <Rice mills> Loss generation due to lack of machine operation skills. - There are poor quality consumables and parts in the market.
Manufacturers	- The manufacturing capacity of manufacturers except large companies, is limited to sheet metal processing, which can at most produce threshers. - Low need of medium to big scale machines due to limited access to farmland.

Subjects for Agricultural Mechanization by Stakeholders (Public Sector)

Stakeholders	Subjects
AMD	- There is no synthetic farm mechanization plan or strategy in Myanmar that involves crossover and collaboration among related organizations. - Each program activity for promotion of agricultural mechanization is carried out individually without systematic management of all programs. - No effective budget allocation suited for activity plans. - No research and development activities. - Unclear future plan for tractor stations, workshops and training centers. - Difficult expectations of the privatization movement for machinery

	manufacturing factories. - Less experience for implementation of donors' support projects.
AMD tractor station	- Almost all tractors are old, break down frequently, with high fuel consumption. - Insufficient budget allocation. - Low staff motivation for activities improvement.
AMD workshops	- Equipment and facilities are too old to perform proper repair. - Insufficient budget allocation. - Low staff motivation for activities improvement.
Factories of AMD and Ministry of Industry	- Unstable supply of electricity. - Insufficient budget allocation. - Difficult expectations of the privatization movement for machinery manufacturing factories.
PTAC	- MAPT's task of post-harvesting technology ceased.
Financial institutions	- There are no adequate financial services programs. - MADB's loan amount is too small for farmers to invest in new inputs. - Microfinance covers only about 10 % of the country, and a limited number of farmers actually access the service.

Possible Fields and Directions for Japanese Support Programs

Possible fields and directions, and expected contents for Japanese agricultural mechanization support programs, addressing the subjects outlined above, are arranged in the following table.

Possible Fields, Directions and Contents for Japanese Support Programs

Fields	Agency in charge	Directions (○: Key Directions)	Priority*	Short/ Long term**	Contents and Remarks
Strengthen promotion system	AMD	○Train staff for promotion of agricultural mechanization.	A	Long	**< Officer training>** To improve capabilities of planning, operation management and monitoring of staff、especially in the department of planning. Same function is attached to the following "Expected Support" with *.
			B	Long	< **Technical training**> To build the capacity of technical staff through providing various technical training opportunities concerning the agricultural mechanization field.
	AMD Others	○Show all prospect and promotion programs for development of agricultural mechanization.	A	Short	< **Support for formulation of agricultural mechanization plan/strategy.***> To assist in the consideration and formulation of agricultural mechanization plan/strategy together with related organizations and agencies focusing on AMD. To assist with producing agreements for collaboration activities among related organizations and agencies focusing on AMD. To improve capabilities regarding planning, operation management, and monitoring of AMD staff.
Strengthen	AMD	○Research and	A	Long	< **Support for establishment of research and**

research and development activities	Others	development for proper utilization of machinery. Development of adaptation technology suited to local farming conditions. Inspection and evaluation of machines sold in the market.			**development organizations and strengthening activities.*>** To assist in the establishment of effective organization through collaboration among rated organizations such as YAU and DOA, focusing on AMD To train researchers and staff on a series of activities, a selection of subjects, and implementation and evaluation. (Since experienced staff are limited it will take a long period)
			B	Long	< **Technical training**> To build the capacity of technical staff by providing various technical training opportunities concerning research and development of agricultural machinery.
			B	Short	**< Support for inspection and evaluation activity of agricultural machines>** To provide inspection equipment. To assist in teaching and training methods of inspection and evaluation. To assist with adaptation to international test codes and preparation of local standards. It will be activity in a section if the R&D organization is established. Since it takes time to acquire results from R&D activities, it can be implemented in advance of an R&D organization program; inspection and evaluation activities can start a short time after technology transfers and after various machines are already used in the field. Capacity and safety evaluation results for machines will be announced publicly and for disqualified machines under the standard, advice or recommendations will be given to import dealers to improve or exclude them from the market.
			B	Short	< **Support for introduction of a certification system for agricultural machines' quality and safety.**> To assist with machine quality and safety inspections through manufacturer, importer, and dealer requests To issue certification labels to qualified machines based on the above standard. If there is the rule that machines purchased for official projects or buyers using official loans require this certification, disqualified machines in the market will be gradually reduced.
Strengthen	AMD	○Expand farms	A	Short	< **Support for improvement and expansion of**

Land Consolidation and Reform Activity		accessible to machinery.			**model mechanization farm program* by AMD**>
To assist in showing the economic advantages to farmers after land consolidation and reform of plots by farmers' agreement, provide a series of mechanization services suited to local farming conditions and economic evaluation of mechanized farming.
To assist with the dissemination evaluation results and promotion in other areas. (Appropriate loan programs are effective for the extension of the model program.)
To assist with total management technology training programs to AMD staff, with cooperation from DOA on extending farming technology to farmers.
To utilize the place for experimental R&D activities for establishing farming guidelines.
Strengthening Technology Extension Activity	AMD+ DOA	○Extension of methods of consideration including economic analysis for introduction of machines.	A	Long	<**Support for dissemination of agricultural mechanization extension programs.***>
To assist in disseminating the "agricultural mechanization extension program" by compiling the results of R&D activities and achievements of model mechanization farm program to farmers.
To assist in showing the experimental and practical material, including considering methods for introduction of machines and use, and utilization methods for economic use of machines.
		○Experimentation and extension of proper model mechanization systems.	B	Short	<**Support for demonstration of model mechanization farms. ***>
To attach demonstration mechanized farms to ordinary DOA demonstration farms through the collaboration of DOA.
To divide a farm to small, medium, or large plots by size.
To assist in demonstrating effective machine, animal and labor use, by the size of each plot. The results of the above economic evaluation are shown publicly.
To assist in demonstrating various post-harvest processing methods by showing comparative data of product quality and losses, if possible.
To use the place for experimental R&D activities for establishing farming guidelines.
	AMD	○Improvement of operation, maintenance and repair technology for agricultural machines.	A	Short	< **Support for training of operation, maintenance, and repair technology to farmers.**>
To assist in strengthening training of operation, maintenance and repair technology to farmers owning machines.
To assist in the formulation of an expansion plan

					for the training program held in the central AMD training center, to improve training contents, and to increase the number of trainers. To strengthen training machines and equipment.
		○Improvement of maintenance and repair technology for agricultural machines.	A	Short	< **Support for training of maintenance, and repair technology to engineers of repair shops**> To assist with training of maintenance and repair technology to engineers of repair shops, as developed from the above program. To assist in formulating methods for training, preparation programs, and to train instructors. To introduce training machines and equipment. To issue the certifications to trainees.
			B	Short	< **Support for formulation and implementation of repair technology authorization systems for repairing engineers.**> To provide the certification examination to repairing engineers and issue licenses to successful candidates. To assist in determining certification standards and the contents of examinations, to train examiners. To introduce equipment and materials for examinations. This program can be included with the above program.
			C	Short	< **Support for formulation and implementation of evaluation and certification systems for facilities of repair shops.**> To inspect and evaluate repair facilities including machines and tools, and provide the rank and certification. To assist in preparing checklist and to train inspectors. Inspectors go around randomly, visit to shops and provide advice for improvements after evaluations.
		Improve economic mindset for introduction of machines	B	Short	<**Support for strengthening economy management technology to farmers**> To assist with training of basic economic technology such as accounting and bookkeeping for farmers to evaluate economic effects of machines.
		Improve business management mindset concerning machinery use	B	Short	< **Support for strengthening farm economic management technology to processors.**> To assist with training and teaching basic business management technology, such as accounting and bookkeeping To assist with training in cost/benefit analysis for using machines

	PTAC/ AMD	Extension of improvement technology for rice millers and distributors.	C	Short	< **Support for formulation and implementation of market oriented model extension programs.**> To assist with demonstrating the business model of post-harvest processing, storage and rice milling, including marketing, if possible. To assist with promotion of a self-certification system for the quality of products。
Loan provision	MADB	○Provision of proper loan program for purchasing machines.	A	Short	< **Support for development of a loan program suited to machine purchasing**> To provide a fund. To assist with developing a loan program with proper conditions suited for farmers who purchase machines. The program is implemented by MADB using their network and management know-how.
Comprehensive program	AMD / Cooperatives /NGOs /other	Extension of collective use of machines as a component of village/rural development programs.	B	Short	< **Support for planning and implementation of "village/rural development programs through mechanization"**> To assist with constructing village roads, farm roads, land consolidation and reform, in a village or a community. To assist with promoting income increases through collective mechanized farming. If possible, mechanization service to other farmers can be included. To provide agricultural inputs including machines, to construct repair shops and offices, etc. To assist with training of mechanized farming, business management, operation, maintenance and machine repair technology, etc. To assist with collecting machine use charges from farmers for machine replacement and purchasing in the future. Such accumulated funds can be lent out as a short term micro-credit to members.

*Order of importance and priority from A (highest) to C (lowest) **Period of support program

Chapter 1

Introduction

Chapter 1 Introduction

1.1 Background of the Study

In the Republic of the Union of Myanmar (Myanmar), approximately two-thirds of the total working population is engaged in the agricultural sector. In 2009, the agricultural sector comprised 39.9% of Myanmar's total GDP (Gross Domestic Product). The proportion of the population engaged in the agricultural sector is one of the highest in the ASEAN region. In March 2011, Myanmar President Thein Sein, emphasized the importance of the agricultural sector in his inaugural address. Thein Sein noted that Myanmar is a nation largely dependent on agriculture. Therefore, the government will develop the agricultural sector to increase the quantity and quality of crops and improve the livelihood of farmers.

Since the introduction of the market economy in 1988, the Myanmar government's agricultural policy focused on three main areas: (1) food security and production of surplus food through the expansion of rice farming; (2) achievement of self-sufficiency in edible oil production, and; (3) increase in the availability of crops for export. The government has also recognized the need for agricultural mechanization and has actively promoted it. In the 1990s, the government implemented a dry-season rice farming plan and introduced Chinese-style water pumps to increase the farming area in the delta during the dry season. From 2000-2010, the Ministry of Agriculture and Irrigation (MOAI) planned for mechanization to cover 63% of the total farming area within 30 years. Moreover, in May 2008, the government, and local/international NGOs provided small-power tillers to farmers affected by Cyclone Nargis, to compensate them for their loss of cows and water buffalos in the Ayeyarwady Delta. These machineries were not only imported, but also domestically produced by the MOAI, the Ministry of Industry, and private small-to-medium sized companies.

Despite such endeavors, agricultural mechanization has not been smoothly achieved. According to previous studies, mentioned later herein, two major factors play a role. They are the "ecological and social circumstances in rural Myanmar" and "the structure of agricultural and economic policy." Regarding ecological and social circumstances in rural Myanmar, it is pointed out that nearly 30-50% of the rural population consists of landless agricultural laborers, most of whom live below the poverty line[1]. Furthermore, in the central plain area, annual rainfall is small and unstable. It is difficult to manage the risk of unstable agricultural income by high input farming, including mechanization[2]. In regards to the policy itself, past policies that called for governmental control over production and marketing conflicted with newly introduced policies of economic liberalization.

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1 Okamoto "Economic Disparity in Rural Myanmar," 2008

2 JICA "The development study on sustainable agricultural and rural development for poverty reduction program in the central dry zone of the Union of Myanmar," 2010

Furthermore, it can be argued that agricultural machinery available in the market does not necessarily meet the needs of farmers. For example, machinery recently imported from China is cheap but of lower quality, while other imported machinery, from Japan, for example, are too costly for most farmers to purchase. Even if farmers obtain agricultural machinery currently available, the price of diesel oil is so high that they are forced to cease their use. The Agricultural Mechanization Department (AMD) under the MOAI provides the mechanization service[3] for farmers. The Ministry of Cooperatives organizes farmers' groups to assist them in purchasing small agricultural machines by loan. However, machinery possessed by such government organizations is limited and old, and cannot respond to the needs of farmers.

With this backdrop in mind, the study aims to examine the current condition of agricultural mechanization in Myanmar and determine the approach for Japan's aid policy for sustainable agricultural mechanization. The team expects that the study and its findings support maintaining food security and farmers' income generation in Myanmar.

For years, Japan has postponed new economic supports for the nation. However, under the current democratization process and introduction of an open policy by the current government led by President Thein Sein, Japan should consider expanding official development assistance with an aim to restructure its partnership with Myanmar. The agricultural sector reflects the current changes in Myanmar. Japan should focus its attention and support in this area. The study, therefore, focuses on agricultural mechanization.

Summary of problems and study points in the previous studies

・An Economic Study on Irrigated Summer Rice Production in Myanmar
(Koichi Fujita and Ikuko Okamoto, 2000)

The paper notes that rice farming in Myanmar does not reach its full potential in the international market due to the problems of agricultural institutions. In addition, a large number of the landless population in rural areas prevented the development of rice farming. In these conditions, increases in capital input in the rice sector cannot improve the situation. As a solution to these obstacles, the paper suggested: (1) redistribution of farmland to landless farmers; (2) promotion of an effective rental market of working animals, power tillers and pumps, and; (3) development of credit services through international aids, etc.

[3] Mechanization service is the service of providing farming activities produced by machinery, or the rental service of machinery to farmers.

・Agricultural Sector Review Investment Strategy (UNDP, 2004)

The report points out the lack of capacity of government agricultural machine factories. They cannot respond to the current needs of mechanization in Myanmar. According to its statistics, there is demand for mechanization in 270,000 households and on 1.55 million acres of farmland. Nevertheless, the government factories can only produce about 21,000 machines annually. Showing such data, the paper insists that the mechanization sector needs to be privatized gradually.

・Rice-Centered Policy and Rural Economy in Myanmar (Kyosuke Kurita, Ikuko Okamoto, Takashi Kurosaki, and Koichi Fujita, 2004)

This research was conducted in eight villages of the Ayeyarwady Delta, the central dry zone and the mountainous zone. The results implied, oddly, that agricultural income tended to decrease in areas where irrigation of rice farming was actively promoted. This situation was mainly caused by a combination of government control over land-use and the rice market on the one hand, and the partially introduced market economy, on the other. In particular, the villages of the Ayeyarwady Delta reflected this trend, while the peripheral areas with less governmental influence, developed more commercialized agriculture.

Additionally, dry season rice farming was actively promoted in the Ayeyarwady Delta through the introduction of water pumps and power tillers by the government. However, there were many unused machines due to the low price of rice, and high cost of diesel oil. The result implied the failure of the policy, which does not match the reality of market mechanisms.

・Economic Disparity in Rural Myanmar (Ikuko Okamoto, 2008)

This paper analyzes the dynamism in rural Myanmar, with special focus on the Yangon Division, where the cultivation of green gram for cash has rapidly increased since the introduction of an economic liberalization policy. The spread of cultivation in the region has been achieved with the support of dissemination tractors, the service of rental tractors, development of intermediaries, and the informal credit system. Recognizing green gram as a lucrative market, various stakeholders developed each business, especially in the mechanization service, with the expansion of production. As a result, the Yangon Division benefited from economic liberalization. Partly because beans were outside the control of the government, the case can be regarded as a model for the spread of mechanization that corresponds to market mechanisms. On the other hand, the paper also points out that the gap between farmers, those who could invest in the non-agricultural sector, and landless workers, has widened. On this basis, with the imbalance in the rural economy, market mechanisms have been promoted.

The Development Study on Sustainable Agricultural and Rural Development for Poverty Reduction Program in the central dry zone of the Union of Myanmar (JICA, 2010)

This survey was conducted in order to draw a comprehensive action plan of poverty reduction and regional development in the central dry zone of Myanmar. According to the report, the region is significantly different from the delta in terms of agricultural ecological conditions. The absolute amount of rainfall is not only small, but has also been characterized as capricious in time and space. Taking conditions into account, multi-input agriculture such as machinery and chemical fertilizer increase the risk. In this region, rather than a single-line agricultural policy as in the delta region, the livestock, which is easily transferred to cash, an appropriate or the combination of crops along with the conditions, can be more suitable for risk diversification.

· Impact of Cyclone Nargis on Rice Production and the Process of Restoration in the Ayeyarwady Delta, Myanmar (Masahiko, Matsuda 2011)

The purpose of this paper is to assess the recovery from Cyclone "Nargis" which caused enormous damage to the Ayeyarwady Delta, in May 2008. According to the report, the Ministry of Agriculture and Irrigation, and international NGOs have embarked on reconstruction assistance immediately after the disaster. They have supplied rice seeds and power tillers as compensation for cows killed by Nargis.

Eco-History in Southern Shan State, Myanmar: Development Process of Commercial Farming and Indigenous Irrigation System (Masahiko, Matsuda 2010)

The purpose of this paper is to investigate and analyze the current situation and the transition of farming systems in the mountainous Southern Shan State, near Taunggyi. According to the paper, since the 1960s, shifting cultivation has gradually converted into continuous upland farming and self-sustainable agriculture into commercial agriculture. Furthermore, from 2000-2010, the introduction of irrigation and chemical fertilizers has spread in the area and more intensive farming of cash crops, such as garlic and soybeans, has increased. Upland agriculture with irrigation, which allows choice of a wide range of crops can adjust market dynamism in the medium and long-term. Those who adopted the system demonstrated economic superiority. It is claimed the development of such commercial agriculture is because the agricultural policies by the central government did not penetrate in the area.

However, in recent years, tension between the central government and ethnic minority organizations has been mitigated, and the central government began to intervene in agricultural development to increase production of rice in the area. The author indicates that to

promote rice farming as in the delta is not necessarily appropriate in the study area, but commercial farming of cash crops, utilizing existing irrigated farmland, will be more effective.

1.2 Purpose of the Study

The purpose of the study is to obtain the latest documentation, such as statistical data, concerning the agricultural sector of the country, to understand the current status of agricultural mechanization, through interviews with related stakeholders and observation of related facilities, and finally to determine the positive and negative factors for the development of mechanization. Analyzing the data, the study ultimately aims to provide information which contributes to create a new framework and direction for Japan's future support of Myanmar.

1.3 Research Methodology:

Hearing survey to relevant agencies

The team obtained the latest documentation and conducted supplementary interviews, along with the list of information attached to the Inception Report which was submitted prior to the visit.

Field survey

A field survey was carried out in three focused areas: Ayeyarwady Delta area (Labutta and Pathein), the central dry zone (Magway and Bagan), and the mountainous area (Taunggyi). In these areas, interviews with farmers and other stakeholders were conducted. In addition, the team also visited facilities such as the AMD Tractor Station and observed the condition of the facilities. Interviews were conducted along with the prepared questionnaires so as to avoid bias by each researcher.

Survey of agricultural machinery production factories

In Yangon and Mandalay, the factories of the Ministry of Industry, AMD, and the private companies were visited and investigated. Observations of the facility survey were carried out along with the prepared questionnaire.

Study of the distribution of agricultural machinery

Imported agricultural machinery was investigated in Yangon and Mandalay. Interviews were carried out along with the prepared questionnaire. In the case of repair shops and parts warehouses, observational research was also conducted.

Analytical methods:

With reference to the considerations that were identified in the preparation prior to the field study, the team reviewed the information gained from interviews and observation, and

obtained the negative and positive factors for agricultural mechanization. Lastly, the framework and focused areas of Japan's support were analyzed.

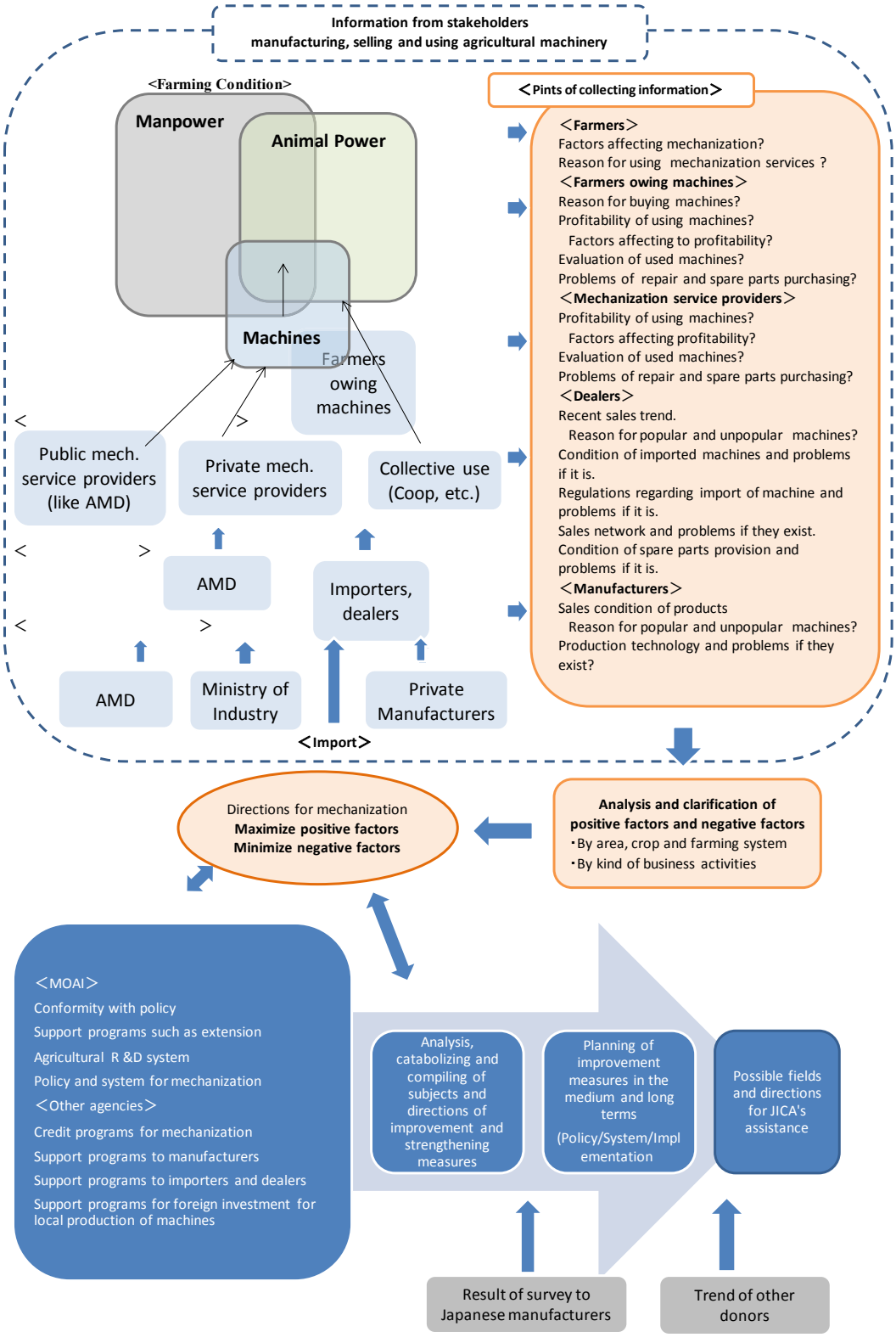


Figure1-1 Operation Flow of Field Survey and Analysis

1.4 The Team Members and Study Schedule

The team was composed of 4 members;

Mr. Akeshi Mori (Advisor; TASK Co., Ltd.)
Leader/Policy of Agricultural Mechanization;

Mr. Yasunobu Kudo (Senior Consultant, TASK Co., Ltd.)
Field Condition of Agricultural Mechanization/Market of Agricultural Machinery;

Mr. Teruhisa Aoki (Senior Consultant, TASK Co. Ltd.)
Operation and Maintenance Condition of Users/Manufacturing Condition for Agricultural Machinery;

Ms. Akiko Akiyama (Consultant, TASK Co. Ltd.)
Field Condition of Agricultural Mechanization/Condition of Donor's Projects for Agricultural Mechanization

Mori organized the study, and was also responsible for the field of agricultural mechanization policy. Kudo was in charge of market research of agricultural mechanization and farmers research. Aoki was in charge of the investigation of agricultural manufacturers and maintenance condition of agricultural machinery, mainly in processing industries after the harvest of agricultural plants. Kudo and Aoki also assisted Mori with his work. Akiyama conducted the survey of donors and NGOs and assisted with the farmers' survey.

In addition, the field survey was carried out as outlined in the table below. With a limited schedule, each researcher collected information in crosscutting areas.

Visited stakeholders	Location	Member in charge
Governmental organizations, relevant organizations	Nay Pyi Taw,Yangon	Mori, Akiyama
Import traders and dealers of machineries	Yangon, Mandalay	Kudo, Mori
Producers of machinery	Yangon, Mandalay	Aoki
Farmers, Service providers of mechanization service, Co-operatives (Using machinery)	Field areas*	Kudo, Mori, Akiyama
AMD Tractor Station, processors (Rice millers and oil millers, repair shops)	Field areas*	Aoki, Mori

*Three areas: Ayeyarwady Delta (Pathein and Labutta), central dry zone (Bagan and Magway) and South Shan area (Taunggyi)

The field survey was scheduled for 28 days, from April 29, 2012 to May 26 2012, in Nay Pyi Taw, Yangon, Mandalay, as well as the three areas for the two-week visit (See also Appendix 1: Schedule of JICA Mission and Appendix 2: List of Interviewees).

1.5 Field Visit Survey

Table 1-1 shows the number of interviewed stakeholders.

Table 1-1 Number of Interviewed Stakeholders

Stakeholders	Ayeyarwady Delta	Central Dry Zone	South Shan Area	Total
Farmers	8	8	7	23
Farmers' groups and cooperatives	1	1	0	2
Import traders and dealers of agricultural machineries	2	2	3	7
AMD Tractor station	3	3	1	7
Farm Machinery Production Factories	2	2	0	4
Rice Mill Factories	3	5	1	9
Oil Mill Factories	0	1	0	1
Sugar processing factories	0	0	1	1
Repair shops	2	4	2	8
Private industrial association (Myanmar Rice Miller Association)	1	0	0	1
Total	22	26	15	63

Chapter 2

Overview of the Agricultural Sector in Myanmar

Chapter 2 Overview of the Agricultural Sector in Myanmar

2.1. Ecological Conditions

Myanmar lies in the northern latitude, 9 degrees and 29 degrees, and to the eastern longitude, 92 degrees and 101 degrees. It is surrounded by Bangladesh (west), India (northwest), China (northeast), Laos (east), and Thailand (east). It has a total area of 676,590 square kilometers and has a variety of geographical conditions, such as a mountainous area (900 to 2,100 meters above sea level), a plain area composed of four major rivers: Ayeyarwady, Chindwin, Sittaung and Salween. In particular, there is the Ayeyarwady Delta in the basin of Ayeyarwady, Chindwin and Sittaung.

The country's climate varies between the tropical monsoon and the dry period. The rainy season occurs from the middle of May to the middle of October and the dry season occurs from the middle of October to the middle of May. Temperatures in the central plain area average from 10 to 15.6 degrees in December and January during the lowest dry season, and at its peak temperatures reach an average of 40.6 to 43.3 degrees during the hottest season. Annual rainfall averages 2,500 to 5,000 millimeters in the coastal area, below 1,000 millimeters in the dry zone, and 1,000 to 2,000 millimeters in other divisions.

The Ayeyarwady Delta and the coastal plains are a vast alluvial area and major rice-producing area in the country. In contrast, the central plain area of Myanmar is spread to the north, 480 to 560 kilometers from the Ayeyarwady Delta. This central plain area of Myanmar has a diverse agricultural ecosystem due to the semi-arid zone with an annual rainfall of 625 millimeters, with 2000 millimeters of rainfall where a variety of crops grow. The mountainous areas of the Chin State (west), the Kachin State (north), and the Shan State (east), are divided to the mountainous area located 1,000 meters above sea level, and the hilly area located below 1,000 meters. In these areas, rice for self-sufficiency, and cash crops, such as vegetables are cultivated, depending upon the ecological conditions of each region.

The current land use of the country is shown in Table 2-1. Agricultural land, including fallow land and uncultivated land, is 17,636,000 hectares (ha), which accounts for 26 % of the total land mass.

The agro-ecological zone of the country is generally divided into the delta zone, the central dry zone, the mountainous zone, and the coastal zone[1]. The Ministry of Agriculture and Irrigation categorizes the 11 agro-ecological zones by annual rainfall (three levels) and soil classification (5, 6 groups).

[1] Matsuda "Dynamic of Rice Production Development in Myanmar," 2009

In this study, three areas from the four general agro-ecological categories were studied, except the coastal zone. Table 2-2 summarizes the characteristics of each zone.

Table 2-1 Land use in Myanmar[2]

(Unit : '000 ha)

	1995/96	2000/01	2007/08	2008/09	2009/10	2010/11	%
Net area sown	8,910	9,909	11,707	11,878	11,975	12,023	17.8
Fallow land	1,231	686	264	256	241	231	0.3
Uncultivated land	7,971	7,205	5,789	5,670	5,610	5,382	8.0
Reserved forest	10,321	12,914	16,756	16,837	16897	18,369	27.2
Other forest area	22,079	19,786	16,548	16,419	16,255	15,378	22.7
Other	17,147	17,159	16,594	16,599	16,681	16,276	24.1
Total	67,659	67,659	67,659	67,659	67,659	67,659	

Source : MOAI "Settlement and Land Records Department"

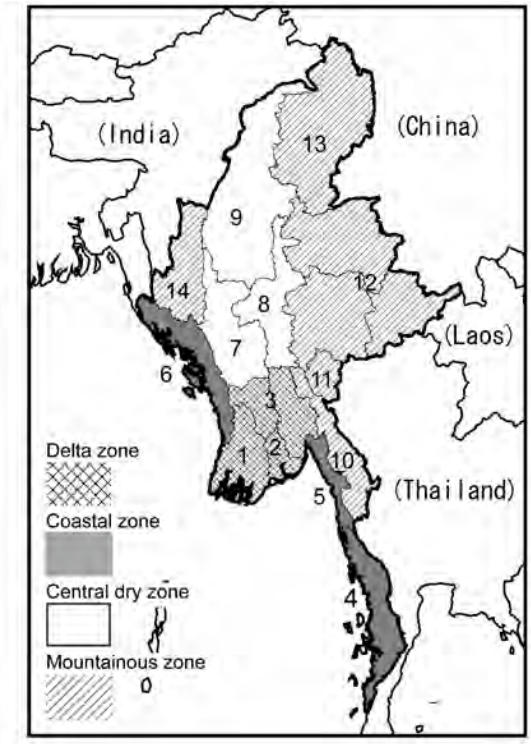
Table 2-2 Agro-ecological Zones and Their Characteristics in Myanmar

	Delta zone	Central dry zone	Mountainous zone	Coastal zone
Division/ State	Bago Division, Yangon Division, Ayeyarwady Division, Mon State (North)	Magway Division, Mandalay Division	Shan State	Tanintharyi Division, Mon State, Kayin State
Overview	Low land in the Ayeyarwady Delta and the Sittaung Delta. Total area is approximately 3.1mil.ha. Mostly a monoculture of rice.	Central plain area in Myanmar with around 1,000 mm annual rainfall per year. Mandalay is the central city in the area. Traditional life styles remain there. Various crops are cultivated. There are main irrigation facilities. Nearly 40 % of all crops in the country are produced here.	High rainfalls. Tropical climate with a combination of deciduous forest and tropical mixed forest. In the lower area of the high land, there is rice farming. There are Shan people who belong to the Thai ethnic group, and they have a strong connection with Thailand. In Bawdiwn, there are lead mines and plantations of Falcata (*Albizzia falcate*). Around the Salween river, there is potential for development.	Along the Malay Peninsula, the area is surrounded by long and thin mountains. It is the highest rainfall area in Myanmar .
Geography	Monsoon delta	The central plateau from Nay Pyi Taw to Mandalay.	Hilly area (Shan hill). Salween river flows vertically in the State.	Along the coast, there is the zonal plain and the altitude is higher towards the east side. There are Kayin and Tanintharyi mountains.
Population	Bamar (or Burman)	Bamar (or Burman)	Minority groups such as Shan, Palaung, etc.	Bamar (Burman), Rakhine (Arakanese)

[2] Since the fiscal year of Myanmar is from April to March, the year is described as "1995/1996."

Climate	Relatively less variation in temperature. Annual rainfall is between 2,000 to 3,000mm. Rainy season (mid-May to mid-October), dry season (mid-October to mid-May)	The lowest rainfall area in the country. There is a distinct rainy season and dry season. Summer (mid-March to mid-May), rainy season (mid-May to October), winter season (November to February).	Rainy season (mid-May to mid-October), dry season (mid-October to mid -May). Annual rainfall is between 1,000 and 2,000mm.	Annual rainfall is between 3700 to 5000mm. It is a high rainfall area.
Soil	Alluvial soil	Red, savanna soil. Due to the dry climate, farmland soil is weathered and sandy.	Red, laterite soil	Alluvial soil
Major crops	Rice (delta-style rice farming and intensive rice farming with an irrigation canal) and beans.	Rice (self-sufficient), oil seeds, beans, vegetables, tea, sesame, and groundnut	Rice, wheat, maize, sorghum, firewood (for steaming tea, and heating), vegetables (cash crops for cities, such as the tomato in Inle lake), and sugarcane	Rice, rubber, oil seeds and fruits
Land use and farming system	Lowland rice. The main rice (rainy season), and beans (black gram and green gram).	Rain-fed rice farming. The combination of sesame, groundnut, beans (chick pea, green gram) are popular in the upland farm area.	There is a rice terrace (12,478ha in Shan state, around 5% of the total lowland). Upland rice and shifting cultivation are practiced. All the rice terrace are irrigated and are mostly single season cropping.	In addition to lowland rice, there are many orchards /plantations of rubber, oil seeds, and fruits.
Water recourse	(Rain-fed), water pump, canal irrigation	(Rain-fed), farm pond (traditionally irrigated rice farming), partially canal irrigation	(Rain-fed)	(Rain-fed)
Sown area of rice (2000/01)	3,073,696ha (rainy)	991,919ha (rainy)	386,083ha (rainy)	474,696ha (rainy)
	872,128ha (dry)	197,088ha(dry)	22,663ha (dry)	12,140ha (dry)

Source：AICAF “Agriculture in Myanmar”(Japanese), 1996
AICAF “The current condition of Agriculture and related organizations in Myanmar”(Japanese), 1996
Kurita et al. “Rice-Centered Policy and Rural Economy in Myanmar,” 2004
Fujita and Okamoto “Agriculture of Myanmar under Open Economy” (Japanese), 2004



1. Ayeryarwady Division
2. Yangon Division
3. Bago Division
4. Tanintharyi Division
5. Mon State
6. Rahkine Division
7. Magway Division
8. Mandalay Division
9. Sagaing Division
10. Kayin State
11. Kayah State
12. Shan State
13. Kachin State
14. Chin State

Source： Mastuda "Dynamics of Rice Production Development in Myanmar: Growth Centers, Technological Changes, and Driving Forces," 2009

Figure 2-1 Agro-ecological Zone of Myanmar

2.2 Agricultural Sector

2.2.1 Trends in the agricultural sector

Gross domestic product (GDP) per capita in the country is US$ 854.6 (2012) and has increased about four-fold from US$ 216.4 in 2005 (see Table 2-3). However, it is still the lowest level among other neighboring countries, and the United Nations regards the country as one of the least developed countries[3].

Table 2-3 GDP Per Capita and Comparison with Other Neighbor Countries

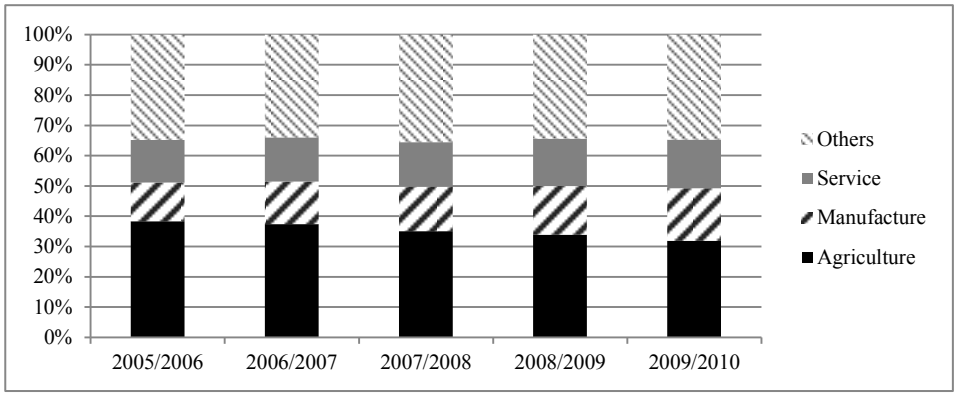
(Unit: US$)

Country	2005	2006	2007	2008	2009	2010	2011	2012
Bangladesh	399.207	419.417	468.888	527.887	584.841	641.992	678.028	700.597
Cambodia	455.089	513.624	603.137	710.883	703.407	752.68	851.529	931.167
Laos	463.545	595.687	693.64	856.177	885.709	1,003.71	1,203.56	1,338.34
Myanmar	216.404	256.66	350.142	533.453	587.274	741.666	831.91	854.632
Thailand	2,825.33	3,296.09	3,917.89	4,399.03	4,151.30	4,992.43	5,394.36	5,851.00
Vietnam	636.911	724.049	835.09	1,047.87	1,068.32	1,173.56	1,374.01	1,498.11

Source：IMF "World Economic Outlook Database," 2012

[3] AICAF "The current condition of Agriculture and related organizations in Myanmar"(Japanese), 1996

Recently, the proportion of the agricultural sector contributing to the GDP has decreased. For example, to 31.9 % in 2009 and 2010. Nevertheless, agriculture is still the backbone industry of the country, since 50.2 % of the total working population remains engaged in the sector, as Table 2-4 indicates.



Source：JETRO "BOP Business Potential Needs Report," 2012

Figure 2-2 Proportion of Each Industry in GDP (%)

Table 2-4 Working Population of Each Industry (2010)

Industry	Proportion
Agriculture	50.2%
Mine	1.6%
Manufacture	5.9%
Construction	4.0%
Trade	10.5%
Other	27.8%

Source：UNDP "Integrated Household Living Assessment Survey (Poverty Profile)," 2011

2.2.2 Trend in agricultural production

The government of Myanmar designated rice, a major export item, as the Principal National Crop, and has focused on expanding its production. Before the war, the country was one of the major rice exporting countries, exporting approximately 3 million tons of rice per year. However, since its independence, a shortage of rice supply was coupled with an increase in population, meaning more rice production was needed as its population rapidly grew.

As described below, as a response to the growing demand for rice, the government has executed an agricultural policy to increase rice production. Between the 1970s and 1980s, under the plan to promote high yielding rice, the introduction of high yielding varieties had improved productivity. In addition, the government launched the plan to promote dry season rice in the 1990s, initially in the delta area, and in the late 1990s, in the central plain and mountainous areas. The series of rice

production policies demonstrated achievement, and the production of rice in 2010 and 2011 increased 1.8 times as much from 1995 and 1996. However, a stable increase in rice exports has not been achieved.

In addition to rice, achieving self-sufficiency of edible oil is also positioned as a priority in the agricultural policy. It focuses on expanding production of groundnuts, sesame, sunflowers, and oil palm. However, the production of oil crops has not demonstrated sufficient results, while import of cheaper oil palm has increased.

On the other hand, the production of some crops, typically green gram, has dramatically increased. Since the introduction of economic liberalization in 1988, certain crops not controlled by the government have yielded high profitability due to a high export demand, mainly in India.

Table 2-5 Sown Area and Production of Major Crops

Crop		1995/96	2000/01	2005/06	2007/08	2008/09	2009/10	2010/11
Rice	Sown area ('000ha)	6,138	6,359	7,389	8,090	8,094	8,067	8,047
	Production ('000MT)	18,580	21,324	27,683	31,450	32,573	32,681	32,579
	Yield (MT/ha)	3.1	3.4	3.8	3.9	4.0	4.1	4.1
Black gram	Sown area ('000ha)	474	620	815	980	988	1,023	1,055
	Production ('000MT)	371	532	1,021	1,381	1,446	1,509	1,604
	Yield (MT/ha)	0.8	0.9	1.3	1.4	1.5	1.5	1.5
Green gram	Sown area ('000ha)	460	742	949	1,066	1,039	1,077	1,121
	Production ('000MT)	337	519	945	1,197	1,240	1,336	1,410
	Yield (MT/ha)	0.7	0.7	1.0	1.1	1.2	1.2	1.3
Oil palm	Sown area ('000ha)	8	19	67	93	102	112	125
	Production ('000MT)	17	72	114	210	211	249	335
	Yield (MT/ha)	3.9	9.1	8.9	8.9	7.3	7.7	8.9
Sunflower	Sown area ('000ha)	221	518	690	835	884	883	859
	Production ('000MT)	164	268	560	703	780	782	790
	Yield (MT/ha)	0.8	0.5	0.8	0.9	0.9	0.9	0.9
Sesame	Sown area ('000ha)	1,276	1,424	1,338	1,508	1,570	1,634	1,585
	Production ('000MT)	304	426	504	781	853	868	862
	Yield (MT/ha)	0.3	0.3	0.4	0.5	0.5	0.5	0.5
Groundnut	Sown area ('000ha)	527	590	730	815	844	866	877
	Production ('000MT)	593	731	1,039	1,222	1,305	1,362	1,392
	Yield (MT/ha)	1.2	1.3	1.4	1.5	1.6	1.6	1.6

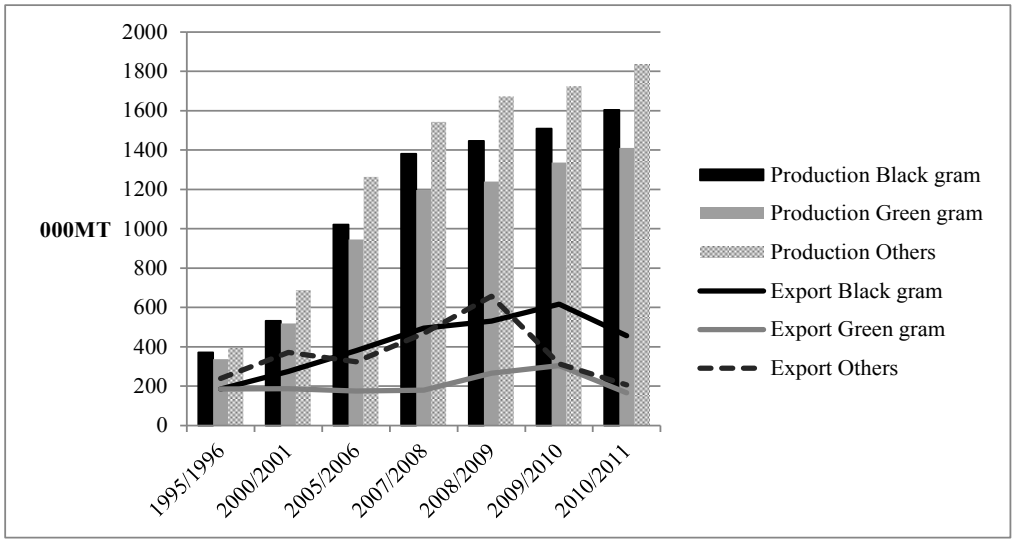
Source： DAP " Myanmar Agriculture at a Glance 2011," 2011

Table 2-6 Export of Major Crops

Unit：’000MT

	1995/96	2000/01	2005/06	2007/08	2008/09	2009/10	2010/11
Rice	354.0	251.4	180.0	358.5	666.4	818.1	536.4
Maize	62.0	147.9	90.0	156.0	120.3	10.4	44.8
Sesame	50.3	34.4	21.5	31.5	19.5	24.4	29.5
Black gram	185.0	274.6	379.6	494.4	529.7	615.8	456.5
Green gram	185.9	186.0	174.1	178.8	264.8	303.6	166.3
Other beans	238.7	370.7	323.8	468.2	656.8	312.5	206.6

Source：DAP “Myanmar Agriculture at a Glance 2011,” 2011



Source：DAP “Myanmar Agriculture At A Glance 2011,” 2011

Figure 2-3 Production and Export of Beans

2.3 Policy of the Agricultural Sector

2.3.1 National policy

The Fifth Five-Year Plan

Since 1988, after taking previous steps, the government of Myanmar has started to adapt its centrally planned economy to the market economy. Along these lines, the government declared "development of agriculture as a base as well as all-round development of other sectors of the economy" as a development goal. Toward this end, the areas of development focused on: (1) commercialization of agriculture and (2) food security. More specifically, the policy initiated the liberalization of the rice market, the distribution of unused agricultural land to private investors, and the exemption of an import tax on agricultural equipment.

The national five-year plan[4] has been ongoing, and currently, the fifth five-year plan (2011/2012 to 2015/2016), is being conducted. The plan focuses on the agricultural sector and the services sector, and sets the goal of 10.5 % of annual economic growth.

In addition, the government is reviewing the entire development plan, including the development plan of each ministry.

Action Plan On Rural Development and Poverty Alleviation[5]

Since March 2011, the new government establishment began to take an active open policy, and it held a "National workshop on poverty alleviation and rural development" on the 20th to 21st of May 2011. The President of the Union of Myanmar indicated that, as an agro-based country, the development of agriculture, livestock and fishery sectors could overcome food security concerns caused by climate change. Increases in rural income and poverty alleviation will be a priority since 70 % of the population is living in the rural areas, the main productive force for the nation. Poverty alleviation can succeed only when the rural economy is developed, since rural productivity and rural economy play a key role in the national economy.

In the workshop the "Action Plan for poverty alleviation and rural development" was summarized. In the general statement, it was mentioned, "the main purpose is to form the institutions firmly and strongly. It should be formed based on the willingness and eagerness of the people, who should not be ordered to be involved. It should be noted that, in the past, cooperative societies failed and unnecessary problems occurred because all households in a village/ward were made a member of the cooperative society." The statement implied that the current government regretted the top-down politics of the past military government and tried to shift politics to a people's participation approach.

2.3.2 Agricultural policy

In the “Myanmar Agriculture in Brief 2011” policies, objectives and strategies are documented. In addition, it also mentions that a published development plan has existed since 1988. The latest version is the Fifth Short-Term Plan (2011/2012 to 2015/2016) although the team could not acquire the document. The plan/strategy regarding agricultural mechanization along with the Fifth Plan has not been established.

In addition, as mentioned above, the government of Myanmar is currently reviewing and reconstructing the entire development plan.

[4] The plan was not officially disclosed.
(http://www.mofa.go.jp/mofaj/gaiko/oda/shiryo/kuni/11_databook/pdfs/01-09.pdf)

[5] IMF “2011 Annual Meeting: Governor Statement,”, 2011

Policy

(1) To allow freedom of choice in agricultural production.
(2) To expand agricultural land and to safeguard the rights of farmers.
(3) To encourage the participation of the private sector in commercial production of seasonal and perennial crops, and the distribution of farm machineries and other inputs.
(4) To encourage the research and development of activities to improve the quality and increase the production of agricultural crops.

Policy changes related to crop production

Some agricultural policies relating to important industrial crops were previously changed for the better performance of producers and the development of local market activity, as mentioned below:

(1) Elimination of the state procurement policy on cotton, sugarcane and rubber, and freedom in trading and production activities of cotton, sugarcane and rubber.
(2) Encourage expansion in the area of rubber, oil palm and other potential crops for export.
(3) Pricing at market rates to purchase raw cotton, sugarcane and rubber for the consumption of state-owned factories and mills.
(4) Permission for the producers and exporters to export surplus rubber after the payment of taxes.
(5) Permission to allow state-owned factories and mills for the area expansion of cotton, sugarcane and rubber, to meet the annual requirements.

Objectives of the agriculture sector

(1) Fulfill the needs of local consumption.
(2) Export more surplus agricultural products to increase foreign exchange earnings.
(3) Assist rural development through agricultural development.

Main objective of the MOAI

(1) Efforts are being made to increase the income of farmers through the increase of crop production.
(2) Targeted yield of 10 principal crops is demonstrated below:

Table 2-7 Targeted Yield of 10 Principal Crops

Crops	Yield(t/ha)	Crop	Yield(t/ha)
Rice	5.16	Sesame	1.21
Sugarcane	75.32	Sunflower	1.79
Long Staple cotton	1.61	Black gram	1.61
Maize	4.93	Green gram	1.61
Groundnut	1.40	Pigeon pea	2.02

Source： Myanmar Agriculture in Brief 2011

Measures to be undertaken for 10 principal crops

(1) Application of improved varieties appropriate for respective regions.

(2) Utilization of adequate fertilizers.
(3) Effective pest management.
(4) Application of efficient and appropriate technologies.
(5) Utilization of appropriate cropping patterns which are suitable for the respective location.

Five strategies for agricultural development

(1) Development of new agriculture land.
(2) Provision of sufficient irrigation water.
(3) Provision and support for agricultural mechanization.
(4) Application of modern agro-technologies.
(5) Development and utilization of modern varieties.

Chapter 3

Present Condition of Agricultural Mechanization

Chapter 3 Present Condition of Agricultural Mechanization

3.1 Situation of Agricultural Machinery Use

Agricultural machinery numbers in Myanmar are listed in Table3-1. It was compiled from data submitted, as of March 2012, to the Agricultural Mechanization Department (AMD) under the Ministry of Agriculture and Irrigation (MOAI), from state and division offices. According to the data, there are about 210,000 power tillers and one third of them are used in the Ayeyarwady Division. Tractors are still very limited, with about 10,000 in number, used mostly in the east Bago Division, the south Shan State, and the Yangon Division.

Moreover, as for roller boats, one wheel power tillers, and mini-tractors, which are mainly used in swamp areas, most are used in the Ayeyarwady Division. As for other agricultural machinery, there are about 180,000 water pumps, 130,000 sprayers, and 40,000 power threshers.

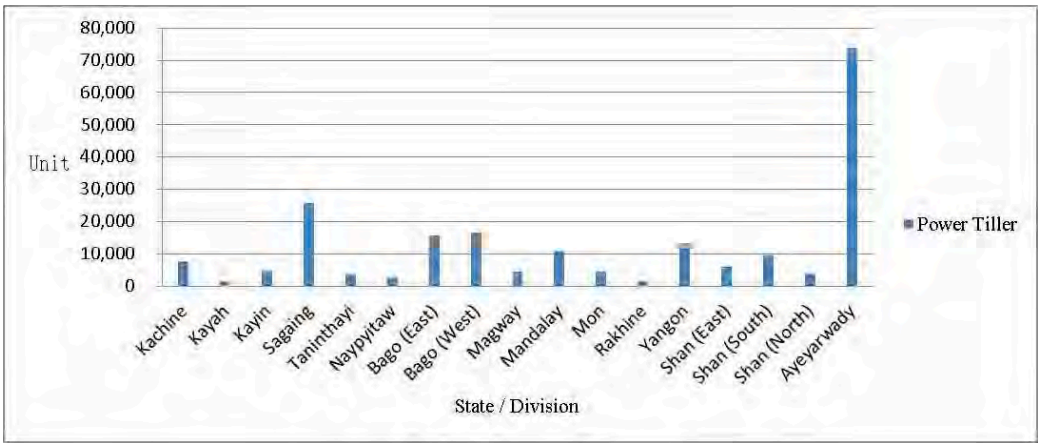
Table3-1 Agricultural Machinery Numbers

Unit: Number

No.	State/ Division	Tractor (50-201HP)	Power Tiller (16-22HP)	Water Pump	Reaper	Power Thresher	Manual Thresher	Inter rolling Cultivator	Seeder	Trailer	Puddler
1	Kachine	265	7,628	2,451	381	966	166	566	311	20	
2	Kayah	72	1,583	493	3	107		875	46	254	
3	Kayin	140	4,845	3,493	41	315		154	22	1,142	
4	Sagaing	891	25,754	29,349	245	8,051	1,065	34,125	18,192	17	
5	Taninthayi	167	3,496	1,203	65	922	37	86	69	24	
6	Naypyitaw	153	2,630	1,815	14	922	15	1,976	388	20	
7	Bago (East)	1,978	15,800	4,661	250	1,450		5			
8	Bago (West)	379	16,608	10,451	16	2,204					
9	Magway	631	4,477	10,930	31	1,113		101,299	13,723	300	
10	Mandalay	469	10,983	25,570	21	2,938		13,349	1,203	200	
11	Mon	441	4,654	5,644	14	81	8	12	2	2,400	
12	Rakhine	45	1,434	155	16	75		52	41	476	
13	Yangon	1,861	13,271	10,293	107	1,660		15	59	20	
14	Shan (East)	66	5,882	191	10	225	14	1,039	1		
15	Shan (South)	1,665	9,604	2,724	20	545		20	19	7,035	
16	Shan (North)	350	3,799	516	62	584	125	309	5		
17	Ayeyarwady	917	73,815	72,941	273	19,131	752	2,969	255	3,247	1,151
	Total	10,490	206,263	182,880	1,569	41,289	2,182	156,851	34,336	15,155	1,151

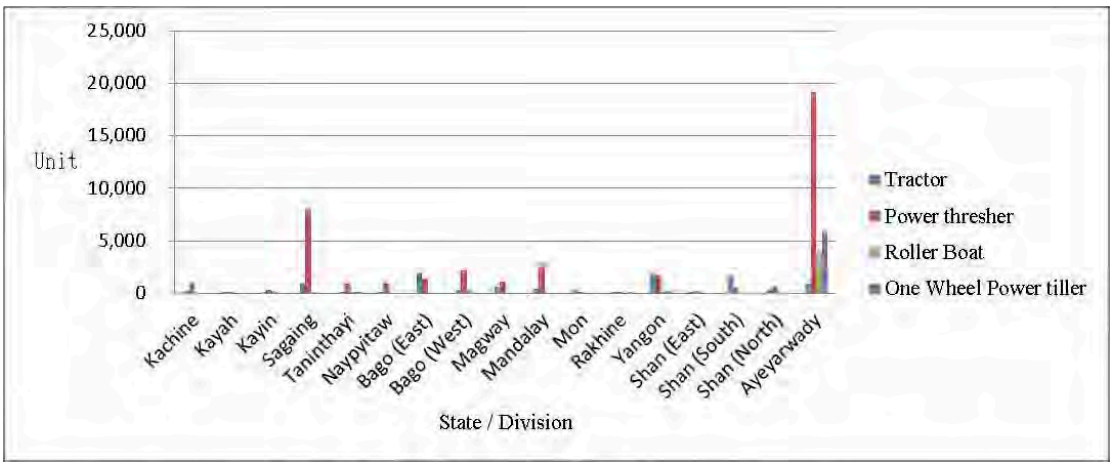
No.	State/ Division	Cultivating Roller Boat	Splinkler	Corn Thresher	Paddy Dryer	One Wheel Tractor	Sprayer	Mini Tractor	Trans planter	Combined Harvester	
1	Kachine		60	2	3		61				
2	Kayah								3		
3	Kayin	38	7	3			14				
4	Sagaing	38					6,260			29	
5	Taninthayi	37				81		2	4	2	
6	Naypyitaw		4	2			19,513			6	
7	Bago (East)				3					3	
8	Bago (West)	412								6	
9	Magway		347								
10	Mandalay		36				52,361		1	22	
11	Mon							13			
12	Rakhine					18	106				
13	Yangon	10				260	14,105		59	40	
14	Shan (East)									8	
15	Shan (South)				1					15	
16	Shan (North)			173	145						
17	Ayeyarwady	3,987	20			5,945	34,280	158			
	Total	4,522	474	180	152	6,304	126,700	173	67	131	

Source: Report on Farmers' Utilization of Farm Machinery submitted by AMD State and Division Offices, March 2012



Source: Report on Farmers' Utilization of Farm Machinery submitted by AMD State and Division Offices, March 2012

Figure 3-1 Number of Power Tillers by State and Division



Source: Report on Farmers' Utilization of Farm Machinery submitted by AMD State and Division Offices, March 2012

Figure 3-2 Number of Major Machinery except Power Tillers by State and Division

However, changes in the number of farm machines, including draught cattle, from 1995/1996 to 2010/2011 are shown in Table 3-2. During this period, the net sown area was expanded by 49.9% from 9,170,000ha to 13,750,000ha, and the total sown area was expanded 83.3% from 12,884,000ha to 23,618,000. Moreover, crop intensity increased 31% from 141% to 172%. Simultaneously, new farmland and irrigation systems have been developed and multi-cropping areas have been expanded along the sawing area.

While the sown area and crop intensity rates have increased, the number of draught cattle heads has only increased slightly, to nine heads from 743 per 1,000 ha in 1995/1996. They are mostly leveling off. On the other hand, the use of power tillers has increased remarkably to

11.1 in 2010/2011 from 1.85 per 1,000 ha in 1995/1996. However, the growth of the number per 1,000 ha of other machines is low, and the investment environment is still weak. As described in Chapter 4, the machine sales market for the past several years has increased the volume of sales, and mostly in the area of power tillers. It is expected that machine investment will see an upward swing over time.

Table 3-2 Changes in the Number of Farm Machines including Draught Cattle

(Machine Q'ty: 1,000 units)

Year	95-96	00-01	04-05	05-06	06-07	07-08	08-09	09-10	10-11
Sown area under various crops (000ha)	12,884	15,450	17,431	18,754	20,405	22,117	22,961	23,363	23,618
Net area sown (000ha)	9,168	10,476	11,415	11,938	12,613	13,224	13,489	13,645	13,745
Cropping Intensity (%)	141	147	153	157	162	167	171	171	172
Draught cattle (Heads)	6,808	8,096	8,711	8,868	9,139	9,557	9,781	10,072	10,338
Per 1,000ha	743	773	763	743	725	723	725	738	752
Tractor	9	11	11	11	11	11	11	11	12
Per 1,000ha	0.98	1.05	0.96	0.92	0.87	0.83	0.82	0.81	0.87
Power tiller	17	57	87	97	109	118	138	148	152
Per 1,000ha	1.85	5.44	7.62	8.13	8.64	8.92	10.23	10.8	11.1
Combine Harvester	1	1	1	0.1	0.08	0.10	0.14	0.16	0.19
Per 1,000ha	0.11	0.10	0.09	0.01	0.01	0.01	0.01	0.01	0.01
Power Thresher	6	19	26	29	32	34	37	40	39
Per 1,000ha	0.65	1.81	2.28	2.43	2.54	2.57	2.45	2.93	2.84
Water pump	72	142	174	179	187	194	198	203	204
Per 1,000ha	7.9	13.6	15.2	15.0	14.8	14.7	14.6	14.9	14.8

Source: DAP "Myanmar Agriculture at a Glance 2011," 2011

Furthermore, other MOAI statistical data[1] show that the total area under tillage by tractors and power tillers in 2010/2011 was 4,146,000 ha. The mechanized cultivation rate of the total planted area was 17.6%, and cultivation using water buffaloes or cows remained in the lead, exceeding 80 %. When annual average area under tillage per machine is calculated from these statistics, it changes within years, but a tractor centering on 50 hp, covers 62-84ha, and a power tiller centering on 20 hp, covers 11-23 ha. The percentage of AMD tractors among all the tractors is about 14 %. Others remain in the private sector.

[1] Although it is from the same source, the numbers are different in Table 3-2. Thus, the accuracy of agriculture machine statistical data in Myanmar is low.

Table 3-3 Utilization of Tractors and Power Tillers

Particular	Unit	1995/96	2000/01	2005/06	2007/08	2008/09	2009/10	2010/11	(%)
Tractors	Number	7,948	8,687	9,773	9,872	9,909	10,110	10,650	100
-AMD	"	2,820	3,151	2,873	2,530	2,458	1,772	1,466	13.8
-Tractors owned by peasants	"	5,128	5,536	6,900	7,342	7,451	8,338	9,184	86.2
Power Tillers owned by peasants	Number	17,000	49,473	100,000	88,126	98,010	132,730	156,977	
Total tillage hectare-turn	1,000ha-turrn	3,166	3,380	1,993	1,974	2,902	3,788	4,146	
-Tractors	"	2,341	1,670	848	609	695	821	858	
-Power Tillers	"	826	1,710	1,145	1,365	2,207	2,967	3,288	

Source: DAP "Myanmar Agriculture at a Glance 201," 2011

3.2 Organizations Related to Agricultural Mechanization

As noted earlier, there is no synthetic farm mechanization development plan or strategy in Myanmar. Activities that involve crossover and collaboration among ministries, offices, and departments in the Ministry of Agriculture and Irrigation (MOAI), are not performed in the field of agricultural mechanization.

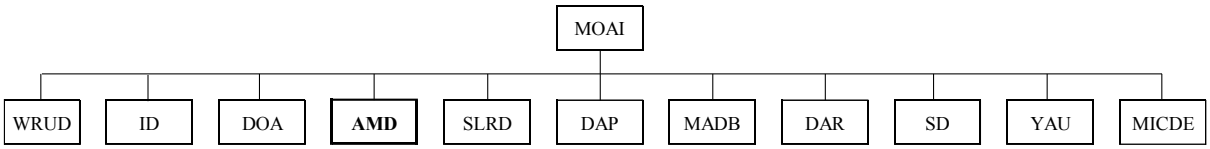
In the Ministry of Cooperatives, there is no program for the promotion of collective activities for the buying and use of agricultural machinery in cooperatives. Moreover, the contents concerning farm mechanization have not yet been introduced into either an agricultural extension program, or into the activity of local offices in the Department of Agriculture (DOA). As a result, AMD is the only organization in charge of promotion activities for agricultural mechanization.

3.2.1 Agricultural Mechanization Department (AMD)

AMD was originally under the Agricultural Rural Development Cooperation established in 1962. It became an independent department in 1972.

Now, AMD has a staff of more than 6,000 across the country, with 315 officials among them, and others who are general employers. It has 16 offices at the state and division level, 23 offices at the district level, 99 tractor stations, three agricultural machanized production factories, ten repair workshops, and two training centers.

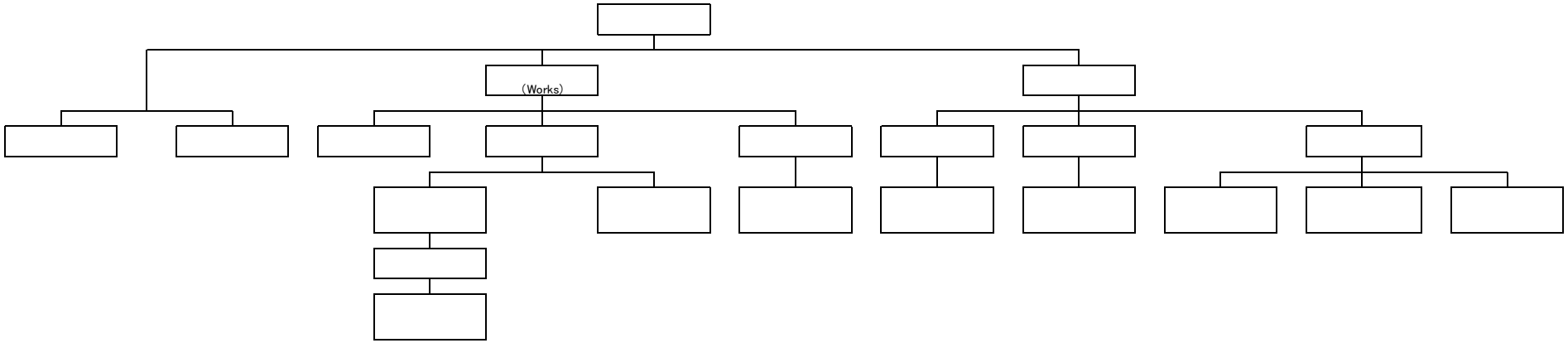
The organization chart is shown in Figure 3-4.



MOAI: Ministry of Agriculture and Irrigation
WRUD: Water Resources Utilization Department
ID: Irrigation Department
DOA : Department of Agriculture
AMD: Agricultural Mechanization Department
SLRD: Settlement and Land Record Department
DAP: Department of Agricultural Planning
MADB: Myanmar Agricultural Development Bank
DAR: Department of Agricultural Research
SD: Survey Department
YAU: Yezin Agricultural University
MICDE: Myanmar Industrial Crop Development Enterprise

Source: MOAI

Figure 3-3 Organization Chart of MOAI



Notes: The number under each section is the number of officials (left) and general employers (right).

Source: AMD

Figure 3-4 Organization Chart of AMD

Budget and expenditures records are shown in Table 3-4. Expenditures exceeded the distribution budget for AMD. This is due to sales of machines produced at three agricultural machine factories and income of mechanization services at 99 tractor stations, partly because of insufficient expenditures allocated from the national treasury budget.

Table 3-4 Result of Budget and Expenditures for AMD

Unit: 1000 Kyats

Year	Budget	Expenditure	Income
2007/08	10,122	15,257	5,135
2008/09	8,119	23,346	15,227
2009/10	3,788	16,933	13,145
2010/11	6,968	18,303	11,335
2011/12	8,701	18,752	10,051

Source: AMD

The planned budget for three years from this year is as follows.

Table 3-5 Three Year Budget Plan for AMD

Unit: 1000 Kyats

Item	2013/14	2014/15	2015/16
Income			
Sales of machinery and mechanizationl services	9,749	9,879	10,009
Other	41	45	50
Total	9,790	9,924	10,059
Expenditure			
Production of machinery and	15,247	1,538	15,526
Raw materials and parts	12,308	12,382	12,465
Expenditure of services	598	610	621
Others	2,342	2,390	2,440
Research & development	100	110	120
Maintenance and reparing	2,095	2,117	2,140
Other	147	163	180
Personel expenditure	6,923	6,923	6,923
Indirect tax (excluding income tax)	60	60	60
Total	22,230	22,365	22,509
Budget	12,440	12,441	12,450

Source: AMD

Functions of AMD

There are six AMD roles[2]:

(i) Land reclamation, land consolidation and land development works
(ii) Provide farm mechanization services on land preparation, harvesting and threshing
(iii) Production and distribution of appropriate farm machineries
(iv) Research and development of agricultural machinery
(v) Implementation of up-land reclamation on hilly regions
(vi) Dissemination of technical know-how on utilizing farm machinery to local farmers and production technologies to private industries

Although there were specific activities in (i) – (iii) and (v) above, there was no substantial activity in (iv). The farmers' training course for operation, maintenance and repair of agricultural machine technology in (vi) was recently established and began last year. The outline of those activities is as follows.

(1) Tractor station (TS)

AMD started establishing TS all over the country in 1972, and installed it in 99 places by 2000. The location of each station and the number of possession tractors is shown in the Table, Appendix-3.

The role of TS are (i) to provide mechanization services to farmers, (ii) to make sales and after sales services of machinery provided from AMD factories, and (iii) to provide land consolidation and reform service to farmers.

Land consolidation and reform services are undertaken at the farmers' request, but there are few farmers who cannot afford to pay service expenses. The "model mechanization farm program," described later, mainly carries it out, instead.

Mechanization services differ depending on the farming environment and mechanization needs of the area. The tractor operating ratios of each TS also differ. Since most TS tractors were produced from 1960 to 1990, they are mostly old and will need to be replaced and updated as soon as possible, otherwise the provision of services will be reduced. Moreover, while service demand of rice transplanting machines and combine harvesters are expected to rise, purchases of these new machines have not progressed as expected. Only 30 combine harvesters produced in South Korea and Japan were recently introduced.

[2] Myanmar Agriculture in Brief, 2011

The total service area of mechanization services in 2011/2012 was 290,000 acres (120,000 ha), and the achievement ratio in the planned area was 84 %. The breakdown of each TS is demonstrated in Table, Appendix-4.

At present, only 1,200 tractors work among a total of 2,000 units, as 800 tractors are out of order. To improve these conditions, AMD has a plan to make 1,600 tractors operate in 2015/2016, by establishing annual improvement standards of 100 new purchases and 100 used tractors, sold after undergoing repair and overhaul work. However, as discussed later, there is a movement toward privatization of agricultural machinery factories. Therefore AMD is considering reorganizing TS in consideration of the environmental needs of each 99 TS, including the future role of TS.

(2) Workshops

AMD has two central workshops and eight medium workshops all over the country. The workshops repair machineries of TS, conduct the after sales services of agricultural machines that TS sells, and repair services to neighboring farmers. However, the activities are not sufficiently performed due to a limited budget and equipment.

Table 3-6 AMD Workshops

No	Workshop	Location	Maintenace Region
1	No. (1) main workshop, Kyaikalo	Yangon	Yangon, Rakhine
2	No. (2) main workshop, Inngone	Kyaukse	Kachin, Shan(North), Mandalay Division
1	No. (1) medium workshop	Pyinmana	Nay Pyi Taw District, Yamethin District, Meiktila District
2	No. (2) medium workshop	Hinthada	Hinthada District, Tharyarwady District
3	No. (3) medium workshop	Magway	Magway Division
4	No. (4) medium workshop	Myaungmya	Pathein District, Myaungmya District
5	No. (5) medium workshop	Ma-Ubin	Ma-Ubin District, Pyapon Distrct, Bago District
6	No. (6) medium workshop	Monywar	Sagaing Division
7	No. (7) medium workshop	Thaton	Mon State, Kayin State
8	No. (8) medium workshop	Shwe Nyaung	Shan State (South), Kayah State

Source: AMD

With this backdrop in mind, AMD has established a plan for three medium workshops. The plan aims to strengthen repair service capability to TS and neighboring farmers, through the introduction of new repair equipment, tools and facilities including buildings.

Table 3-7 Location and Target Machine Numbers of Medium Workshop Construction Plans

No.	Medium Workshop	Maintenance region	Machine owned by farmers		Machine owned by AMD
			Tractor	Power Tiller	Tractor
1	Myitkyina	Kachin State	265	7,628	122
2	Phyu	Bago Division (East)	1,978	15,800	192
3	Pyay	Bago Division (West)	379	16,608	147

Source: AMD

This plan will be reconsidered within the framework of existing workshops with the goal of privatizing AMD agricultural machinery production factories, allowing for the coexistence of state AMD workshops and private repair shops. This will also address the fundamental problem of insufficient budget allocation to all repair workshops.

(3) Model mechanization farms

Farmland reform has not been carried out well in Myanmar. There are many irregularly shaped farm plots, surrounded by narrow and vulnerable ridges, and in terrace fields of the hilly area. There is no access road for machines. They cannot be used even though light machinery such as small power tillers can be used.

For this reason, farmland consolidation expansion and reform work, together with farm road improvements, are indispensable to the promotion of agricultural mechanization.

The "model mechanization farm" program, was promoted last year in response to a directive by the Minister of Agriculture and Irrigation. Along these lines, AMD is trying to expand mechanized farmland by forming agreements between the farmers at the sites in nominated areas.

Through this program, AMD reforms and improves the irregular shape of farm plots, consisting of rectangle plots of 1 to 2 acre(s), equipped with farm roads, irrigation, and drainage waterways, if necessary. Additionally, AMD provides new ridge making and leveling works for each plot. Furthermore, AMD provides mechanization services when farmers request it. In some areas, benefited farmers may construct farm roads and waterways independently, without AMD's support reform. In this case, it is called the "semi-mechanization farm."

Following the achievement that the "model mechanization farm," the program undertook a total of 2,656 acres in 16 areas, 9 states and divisions in the last year (2011/2012). AMD plans to cover 3,500 acres (the number of participating farmers: about 350 houses) in 7 states and divisions this

year. It is proposing a budget of US$1,800,000 per one place but a total budget has not yet been approved. .

This program seems to emphasize only implementation, as the economic evaluation activity results for participating farmers are not currently available. It is necessary to evaluate economic efficiency by examining farm management after farmland reform. By demonstrating the results openly, the participants in the program can be increased .

Table 3-8 Results of Model Mechanization Farm Programs (2011/2012)

	State/Division	Location	Grade*	Area (acre)
1	Sagaing	Shwe Bo Township, Seik Khon Village	○	58
2	Bago (East)	Deik Oo Township, Pauk Tapin Village	△	20
3	Bago (West)	Natalin Township, Kantha Village	○	16
		Pyay Township, Zee Oak Village	○	42
4	Mandalay	Wanndwin Township, Shwe Taung Farm	○	367
5	Nay Pyi Taw	Pope Bathiri Township, Nyoung Pin Gyi Su Village(500 - acre Farmer Educative Model Mechanized Farming)	○	500
		Pope Bathiri Township,Nyoung Pin Gyi Su Village (20 - acre Farmer Educative Modle Mechanized Farming)	○	20
		Zayarthiri Township,Aung Zay Ya Village	○	35
		Dakkhinathiri Township, Chaing Village	△	50
		Zabuthiri Township, Tae Gyi Gone Village	○	65
		Dakkhinathiri Township, Kyargu Field	○	72
		Dakkhinathiri Township, Yan Aung Myin Village	○	40
6	Mon	Mu Don Township, Bal Yann Field	△	200
7	Rakhine	Kyauk Taw Township, Daung Taw Htoe	△	100
8	Yangon	Ideal Mechanized Farming Special Zone (1) , Dagon (East)	○	402
		Ideal Mechanized Farming Special Zone (2) , Dagon Seikan Township	○	649
9	Ayeyarwady	Pantanaw Township, Kyone Tone lay	△	20
		Total		2,656

* ○ : AMD provided full services including farm road and water-way construction
△ : AMD provided only land reform work except farm road and water-way construction (Semi - mechanized Farm)

Source: AMD

(4) Training centers

AMD has two training centers in Meiktila, in the Mandalay Division, and in Phayagyi, in the Bago Division.

While there is some use of the training center in Phayagyi, the training center in Meiktila plays a central role. This training center was founded in 1964, and was under the control of AMD starting in 1984. It has provided training to AMD staff on general business and operation, maintenance, and repair of agricultural machinery.

There is a 13-acre training farm, a repair workshop, five classrooms, accommodation (it is possible to accommodate 160 men and 80 women) all in a 55 acre site. Maintenance management of the center is good and functional, although the repair equipment and agricultural machinery are out-of-date and in short supply. Moreover, the introduction of new machines, such as the combine harvester, is not going well. There are 88 staff members at the center as shown in Table 3-9. The expenditures for training programs are allocated separately in the general administration budget. This training budget allocated about 60 million Kyats in the last year (2011/2012).

Table 3-9 Staff at the Meiktila Training Center

Section	Role	Number
Director Vice-director	Management	2
Administration	General affairs, personnel affairs, maintenance management	20
Accounting	Accounting	3
Training	Implementation of training programs Management of trainees (Engineer:15, Operator/repair: 17, Trainer of general business: 10)	42
Suppling	Arrangement and supply of materials and equipment for training	21
	Total	88

Source: AMD

In the last year, the center started the training program for operation, maintenance and repair of agricultural machinery for farmers by the Minister's instructions. It provides training of operation, maintenance, and repair of major agricultural machines, except combine harvesters, over four weeks. In the last year, it carried out the training program six times and trained a total of 252 farmers. Farmers can undergo this training program free of charge, which includes lodging and meals. The AMD head office receives the candidates and AMD regional offices announce and promote the farmers' participation.

The training of AMD staff members is also held at field locations other than the centers in Meiktila and Phayagyi. All programs conducted in the past year are shown in Table 3-10.

Table 3-10 Results of AMD Training Program（2011/2012）

Educational Programme and Training of AMD (2011-2012)						
No.	Training Title	Location	Duration		No. of trainee	
			From	Until	Staff	Farmer
1	No.(1/2011),Driving and Maintenance of Farming Machinery Special Training Course (farmer)	Meiktila	20.4.2011	19.7.2011		47
2	No.(2/2011),Driving and Maintenance of Farming Machinery Special Training Course (farmer)	Meiktila	23.5.2011	12.8.2011		41
3	Paddy Transplanting Machine Skill Training Course	Pyinmana	1.6.2011	21.6.2011	20	
4	Paddy Transplanting Machine Skill Training Course	Ywar Thar Gyi	7.6.2011	21.62011	20	
5	Training for skilled machinery operator	No.(1) Lal Yar Thone	6.6.2011	7.7.2011	13	
6	Training for skilled transplantig machine opertor Course	Ywar Thar Gyi	4.7.2011	22.7.2011	20	
7	No.(3/2011),Driving and Maintenance of Farming Machinery Special Training Course (farmer)	Meiktila	18.7.2011	7.10.2012		37
8	Training for Cultivation of Explored Farms according to Mechanized Farming System	Bo Ni Gyi Kwin, Gyinevillage, Detkhinathiri village, Detkhinathiri Township Nay Pyi Taw	20.8.2011	20.9.2011	84	
9	No.(4/2011),Driving and Maintenance of Farming Machinery Special Training Course (farmer)	Meiktila	17.10.2011	6.1.2012		31
10	No.(1/2011), Elementary Clerk Training Course	Pha Yar Gyi	14.11.2011	23.12.2011	48	
11	No.(1/2011), apprenticed deputy staff officer	Meiktila	14.11.2011	23.12.2011	21	
12	No.(5/2011),Driving and Maintenance of Farming Machinery Special Training Course	Meiktila	5.12.2011	24.12.2012		55
13	No.(1/2012), Elementary Clerk Training Course	Pha Yar Gyi	9.1.2012	17.2.2012	41	
14	No.(1/2012), Refreshing Training course for Tractor driving (3)	Meiktila	9.1.2012	3.2.2012	75	
15	No.(1/2012),Repair and Maintenance of Farming Machinery Special Training Course	Meiktila	6.2.2012	30.3.2012		41
16	No.(2/2011), Elementary Clerk Training Course	Pha Yar Gyi	20.2.2012	30.3.2012	55	
17	No.(1/2011) Training for changing from Conventional Farming to Mechanized Farming System	Dagon Myothit (East)	27.10.2011	25.11.2011	21	
18	No.(1/2011) Training for changing from Conventional Farming to Mechanized Farming System (deputy Staff Officer)	Dagon Myothit (East)	10.11.2011	25.12.2011	38	
19	No.(1/2011) Training for changing from Conventional Farming to Mechanized Farming System (deputy Staff Officer)	Dagon Myothit (East)	25.12.2011	11.2.2012	18	
20	No.(1/2011) Training for changing from Conventional Farming to Mechanized Farming System (Other Ranks)	Dagon Myothit (East)	25.12.2011	11.2.2012	53	
	Total Trainee				527	252

Source: AMD

Many agriculture machine users (mainly farmers) operate a machine following another user's example, and they also conduct maintenance and repair in the same way. On the other hand, in an area where machine use has just started, the cost for a farmer without such technology to pay a repair shop is high. The four-week farmer-training course at the central training center is limited in its ability to increase the attendance numbers, however AMD has a plan to strengthen training capability. By this plan, AMD will train instructors at the central training center, and choose nine tractor stations in the area with the highest mechanization needs among the 99 tractor stations. Here the trained instructors will conduct training programs for farmers in operation, maintenance and machine repair.

Table 3-11 Strengthening Training Centers Plan

No.	Category	State/Division	Township	Remark
1	Central Training Center	Mandalay	Meiktila	Existing
2		Bago	Phayagyi	Existing
3	Regional Training Center (Tractor Station)	Sagaing	Shwebo	
4		Sagaing	Monywa	
5		Mandalay	Pyinmana	
6		Magway	Pwint Phyu	
7		Shan	Lashio	
8		Bago	Tungoo	
9		Bago	Pyay	
10		Ayeyarwady	Pathein	
11		Ayeyarwady	Hinthada	
12		Yangon	Thanlyin	

Source: AMD

Table 3-12 Introduction Plan for Machines for Training

No.	Machinery	Central Training Center	Regional Training Center	Total
1	Tractor	10	3	13
2	Power tiller	15	5	20
3	Transplanter	5	2	7
4	Reaper	5	2	7
5	Thresher	5	2	7
6	Combine harvester	3	1	4
7	Flat bed dryer	3	1	4

Source: AMD

(5) Agricultural machinery manufacturing factories

AMD has three agricultural machinery manufacturing factories in Mayangore and Dagon, in the Yangon Division, and Kyaukse in the Mandalay Division. The table below outlines the capacity of these factories.

Table 3-13 Outline of AMD Agricultural Machinery Factories

Name of Factory	Factory No.1	Factory No.2	Factory No.3
Location	Mayangore Township Yangon Division	Inngone Village, Kyaukse Township, Madalay Division	Ywar thar Gyi Village, Dagon (south) Township, Yangon Division
Access	In a northern direction from Yangon. 10km from center of Yangon, it takes about 20 minutes by car.	In a southern direction from Mandalay. 52km from center of Mandalay, it takes about 1 hour by car.	In a northeastern direction from Yangon. 18km from center of Yangon, it takes about 40 minutes by car.
Establishment / History	Established in 1953 as the factory of Ministry of Agriculture and Irrigation. In 1972, overall rehabilitation was done. In 1993 changed the name to AMD Factory No.1.	In 1973, established by AMD as a repair factory. From 1995, started machinery manufacturing. This factory borders Ministry of Industry No.18 Inngone factory.	Established in 2001 by AMD by utilizing Chinese loan.
Number of staff	About 180	About 200	About 320
Allocated budget from AMD head quarters	626 million Kyats	700 million Kyats	1,498 million Kyats
Machinery sales value	3,447 million Kyats	2,003 million Kyats	2,042 million Kyats

Source: Interview and questionnaire survey conducted by the Study team.

Change in the quantity of agricultural machinery production in AMD factories from 1993/1994 to last year (2011/2012) is shown in Table 3-14.

Table 3-14 Quantity of Agricultural Machinery produced in AMD Factories

No.	Machine name	1993/94 ～ 99/2000	2000/ 2001	2001/ 2002	2002/ 2003	2003/ 2004	2004/ 2005	2005/ 2006	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012	Total
1	Power tiller	21,795	4,891	6,691	3,711	2,332	2,516	5,850	6,898	5,382	3,664	4,285	4,770	2,985	75,770
2	Mini-tractor													50	50
3	One wheel power tiller											852	108	20	980
4	Roller boat											700	551	150	1,401
5	Transplanter													102	102
6	Reaper	1,045					20	20	7	100	100	294	100		1,686
7	Thresher	6,881	20									357	732	775	8,765
8	Farm track								85	27	20	89	80		301
9	Flat-bed dryer	640	10											21	671
10	Gasifire											60	20		80

Source: AMD

The production plan for the next three years is shown in Table 3-15. However, the government is considering a way to fundamentally privatize these factories. Information collected during the field survey was as follows.

- For the first factory of Mayangore Township, the plan to lease it to a private enterprise is progressing.
- The plan for the second factory in Kyaukse Township is unclear.
- For the third factory in Dagon Township, the 30-year lease plan to Good Brothers Co., Ltd., a major company that manufactures, imports and sells agricultural machines, appears to have been determined.

Table 3-15 Production Plan of Three Factories

Description	State/Division	Three Years Plan (Unit)		
		2013-2014	2014-2015	2015-2016
No.(1) Factory	Yangon			
(9)miles,Yangon.				
Downfung Farming Tractor		2000	2000	2000
Roller Boat		300	300	300
Reaper		300	300	300
No.(3) Factory	Yangon			
Ywar Thar Gyi , Yangon.				
Highland Tractor		250	250	250
Downfung Farming Tractor		500	500	500
One Wheel Tractor		300	300	300
Reaper		100	100	100
Paddy Dryer		10	10	10
Mini Tractor		100	100	100
No.(2) Factory	Mandalay			
Inngone, Kyaukse.				
Farm (16/22) Tractor		500	500	500
Highland Tractor		750	750	750
Reaper		210	210	210
Paddy Dryer		40	40	40

Source: AMD

(6) Land reclamation of terrace farming in the upland areas

Since 2003, AMD has developed terrace fields using construction machinery such as bulldozers, excavators, and tractors, in the hilly area, and mainly in the Shan State. The total field developed by year 2011/2012 was 32,000 acres (about 13,000 ha).

Table 3-16 Results of Reclaimed Acres

(2003/04 – 2011/12)

No.	Project Site	No. of Machine	Reclaimed Acres
1	Lashio, Shan (North) State	7	11,406
2	Kyaine ton, Shan(East) State	9	5,927
3	Taunggyi, Shan (South) State	8	7,233
4	Chin State	7	7,144
5	Kyakhtu , Magway Division		202
6	Ann, Rakhine State		100
7	Nay Pyi Taw		559
	Total	31	32,571

Source: AMD

3.2.2 Ministry of Industry

In the Ministry of Industry, agricultural machinery is produced in three factories. The following development strategy is for the agricultural machinery production field.

(1) To establish foreign marketing plans, to build industrial zones that produce export oriented products,
(2) To produce agricultural products by means of local manufacturers,
(3) To have farm mechanization and agricultural development in different agro-ecological zones,
(4) Encourage SMEs to develop and extend heavy industries and to accelerate the rate of import substitution and export orientation.

The outline of the three factories producing agricultural machinery is as follows.

Table 3-17 Outline of Three Agricultural Machinery Producing Factories

Name of Factory	16th Factory (Sinde Factory)	17th Factory （Malun Factory）	18th Factory (Inggone Factory)
Location	Sinde Village Padaung Township Bago Division	Malun Village Minhla Township Magway Division	Inngone Village, Kyaukse Township, Madalay Division
Access	Opposite side of Pyay city. (West bank of Ayeyarwady river)		In the southern direction of Mandalay. 52km from center of Mandalay, it takes about 1 hour by car.
Establishment/ History	Established in 1965 by Japanese assistance.	Established in 1967.	Established in 2003. (This factory borders AMD factory No. 2）
Number of staff	About 1,030	About 820	About 850
Allocated budget from Ministry of Industry	6,012 million Kyats	1,700 million Kyats	3,104 million Kyats

Source: Interview and questionnaire survey conducted by the study team

The actual production year mentioned in 4.1 (2) and the production plan for the main agricultural machines for the current year is as follows.

Table 3-18 Production Plan of Main Agricultural Machines in Ministry of Industry Factories (2012/13)

No.	Type of Machines	Production / Sales Plan		
		Unit Price Kyats	Production Nos	Sales Mil. Kyats
Sinde factory				
1	Pump(4")	180,000	4,000	720
2	Power tiller(Ayeyar-1)	1,200,000	3,000	3,600
Malun factory				
1	Tractor 90hp	5,000,000	200	1,000
2	Tractor (ZTM-40)	1,850,000	200	370
3	Small rice mill	1,200,000	300	360
4	Thresher	1,000,000	500	500
Inngone factory				
1	Diesel engine 22hp	390,000	1,500	585
2	Combine harvester	27,000,000	75	2,025

Source: Ministry of Industry

For these factories, the policy of PPP (Public Private Partnership), technical cooperation with private enterprises and long-term lease to private enterprises, has been considered, as well as AMD factories. It is expected that the Ministry will move in the direction of privatization in the long run.

3.2.3 Ministry of Commerce, Myanmar Agriculture Products Trade (MAPT)

The Agriculture and Food Produce Trading Cooperation (AFPTC), a predecessor of the current MAPT, played a significant role in buying crops, marketing, selling and exporting under the centrally planned economy of the former socialist establishment. However, since 1988, the liberalization of agricultural marketing has been actively promoted and the organizational size of MAPT has been reduced dramatically. Almost all tasks related to crop marketing, including the monopoly of buying and exporting rice were demolished. As a result, staff were cut from 10,000 to 2,187 and the main role of MAPT changed, to issue permission for trading or construction of rice mills.

Accordingly, the large rice mill plants, which were constructed with foreign loans, by the Asia Development Bank and Japanese government, were sold, mainly to private exporters.

As previously described, AFPTC was in charge of the research and development sector of

post-harvest technology. The Post-harvest Technology Application Center (PTAC) was established in 1985, supported by the Japanese government. Taking the current MAPT's situation into consideration, their original role in the research and development sector, can be questionable. The findings of the study are as follows:

Present condition of PTAC

PTAC is located in the Hlegu Township near Yangon. This center was founded by grants-in-aid by the Japanese government for the purpose of the following:

(1) To contribute indirectly to the distribution of agricultural products,
(2) To develop suitable post-harvest processing technology,
(3) To minimize losses resulting from post-harvest processing, and;
(4) To create quality control of agricultural products

Its present activity, inspection-of-quality services, is a main income source for the center. Although the center explained that they are performing training and dissemination activities, this actually occurred only about 1 to 2 times in a year.

In this situation, only the laboratory is used frequently for inspection-of-quality services. Therefore, the request from PTAC suggests the relevant inspection services:
(1) Supply spare parts for experimental devices,
(2) Supply equipment for the inspection of quality fruits or vegetables,
(3) Supply gas chromatography for a residual-agricultural-chemicals inspection,
(4) Enforce the trainings and holding of workshops for the personnel of PTAC and MAPT,
(5) Assistance to the subsidy for training, and;
(6) Assistance for maintenance of the training institution.

In addition, most of the staff have appeared to take charge of the quality inspection section.

The investigation team pointed out that quality inspection services have become the main activity and income source, which is different from the original purpose of the center's establishment. However, the center emphasized that, "On the revenue side, the main income is from quality inspection services, however technical research and dissemination activities are also a source of income."

PTAC explained that the area within ASEAN is due to become a free trade system by 2015. As one

condition for participants in this organization, the existence of a Committee on Consumer Protection is required. Out of all the ASEAN countries, it is only in Myanmar that this committee does not exist. PTAC is also involved in establishing this committee. This is one of the important roles of PTAC as a government organization.

3.2.4 Financial institutions

Financing of Myanmar consists of (1) 4 state-owned banks (Myanmar Agricultural Development Bank, Myanmar Foreign Trade Bank, Myanmar Economic Bank, Myanmar Investment and Commercial Bank), (2) 20 private banks, (3) 18 foreign based banks, (4) rural cooperatives under the Ministry of Cooperatives (5) microfinance by international organizations and International NGOs, and (6) informal moneylenders. This section selectively describes institutions related to agricultural mechanization.

(1) Myanmar Agricultural Development Bank: MADB

The Myanmar Agricultural Development Bank (MADB), a state-owned bank, was established in order to offer credit services for rural socio-economic development in 1996. Currently, it is headquartered in Yangon and is in 16 divisions/state levels, and 205 district level of branches.

MADB has two major loan systems, a seasonal loan (shorter than one year) and a mid-term loan. Approximately 90 % of all loans are seasonal loans and it targets producers of eight specific crops, namely rice, sesame, groundnut, and cotton, etc. The repayment period of the seasonal loan is around eight months and it allows only bullet loans, not installments. The interest rate is 1.42 % (17.04 % per year; before 2005, it was 1.25 %). To obtain the loan, a group of five to ten farmers should be organized as a collective responsible unit.

Recently, the number of MADB users has decreased. In 1996, nearly 2 million farmers accessed MADB's loans, but the number dropped to 1.3 million in 2004. This is partly because the village banking system was abolished in 1997, and farmers now have to go to district level branches for lending[3]. Additionally, the loan size is too small to meet the farmers' needs. MADB targets to provide farmers around 30 % of total farming costs per seasonal loan. However, rice farmers make up of 80 % seasonal loan borrowers, actually gaining 2,000-8,000 Kyats per acre (typically, the farming cost is 50,000-61,000 Kyats per acre). Other farmers gain less than that of rice farmers[4].

[3] Umino 2009
[4] UNDP 2011

(2) Private banks/retailers partnerships

In October 2011, an installment system for the public and retailers of agricultural machinery began, cooperating with private banks to offer an installment option to customers. In Yangon, some retailers and private banks, including Innwa Bank Ltd. and Myanmar Oriental Bank Ltd., started a credit service for farmers. The partnership provides a benefit to retailers who otherwise had to use their own funds for the loans.

(3) Cooperatives and cooperative banks

In September 2003, some 1,904 credit cooperative societies were licensed by the Department of Cooperatives under the Ministry of Cooperatives. They permitted licenses to carry out savings and lending activities only[5].

In the field, the team could have interviewed a cooperative called the Pannya Wady Agriculture & General Business Cooperative[6] in the Chauk Township, Magway Division.

The Cooperative received initial financial support of 49.2 million Kyats in 2010 from the Co-operative Bank Ltd. (a private bank under the Ministry of Cooperatives). The conditions for the loan were (1) 6 month short-term loan, (2) 10 % of the loan amount should be a deposit (the cooperative put 1.5 % interest down), (3) the maximum loan amount was 150,000 Kyats per person (20,000-30,000 Kyats per acre), (4) the interest rate was 2.5 % per month (1.5 % from Cooperative Bank), (5) five persons were responsible as a responsible unit. According to the executive member of the cooperative, the loan system demonstrated certain achievements and its own fund increased over 2 years, from the initial 49.2 million Kyats to 82.9 million, and 101.2million (in the latest term, it dropped to 61.4 million Kyats). The number of users also increased from 697 in the first year to 847 in 2012. Most farmers utilized the funds for farming costs such as fertilizers and pesticides, and almost all of them repaid the loan on schedule.

(4) Microfinance by international organizations and international NGOs

In Myanmar, UNDP launched the "Human Development Initiative" in 1997 and as a part of its pilot projects, the micro-finance program was organized. Since then, various international NGOs, PACT, EDA Rural System (EDA), Grameen Trust, GRET Professionals for Fair Development (GRET), and the Association of Medical Doctors (AMDA), participated in microfinance programs all over Myanmar.

While the number of MADB lending has dropped, microfinance has been expanding. According to

[5] UNDP 2011

[6] It was established in 1970 and currently has 940 members in 5 villages.

the statistics, the number of loans increased from 10,000 in 2001 to 76,000 in 2004. The number was recorded at 385,000 in September 2009. It seems that microfinance matched the needs of the beneficiaries. For example, compared to the financing of the MADB, the amount of the loan under microfinance is higher, 50,000 on average during 2001 and 2004. Also, the finance plan has more flexibility when it comes to the farmers' condition. Farmers can complete the procedures for the loan in their own villages. Therefore, microfinance can benefit farmers, but it has been used only in 10 % of the whole nation, 46 out of the total 324 districts, and in about 6,000 villages out of 65,148.

(5) Informal money lending

As mentioned above, the formal financial system in Myanmar is still underdeveloped. Under these circumstances, a number of farmers are obliged to rely on informal moneylenders, including pawns, landlords, rice millers, and even relatives. However, the interest rates of these lenders are outstandingly high, with rates as high as 20 % a month. In many cases, the loan is disrupted and farmers who borrowed the loan from these informal lenders are still left to repay the monthly interest[7].

3.2.5 Donors and NGOs

(1) Official Development Assistance

Since the political upheaval of 1988, many donors such as the USA and EU countries limited their Official Development Assistance (ODA) for Myanmar. Thus, annual ODA per capita in the country was as low as US$ 5 between 1990 and 2007 (US$ 48.8 in Cambodia, and US$ 66.4 in Laos).

However, as a response to democratization by the Thein Sein establishment, many donors restarted their ODA or are in the process of restarting it. In such a transitional time, only limited ODA programs engage in the agricultural mechanization sector. For instance, KOICA (Korea International Cooperation Agency) started to construct the Post-harvest Technology Training Center in Mandalay Division as well as to dispatch engineers to the center[8]. In addition, KOICA also applied to donate US$ 500 million for 362 acres of mechanization model farms in Nay Pyi Taw, to the Irrigation Department, although it has not yet been confirmed. The Indian government also promised to donate US$ 10 million to Myanmar and provided 300 tractors, 150 combine harvesters and 288 power tillers.[9]

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[7] JETRO 2012

[8] Kim Hae-yong "South Korea: Sharing its Experience with Myanmar," 2011

[9] http://www.indiaembassy.net.mm/index.php?option=com_content&view=frontpage&Itemid=20&lang=en

(2) International organizations/international NGOs

Activities of international organizations/NGOs were limited in Myanmar until recently, due to the government control of activities.

Under the circumstances, only a few organizations engaged in agricultural mechanization. Bridge Asia Japan (BAJ), for instance, has provided engineering/repair training courses for youth in Rakhine State, and irrigation facilities maintenance skills in Mandalay Division.[10]

The situation changed when Cyclone *Nargis* hit in 2008. The government loosened its constraints especially towards humanitarian activities. The change invited various international NGOs to Myanmar, and the number of them increased from 40 to over 100 during the peak time (there are currently more or less than 64 NGOs in service).

Regarding agricultural mechanization, several organizations started to supply machinery. For example, UNDP donated 592 power tillers with diesel oil, maintenance tools, and maintenance courses, and 220 water pumps to 6,500 farmers[11]. In the same manner, an international NGO called International Development Enterprises Myanmar (IDEM) offered inputs such as fertilizers, 740 power tillers, and 18,570 gallons of diesel oil to 1,197 villages, in 11 townships of the Yangon and Ayeyarwady division. Another NGO, Cooperazione a Svilupo (CESVI) donated 50 power tillers to 500 farmers in 50 villages, and six irrigation pumps to six villages[12].

IDEM also provides agricultural machinery in addition to reconstruction assistance. It changed the name to Proximity Designs in 2008, developing/selling lower cost agricultural machines for small farmers[13]. For instance, it developed the metal pump, which uses treddle power, not diesel engines. The pump is one popular product of Proximity Designs, and 27,446 of the pumps were sold in 2010.

In this way, a number of donors and international NGOs have provided agricultural machines since Cyclone Nargis. Currently, several international NGOs are involved in related projects or plan to be, although the number is limited.

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[10] http://www.baj-npo.org/

[11] UNDP “Community-Driven Recovery: Cyclone Nargis On Year On,” 2009

[12] UN “Myanmar Cyclone Nargis OCHA Situation Report No.45,” 2008

[13] JETRO “BOP Bisiness PotentialNeeds Report,” 2012

Table 3-19 Agricultural Mechanization Support by International NGOs

Organization	Area	Duration	Project
International Volunteers Service Association (AVSI)	Ayeyarwady Division, Mandalay Division	3 years from January, 2010	As a part of "Improvement of Food Security and Sustainable Agriculture Development Project," power tillers and small rice mills are provided.
Federation on Organization of Charity Service for International Volunteer (FOCSIV)	Shan State (Sotuth)	In the planning stage	As a part of the Rural Development Program, power tillers and combine harvesters will be donated.
International Rescue Committee, USA (IRC)	Chin State, Rakhine State Northern Shan State	In the planning stage	As a part of the Rural Development Program, agricultural machines will be donated.
Adventist Development and Relief Agency Myanmar (ADRA Myanmar)	Ayeyarwady Division, Magway Division	In the planning stage (3 years)	As a part of "Improve the livelihood of Rural People," power tillers and irrigation pumps will be provided.

Source: DAP

3.3 The Present Situation of Agricultural Mechanization

3.3.1 Agricultural mechanization at the farmer level

(1) Reason for machinery introduction and payment terms

There are two main reasons for farmers to buy agriculture machinery. One is to complete land preparation in a short time. Especially in unseasonable weather, it is difficult to work in the field as planned. Work has to be done quickly, but work using animal power takes time. Furthermore, it is difficult to hire animal power, since all farmers want to finish land preparation quickly. Medium-scaled (more than 10 acre) farmers, who rent animal power from other farmers, tend to buy machinery to avoid the delay of land preparation.

In the case of bean farming, farmers need to prepare the land to maintain adequate production immediately after harvesting rice, since soil cannot preserve water long once dry season begins. Therefore, mechanization is quite unavoidable in this circumstance. It is reported that 90 % of farmland is mechanized during the season, in a village of the Thongwa near Yangon city[14].

Another factor is income generation by machinery service to other farmlands. Relatively small-scale farmers, who can expect idle time, tend to purchase agriculture machinery, mainly power tillers.

[14] Okamoto "Economic Disparity in Rural Myanmar," 2008

When farmers purchase agriculture machinery, they generally buy on credit, except for a part of southern Shan State. Until last year (2011), retailers provided credit to farmers from their own capital. Starting in 2012, a new credit system collaborating with private banks was introduced. Farmers can receive credit, guaranteed by retailers, from collaborating private banks. Table 3-20 shows the difference in the payment terms of credit systems before and after 2011, and also the merit and demerit of farmers and retailers, in these systems.

A merit for a farmer is easier to prepare for initial funds with a lower percentage of down payment. A demerit requires a payment of interest. A merit for retailers is a quick payment collection, and is unnecessary to add capital for sales expansion. The banks can earn interest receipts without taking a big risk.

Table 3-20 Merit and Demerit of Farmers and Retailers by Payment Terms

	Credit by Retailer (Before 2011)	Credit by Private Banks (After 2012)
Payment term	Down payment: 65% of machinery price, and 35% in cash after 6 months. No interest, but in case payment is delayed, some retailers charge interest for delayed periods.	Down payment is 50% of machinery price, and the rest is paid in twice a year (every 6 months) with 1.5%-2.5% monthly interest rate.
Merit and demerit of retailers	Merit: N/A Demerit: In order to expand sales, retailers need more capital to increase account receivables.	Merit: Since the bank pays the retailer at the time of purchase, it is not necessary to increase capital for account receivables. Demerit: In case the customer cannot repay, the retailer has to pay the bank for the customer.
Merit and demerit of farmers	Merit: Interest-free Demerit: Part of the down payment is high. Payment period is short (1 season)	Merit: Down payment is decreased. Repayment period is longer as 1 year or 2 seasons. Demerit: Interest has to be paid.

Source: Results of retailer interviews

For agricultural machinery, the procedure for new loan systems in cooperation with private banks, which started in 2012, is shown below.

(a) The farmer pays 50 % of machinery price as down payment to the retailer.
(b) The retailer issues a recommendation letter to the bank.
(c) The farmer prepares and submits a loan request document, ID card, official list of family members, recommendation letter from the village head, and recommendation letter from the retailer.
(d) The farmer and the bank make a loan contract.
(e) The bank transfers 50 % of machinery price to the retailer's account.

(f) The retailer hands over the machinery.

(g) The farmer repays his debt to the bank twice a year or every 6 months.

In case the farmer does not repay his debt by the due date, the retailer has to repay it. Some banks request retailers to deposit the same amount as the loan amount, and if payment is delayed, they deduct repayments from this deposit. Retailers have to recover the debt on their own behalf. In the old loan system before 2011, some retailers created a loan contract by putting up machinery as collateral. But, most retailers do not do this, because machinery is necessary to generate more income for repayment.

(2) Operations by agricultural machinery

Before the introduction of agricultural machinery, all work was done by both animal power (ox or water buffalo) and manpower. Agricultural machinery was introduced as an alternative power to animal power for plowing, harrowing (leveling), and paddling. Alternatives to manpower work such as seeding and covering, transplanting, weeding, and harvesting, are very limited.

Cultivation by Power Tiller

Plowing befor groundnut seeding. Upland type with a long handle and cage wheels.

[Kalaw, Shan State]

Tables 3-21 to 3-23 show comparisons of operation efficiency and costs of machinery and animal power. In plowing, costs per acre are 2.5-3.0 times higher for machinery than for animal power, but operation efficiency is 10 times higher than animal power. The first reason farmers purchase a power tiller is to operate on time and in a short time period, because it affects volume of production. Meanwhile, in paddling, operation efficiency in machinery is 3.0 to 4.0 times higher than it is for animal power, and unit cost per acre is 1.5 to 2.0 times higher than it is for animal power. It is considered that cost performance of machinery is higher than it is for animal power.

Table 3-21 Operation Efficiency and Cost by Machinery and Animal Power (Rice)

Operation	Power Tiller (22hp)		Ox (1 pair or 2 heads)	
	Operation efficiency	Unit cost	Operation efficiency	Unit cost
Plowing	3～5ac/day	K.12,000～20,000/ac	0.25～0.5ac/day	K.4,000～8,000/ac
Paddling	6～8ac/day	K.1,800～2,400/ac	1.8ac/day	K.1,200/ac

* Working hour is 8 hours per day

* In case operator for animal power is hired temporarily (not permanently)

Source: interview results from farmers

Table 3-22 Work Efficiency and Cost by Machinery and Animal Power (Groundnuts)

Operation	4-wheel Tractor (50hp)		Ox (1 pair or 2 heads)	
	Operation efficiency	Unit cost	Operation efficiency	Unit cost
Plowing	5.7ac/day	K.14,870/day	0.5～0.55ac/day	K.3,600～4,000/ac
Harrowing	7ac/day	K.18,200/day	1.3～2.5ac/day	K.800～1,500/ac

* Working hour is 8 hours per day
* In case operator for animal power is hired temporarily (not permanently)
Source: Interviews results from farmers

Table 3-23 Cost of Works by Manpower (Rice)

Operation	Operation efficiency	Unit cost
Transplanting	9～15 workers/ac-day	K.12,000～20,000/ac
Harvesting	10 workers/ac-day	K.12,000～15,000/ac

Source: Results from farm interviews

(3) Shortage of farm labor and agricultural mechanization

In general, farm laborers in agriculture production are women. Men work in ridge making of rice fields, operation and maintenance of canals, and operations of animal traction and equipment and machinery. Most interviewed farmers recognize that the shortage of farm labor raises labor costs. Currently in the rural area, the number of public works projects tend to increase, as well as the number of migrant laborers from the rural areas. This results in increased costs. Farm labor costs were uniform through the production season previously, but now, depending on the area, two rates are applied, one in the slack period and the other during the busy period. It also indicates a shortage of farm labor in the rural areas.

In southern Shan State, labor shortages arose with the introduction of agriculture machinery. In some areas, farmers could expand their farmland by efficient work of agriculture machinery. As a result, they need more farm labor in their expanded land, which causes shortage of farm labor in this area.

As mentioned above, agriculture machinery is generally utilized as substituted power for animal power. Therefore, agriculture machinery has not been introduced as a substitution for manpower. Meanwhile, farmers need household members who can look after livestock to maintain animal power. In one example, a farmer released his working cattle, because his son left home to receive a higher education. The increase in the number of migrant laborers and in educational opportunities may cause a decrease in the number working cattle, and accelerate demand for agriculture machinery in the future.

(4) Maintenance of agriculture machinery

Most farmers maintain their machines by themselves, including the replacement of spare parts. Most farmers replace spare parts after a machine has trouble, but some farmers change spare parts periodically just before every season in order to avoid machine trouble during the season. Regarding maintenance work by farmers, the degree of processing work (grinding, boring and welding) on parts is not high enough. It may result in a shorter machine lifespan or create machine problems.

(5) Availability of spare parts

According to the interviewed farmers, they can easily access spare parts. They have retailers or parts shops near their villages. These retailers and parts shops have enough stock as well. In case there are no genuine parts, they can use converting works, such as welding and grinding work. They are not particular about genuine parts. With regards to Chinese made spare parts, the manufacturer does not guarantee parts, and some do not work properly, even if they are brand new.

(6) Operating capital

During the production period, farmers need a certain amount of capital for buying seeds, fertilizers, chemicals, and for animal plowing services and farm labor. In addition to paying for fuel, they need spare parts, and to conduct maintenance, if they have agriculture machines. Some farmers borrow money from informal credit services with 5 - 10 % monthly interest. Even if a farmer does not have any debt, it does not always mean he can manage the farm properly. He may not use enough inputs on his farm, and this causes low productivity. Furthermore, some farmers increase production area, through the introduction of machinery, but they cannot afford to have further operation capital for agriculture input, labor and operation, and maintenance. Therefore, in order to increase production, operation capital has to be increased as well as the introduction of machinery.

3.3.2 Agricultural mechanization of agricultural cooperatives

The study team interviewed one agriculture cooperative, which was introduced by the Ministry of Cooperatives. According to the Ministry, this cooperative provides machinery services to their members, but they only provide credit for operation capital and joint purchasing of fertilizer. There are no members who have agriculture machinery as well.

Board members have negative opinions towards providing machinery services to members, because of the difficulty in managing funds for operation and maintenance costs, such as fuel, operator hiring, and repair as well as service schedule management and operation management. Before 1988, farmers' cooperatives had a tractor and a truck for agriculture production, but managers used it

improperly, and the equipment disappeared when the farmer cooperatives dissolved. So, they do not want cooperatives to own machinery. Rather, they want their own machinery to receive private machinery services.

3.3.3 Present conditions of AMD tractor stations

AMD allocates 99 tractor stations all over the country, and carries out land preparation services by tractors. (Details of the tractor station and the number of tractors of each station are seen in Appendix-3)

Tractors designed by Zetor, Czech

This type of tractors are major for mechanization services in AMD Tractor Stations. The tractors in the photo were produced in 1982 - 1991 and are very old.

[AMD Tractor Station, Magway, Magway Division]

AMD tractor stations offer two kinds of land preparation services, (1) services offered with a driver, and (2) tractors lent out without a driver and the borrower provides the driver himself. The first object of the tractor station is to provide land preparation services to neighboring farmers. In addition, selling the agricultural machines produced at the AMD factories to a farmer is the goal.

In this investigation, it interviewed the following six stations. The results of the investigation were as follows.

Station number	9
Station name	Kyaunggone
Location	Pathein, Ayeyarwady Division
Main investigated points	• Established in 1967. Number of staff: 28 persons. • At present, tilling services for rice and beans are carried out for about 500 agriculture households by using 12 tractors. • Except land preparation services, the station is selling power tillers, threshers and reapers etc. which were manufactured at AMD agricultural machinery factories.
Additional points	• Since there is no time for planting of beans after the harvest of rice, quick tilling by machineries is required.

Station number	51
Station name	Pathein
Location	Pathein, Ayeyarwady Division
Main investigated points	• Established in 1963. Number of staff: 46 persons. • At present land preparation services are carried out for about 200 agriculture households by using 12 old tractors. • Except mechanization services, the station is selling power tillers, threshers and reapers etc. which were manufactured at AMD factories. • Out of the services, about 85% are carried out with drivers, and about 15% are carried out without drivers (only rentals of tractors) • Mechanization services by using tractors are gradually decreased. And selling of the

	machineries is increased. • If the old machines can be updated by government assistance, the service can be provided for more farmers, and mechanization services depend on the profit. It is not thought that profitability becomes good only by providing a new machine. It seems that lack of management efforts caused aggravation of the present profitability, such as improper expenses for maintenance work, and improper arrangements of the personnel in charge etc.

Station number	97
Station name	Labutta
Location	Labutta, Ayeyarwady Division
Main investigated points	• Established in 2005. Number of staff: 27persons. • At present, plowing and harrowing services for rice are mainly carried out for about 1,200 agriculture households by using 4 tractors with 25hp. • Since farmlands are damp and soft grounds, heavy tractors cannot be used, and comparatively small tractors are used.
Additional points	• Since draught cattle were killed by the cyclone, they have no other choice except carrying out tilling by machineries. Requirement for mechanization services is increasing. • Because of labor shortages, there is also the need for harvesting services by using combine harvesters.

Station number	29
Station name	Magway
Location	Magway, Magway Division
Main investigated points	• Established in 1962. Number of staff: 36 persons. • At present, mechanization services are carried out for about 500 agriculture households by using 12 tractors. • Except mechanization services, the station is selling about 50 units of power tillers (22hp type) every year.
Additional points	• The station intends to participate in the “Farmland Reform Sector”

Station number	99
Station name	Nyaung U
Location	Nyaung U, Mandalay Division
Main investigated points	• Established in 1964. Number of staff: 30 persons. • At present, mechanization services are carried out for about 7,000 agriculture households by using 16 tractors. • In this Nyaung U area, about 30 tractors and about 80 power tillers are owned by farmers. Therefore, the station also carried out the repair work and supplied the required spare parts for them. • About 75% of the mechanization service is for green gram, and about 20% is for pigeon pea, both before planting.

Station number	85
Station name	Shawenyaung
Location	Taunggyi, Shan State
Main investigated points	• Established in 1962. Number of staff: 58 persons. • At present, mechanization service are carried out for about 3,000 agriculture households by using 42 tractors which consist of 12 tractor Zetor models (former Czechoslovakia), 9 Massay Fergason models (provided by Japanese assistance in

	1996), and 21 Chinese Shanghai models. • 15 units of 40hp tractors, 15 units of tillers and 5 units of large combine harvesters have arrived at this station. Those machineries are donated by the government of India to the government of Myanmar, and the local government of Shan State co-signs the machine management and operation to AMD. • It is distinct in that the large scale combine harvesters are not suitable for the area (there is no large farmland). It should be noted that these combine harvesters should be delivered to more appropriate areas.
Additional points	• New tractors donated by India might be used efficiently instead of old tractors.

Source: AMD

The following are prices for land preparation services by tractor stations.

Table 3-24 Prices of Service by AMD Tractor Stations

Station No.	No.9	No.51	No.97	No.99	No.29	No.85
Location	Pathein, Ayeyarwady Division	Pathein, Ayeyarwady Division	Labutta, Ayeyarwady Division	Nyaung U, Mandalay Division	Magway, Magway Division	Taunggyi, Shan State
Object crops	Rice, Beans	Rice	Rice Green gram	Green gram (75%) Pigeon pea (20%)	Ground nuts (40%) Sesame (40%)	Rice (36%) Corn (25%) Pigeon pea (18%)
Specification of tractor	50hp	50hp	25hp	50～75hp	50hp	50～67hp
No. of tractors	12	14	4	16	12	42
Work charge						
Plowing	K.13,000/acre	K.13,000/acre	K.13,000/acre	K.13,000/acre	K.13,000/acre	K.13,000/acre
Harrowing	K.6,500/acre	K.6,500/acre	K.6,500/acre	K.6,500/acre	K.6,500/acre	K.6,500/acre
Annual working day						
Plowing	60 days	75 days	50 days		25 days	50 days
Harrowing	60 days	75 days	50 days		25 days	50 days
By draught cattle						
Plowing	K.9,000/acre	K.8,000/acre	K.12,000/acre	K.8,000/acre	K.35,000/acre	K.10,000/acre
Harrowing	K.4,500/acre	K.4,000/acre		K.4,000/acre	K.17,500/acre	K.5,000/acre

Source: AMD

Selling price and number of agricultural machineries at AMD tractor stations are as follows.

Table 3-25 Selling Price and the Number of Machinery

Station No.	No.9	No.51	No.97	No.99	No.29	No.85
Power tillers						
Unit price	K.1,400,000			K.1,750,000	K.1,500,000	
Annual sales	50 units			13 units	50 units	61 units
Threshers						
Unit price	K.1,200,000			K.1,220,000		
Annual sales	10 units			1 units		7 units
Reapers						
Unit price	K.900,000					
Annual sales	1 units					
Trailers						
Unit price				K.740,000		
Annual sales				1 units		

Source: AMD

3.3.4 Present condition of AMD repair workshops

AMD arranges two central workshops and eight medium workshops all over the country, carrying out repair works for the machineries owned by the tractor stations.

In this survery, it interviewed the following three stations. The results of the survery were as follows.

Adjusting Work of Fuel Nozzle of a Engine
[AMD Medium WorkshopNo.4]

Workshop number	4
Location	Myaungmya, Ayeyarwady
Main investigated points	• This workshop is carrying out maintenance work for 7 AMD tractor stations in Pathein Township, Myaungmya Township, and Labutta Township in the Ayeyarwady Division. • The repair (overhaul maintenance) capacity for tractors is about 10 to 20 units in one month, however actual repair numbers are about 3 units monthly. • Except repair services, the workshop is selling tractors etc. which are manufactured at AMD factories. • Machine repair works other than AMD are also performed, visitors are not increasing in number. Since this workshop is far from villages, the expenses for carrying a broken machine to an AMD workshop is higher than a local repair shops' wages.
Additional points	• Since many private agricultural machinery manufacturers are located nearby, this workshop is intending to produce threshers, trailers, and husk gasification plants by joint venture with the private manufactures.

Workshop number	3
Location	Magway
Main investigated points	• This workshop is covering 8 AMD tractor stations. • Established in 1995. Number of staff: 41persons. • Except general repair work, this workshop is overhauling old tractors and selling them to the private sector as second hand machines. 1 to 2 units annually. • AMD headquarter instructed each workshop to consider production and sales of agricultural machineries. This workshop is planning to manufacture a thresher. Workshop in Nay Pyi Taw has already started manufacturing machines.

Workshop number	8
Location	Taunggyi
Main investigated points	• This workshop is adjacent to AMD tractor station No.85, and is covering 4 AMD tractor stations. • Established in 2001.
Additional points	• Required spare parts can be procured from AMD offices or markets in Yangon.

3.3.5 Present condition of private repair shops

The private sector agricultural machinery repair shops can be classified into the following two categories.

(1) The private repair shop is a small-scale workshop in a village, and provides services to neighboring farmers for their agricultural machines, motorcycles, etc. The employees are at a maximum, about five persons, and the shops are equipped with power tools, electric-welding machines, etc.

Case-1 Repair shop in Pathein, Ayeyarwady Division

Five employees' small repair shop was established in 2006 with the fund of 3 million Kyats. The present annual sales are 24 million Kyats.

Repair items are power tillers, engines, trailers, threshers, pumps and engines for boats, etc. They also manufacture and sell threshers. The unit price of threshers is about 1.5 million Kyats and they sell about 15 in one year. Since most spare parts are available in neighboring shops, the stock of parts is not required.

The representative has 15 years of experience. Although employees have not received any special education in the area of repair,

Small Repair Shop

Three members manage the shop among three generation families. They use a small lathe and electric equipment.。

[Pwint Phyu, Magway Division]

technology has been mastered on the job. This repair shop is also profitable, and they intend to develop the shop continuously.

Case-2 Repair shop in Pwint Phyu, Magway Division

Five employees' small repair shops were established in 2006 with the fund of 3 million Kyats. The present annual sales are 24 million Kyats.

Initially, the former engineer of the AMD tractor station started repair work at his house during his tenure at AMD. After retirement from AMD, he began to run the small shop with five members of his family. They repair about two power tillers and about one *toraji,* a small track using a small engine or power tractor body, per month. Steady factory management by the family is performed.

In the village where the shop is located, there are about 500 households, and out of those, 100 houses have power tillers. This repair shop covers about 75 % of them, and the remaining 25 % of power tillers in the village are repaired by five repair engineers who do not own a shop.

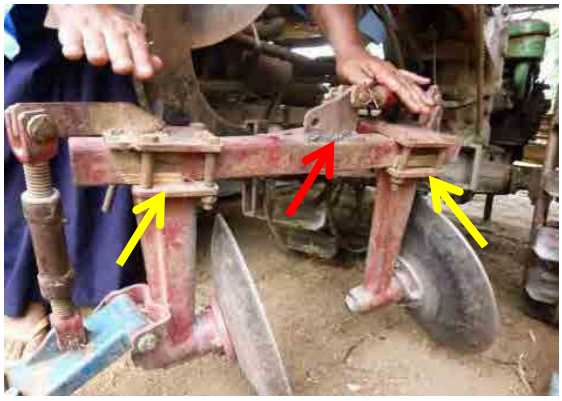
Sometimes, the parts can't be fixed properly because the industrial standards for parts are not uniform. Moreover, occasionally, spare parts cannot be obtained locally, and it is necessary to procure them from a distant place.

(2) The private repair engineer who does not have a shop. He visits clients with hand tools to repair machines.

Case-1 Repair worker in Nyaung U, Mandalay Division

He has provided repair services since 1997. There are about 360 households in the village, and he works for about 50 households who own agricultural machines, mainly 22hp power tillers.

He has not formally studied repair technology, although he has more than 20 years of experience. He enjoys repair work and intends to continue this pursuit.



Problems of Disk Harrow

Local made disk harrow is weak in welding, then rewelding is dane for reinforcement (red arrow).Allowance of bolts fixing is too loose、and fixed by wood chipps (yellow arrow).

[Kalaw, Shan State]

Although acquisition of a spare part is not difficult, there is no unified standard and sometimes it cannot be fixed properly. A machine standard has probably been enacted, however there are various conflicting standards, and it burdens the repair and maintenance process.

Overhaul Works by Repair Engineer
A engineer goes to the client's place and does overhaul works of a machine, spending two weeks.
[Kalaw, Shan State]

Case-2 Repair engineer in Taunggyi, Shan State

He started providing repair services in 1992. His father was a maintenance engineer at an AMD tractor station, allowing him to master repair technology from his father when he was 14 years old. He repairs about 10 units of power tillers and one tractor per one month. For the overhaul work of a tractor, it takes nearly over two weeks per unit, at the customers' house.

He commented that the job is suitable for him and he would like to continue it. Although he would like to have his own repair shop, there are currently no available funds.

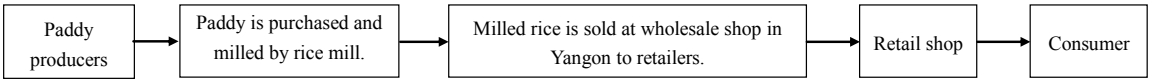
The overhaul of machines, including disassembling and cleaning machine parts, may be required after years of their operation. However, the work of precision instruments is carried out, outside. It seems to be doubtful that machines' lives can be prolonged.

3.3.6 Present condition of post-harvest processing factories

Following post-harvest processing factories, large scaled rice mills (now privatized from MAPT) and many medium and small-scaled rice mills, have been surveyed.

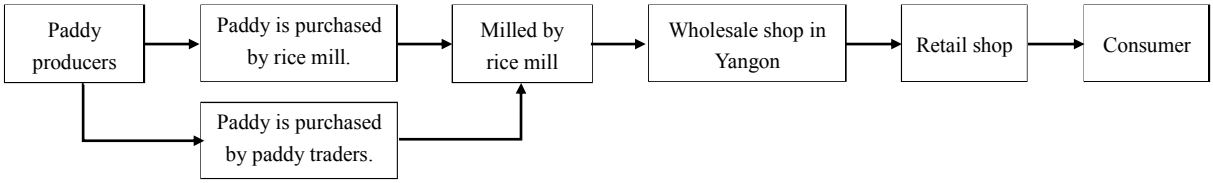
Category	Location, Name of factory	Main investigated points	Additional points
Large rice mill	Pathein, Ayeyarwady No.612.150 ton Rice Mill (same as former MAPT's name)	・ Established as MAPT rice mill by Japanese assistance in 1982. ・ Number of staff is 42. ・ In 2008, rice trader in Yangon acquired it by his own funds of 580 million Kyats. ・ Factory manager (chief operator) was transferred from this factory to MAPT. ・ All milled rice is sold at their own wholesale shop in Yangon. ・ They are promoting to farmers to bring their paddy to this rice mill.	・ They intend to produce high quality rice and export it. ・ In order to produce higher quality milled rice, they want to install color sorters.

- Paddy procurement price：K.2,800/basket (K.134/kg)
- Milled rice sales price：K.7,500/75pounds (K.220/kg)
- Annual processing amount：about 2,500 tons
- Distribution channel



Medium rice mill	Pathein, Ayeyarwady Ayeya Pathein Company Rice Mill	・Established in 1948. ・Number of staff is 34 (full time 14, part time 20) ・Present owner acquired it by his own fund of 270 million Kyats in 2011. ・Actual milling capacity is 20 tons per day (24 hours). Annual working day is 180 days. ・Since power source is the steam engine (husk is used as fuel), rice mill is not affected by electric power failures.	・Since high quality parboiled rice can be exported to India, this rice mill intends to extend parboiling plants. ・Exhausted steam from steam engine can be utilized for parboiling process.

- Paddy procurement price：K. 2,800/basket (K.134/kg)
- In cases subsidized by the government procurement price becomes K.3,200/basket (K.153/kg)
- Milled rice sales price：K.7,500/75pounds (K.220/kg)
- Annual processing amount：about 3,600tons
- Distribution channel



Large Rice Mill（Privatized from MAPT Rice Mill）
Originally, the mill ws constructed by Japanese Yen Loan Project but main machines wre replaced Chinese and Thai machine.
[Arakan, Pathein, Ayeyarwady Division]

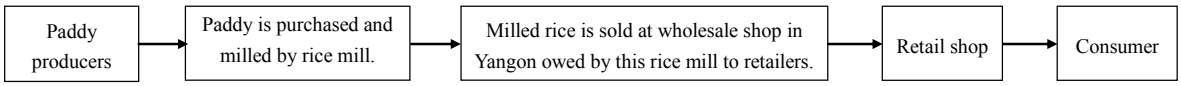
Small Rice Mill
Conventional rice mill equipped with local machinery that main machinnes are a under runner type husker and abbrasive type milling machine.
[Sa Gu, Magway Division]

Medium rice mill	Labutta, Ayeyarwady Nyein Chon Rice Mill	・ Established in 1954. ・ Number of staff is 30. ・ In 2008, the rice mill was damaged by Cyclone Nargis, and present owner acquired it from the previous owner by his own fund of 90 million Kyats. ・ Actual milling capacity is 2 tons per hour, and 30 tons per day. ・ Power source is steam engine (husk is used as fuel) ・ Owner has been a trader since before he procured paddy in this area and asked rice mill to process and sell milled rice at Yangon. ・ After acquisition of the rice mill, he received more profit. ・ Almost all paddy milled in the mill is procured by the owner. ・ Accident: His boat that was transporting paddy to the rice mill was sunken and all rice was lost.	・ This business is developed from only procurement of paddy to the total rice business, including rice milling and whole selling. Now the business is in good condition. ・ After he acquired this mill, owner also purchased two more rice mills. ・ This mill：30tons/day ・ No.2 mill：100tons/day ・ No.3mill：50tons/day

・ Paddy procurement price：K.3,950/basket (K189/kg)

・ Annual processing amount：about 4,800 tons

・ Distribution channel



Medium scaled rice mill	Minbu, Magway Mingaler Zay Yon Rice Mill	・ Established in 1995. ・ Number of staff is 3 ・ Owner is the Chairman of the Merchant Association of Minbu Township. ・ He produces rainy season paddy and chickpeas on his 25 acres farm. ・ Milling yield is explained at about 65%, which seems to be a reasonable figure.	・ They want to renew the mill, which can produce high quality export rice. ・ This rice mill is located far from the sea port, however the study team suggested using water transportation (Ayeyarwady river) ・ Myanmar Rice Industry Association is promoting export of rice.

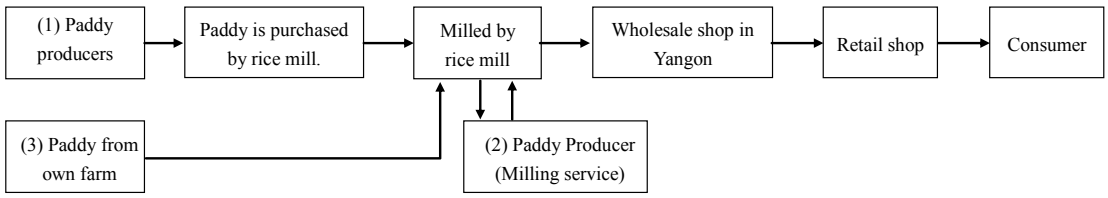
・ Annual processing amount：about 450 tons

(1) About 105 tons: Purchase paddy from producers K. 3,500/basket（K167.5/kg). After milling, sell to wholesellers K.13,000/bag (K.260/kg)

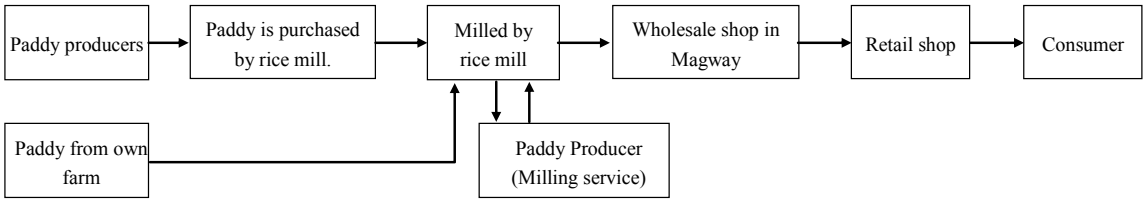
(2) About 250 tons: Milling service (K.150/basket-paddy, = K.7.18/kg)

(3) About 52 tons: Milling the paddy produced in own farm.

・ Distribution channel



Medium rice mill	Sa Gu, Magway Zan Bu Kyow Rice Mill	・ Established in 1990. ・ Number of staff is 3 ・ He is producing rainy season paddy and chickpeas on his 15 acre farm. ・ Milling yield is about 65%, which seems to be a reasonable figure. ・ 360 tons of paddy is milled annually. ・ Owner explained that 100 baskets of paddy are milled into 30 bags of milled rice. From these figures, milling yield is calculated as 71.8%, and this yield seems to be too high and doubtful.	・ Since rice milling is profitable, in order to get higher quality rice, owner wants to procure new whitening and polishing machines. ・ Also wants to procure tracks to transport milled rice to the market at Magway by himself.



Small rice mill (Custom mill)	Labutta, Ayeyarwady	・ Owner is a rice farmer (40 acres), as well as a rice trader. He is trading 60,000 to 70,000 baskets (1,250 to 1,460 tons) of rice annually. ・ Equipped Chinese abrasive and air injection type whitening machines, with processing capacity of 800 kg of paddy per hour. ・ Many kinds of consumable parts such as abrasive rollers or rubber rollers are sold at the market. ・ Chinese, Indian and also so-called "Japanese" parts are sold at the same price. ・ There are many low quality parts among the above, causing numerous problems.	・ They are aware of the improvements for quality of rice.

・ Milling service charge for neighboring farmer: K.300/basket-paddy, = K14.36/kg)

Small rice mill	Pwint Phyu, Magway Say Tanear Rice Mill	・ Locally made under runner type milling machines in 1999, and started milling services. ・ Number of staff is 3 ・ At the first stage, the mill was driven by diesel engines. However, because of the high fuel cost, owners installed husk gasifying systems for the engines. ・ The gasifying systems sometimes break down. Owner wants to change to electric motors. ・ Owner explained that 100 baskets of paddy are milled into 30 bags of milled rice. From these figures, milling yield is calculated as 71.8%, and this yield seems to be too high. So the estimation is not reliable.	・ When electricity will be provided in this area, owner wants to start oil mill services.

Small scaled rice mill	Myant Set Village, Kalow, Taunggyi Aung Pyae Phyo Rice Mill	・ Established in 2009. ・ Number of staff is 2. ・ In order to establish the mill, owner had funds of 3.7 million Kyats, by selling his five cows. ・ First one to two years, mill management was in good condition. However new rice mills were established in neighboring villages two years ago. Instead of milling charges, the mill received broken rice and bran. Many rice producers moved to that mill. Therefore the selling amount of this mill decreased.	

・ Annual processing amount：about 150 tons

(1) Milling service charge for neighboring farmer: K200/basket-paddy, = K9.57/kg)

(2) Ownership of the bran is rice mill, and rice mill sells bran as animal feed. 1,000 Kyats per 18 litter.

Small sugar mill	Nyaung Shwe, Taunggyi	・ Owner is producing sugarcane on 200 acres and rice on 10 acres. ・ Sugarcane extraction plant was installed in 1984. Simple sugar refining mill was installed in 2001. Total investment cost was 9 million Kyats. ・ Out of the total production of sugar cane, only half of the amount can be processed by this mill. Remaining sugarcane is processed in other mills. ・ Production amount of sugar cane is about 1 ton per acre. (2.47 tons per ha)	・ They manage mills successfully by family members. ・ They use locally made or self-made machines as much as possible to reduce the cost. ・ They also buy sawdust from neighboring lumber mills and use them for the fuel of boilers.

・ Annual production amount of refined sugar：about 200tons

(1) Selling price of refined sugar at whole sale market in Yangon: 27,000 Kyats per bag (50kg). (540Kyats / kg)

Small oil mill (with small scaled rice mill)	Pwint Phyu, Magway	・ Owner who was involved in the trading business of sesame and beans, established oil mill in 2005 and rice mill in 2011. ・ His main business is trading sesame and rice and he also provides milling services. ・ Oil mill is the second hand plant and the rice mill is equipped with local under runner machines, driven by electric motors.	・Owner is intending to expand both oil and rice mill business.

・ Oil mill

(1) Annual processing amount: about 22 tons of sesame oil per year.

(2) Annual operation: about 3 months, 90 days.

(3) Purchase sesame from producers K.25,000/basket（K.1,020/kg). After milling, sell to whole sellers K. 3,500/viss (K.2,140/kg)

(4) Oil milling service: K.1,500/basket-material sesame (K. 61.2/kg-material sesame)

(5) Oil milling yield: From 100 basket (2,450kg) of sesame, 750 viss (1,225kg) of sesame oil is extracted.

- Rice mill
  (1) Annual processing amount (Rice Mill): about 105 tons of paddy per year.
  (2) Purchase paddy from producers K. 3,500/basket（K.167.5/kg). After milling sell to whole sellers K.13,000/bag (K.260/kg)

3.3.7 Characteristics in agricultural mechanization by region

Table 3-25 shows characteristics of agricultural mechanization by region. Differences in soil conditions, meteorological conditions, and crops in each region, diversify machinery and attachments from region to region. Introduction of machinery tends to be expanded, because of the commencement of double cropping by construction of irrigation systems, and income improvements through price increases of cash crops.

Table 3-26 Regional Characteristics in Agricultural Mechanization

	Ayeyarwady Area	Central Dry Area	Shan Highland Area
Soil type	Lower swamp	Sandy	Maddy
Crop	Mainly rice	Mainly rice in irrigated areas. Since quoted rice production was terminated last year, cash crops increased in irrigated areas, and miner cereals and industrial crops in rain fed areas (single cropping is economically inefficient for introduction of agriculture machinery).	Mainly cash crop, and rice
Introduction of machiney	In areas affected by the cyclone, Nargis, the government and NGO supported agriculture machinery, then recognized demand increases after Nargis.	The areas started to double cropping by construction of irrigation systems, resulting in the introduction of agriculture machinery.	When prices for cash crop are high, introduction of machines tend to accelerate.
Demand of machinery	Demand of one wheel power tillers and small boats with rotary tiller called roller boat are high.	Situation of irrigated area is shown below Demand for 2 wheel power tillers is high.	Demand for 2 wheel power tillers without seats, with cage wheels, longer handles, smaller engines, is high.
Implement		Disk plow is popular, because they do not plow deeply.	Both normal plow and disk plow are used.
Payment term	Demand increased after the cyclone, Nargis accelerated sales of machinery, but 90% of loans became dead loans for one retailer. The debt still remained 4 years after the cyclone.	Payment by credit is popular. Little dead loan.	Payment by credit is popular, but l rate of lump-sum payments is relatively higher than others.

Mechanization service	Small farmers intend to increase income utilizing agriculture machinery for services during idle times.	Most farmers actively provide machinery services to others during idle times. All the expenses for service are included in the service price.	Most farmers actively provide machinery services to others during idle times. All the expenses for services are included in the service price. Service provisions varied, such as long-term rent, and operation expenses born by borrowers. There is a community which provide machinery services to each other without payment.
Operation	Most farmers learned operation by watching other farmers. It is doubtful that they operate machines appropriately.	Same as on the left.	Same as on the left.
Maintenance	In Labutta, mechanization started after the cyclone, Nargis and farmers are not yet familiar with repair work. So, they ask repair shops to maintain their machines. Therefore, repair costs are higher than other areas. Other than Labutta, farmers learned how to maintain the machines watching other farmers.	Farmers do repair work by themselves, or by asking repair shops. In cases where they do it by themselves, it is doubtful that maintenance skills are high enough. Even though quality of Chinese made spare parts is quite low with no guarantee system, users still prefer cheaper ones.	Same as on the left.
Accident	Falling down from unstable roller boats, and entanglement of clothes by a machine was reported.	Not reported.	An operator was wedged between the machine and an object by the wrong operation, but not injured.
Farm labor	Collection of farm labor tends to be difficult. Farmers ask a broker to find farm laborers in Thongwa. Similar phenomenon was observed in Labutta.	Increase of public works projects in suburb areas and migrant labor causes shortage of labor force and increases labor costs. Farmers have to ask a broker to find labor from outside villages.	Severe shortages of farm labor by increasing public works projects and increasing migrant labor was not observed. But shortage of labor by expansion of farmland, which resulted from efficient utilization of agriculture machinery, was pointed out by farmers.
AMD tractor station	4-wheel tractor in lower Myanmar equips smaller and lighter engines (25hp), because soil is soft.	4-wheel tractor (50～65hp) is used for plowing and harrowing services.	Same as on the left.
Post-harvest facility	Relatively large rice mill is located. Steam engine is still workable as power source for the mills.	Small rice mills, oil extraction factories and sugar mills are scattered in the area.	Same as on the left

Source: Results from farmer interviews

Chapter 4

Present Market Conditions of Agricultural Machineries

Chapter 4 Present Market Conditions of Agricultural Machineries

4.1 Present Production and Distribution Conditions of Local Agricultural Machineries

(1) AMD farm machinery factories

Under AMD, there are three farm machinery factories. Table 4-1 indicates machinery production for 2011/2012 for each factory.

Table 4-1 Production of Machinery at AMD Factories (2011-2012)

Product	Factory No.1	Factory No.2	Factory No.3
Power tiller 22hp	Model: DF-121 (for transportation) Annual production: 2,000 Unit sales price: K.1,505,000	Model: LY-22	Dong Feng type Annual production: 800 Unit sales price: K.1,020,000
Power tiller 16hp		Model: LY-16 Annual production: 100 Unit sales price: K.1,435,000	
Power tiller 12hp			Upland type Annual production: 250 Unit sales price:K.1,475,000
Power tiller 10hp		Model: FT009 (Upland type) Annual production: 750 Unit salesprice:K.1,504,000	
Thresher 16hp (except engine)	Model: TH-60 Annual production: 200 - 300 Unit sales price: K.1,200,000	Model: TH-60 Annual production: 200 Unit sales price: K.1,200,000	Model: TH-60 Annual production: 100 Unit sales price:K.1,200,000
Thresher 25hp (except engine)		Model: TH-120 Annual production: 50 Unit sales price: K.1,900,000	
Others	Cultivation Roller Boat 6 hp Annual production: 150	Flat-bed Batch Dryer 12 hp Model: FBD200 Annual production: 25 Unit sales price: K.2,500,000	Trans planter 5 hp Model: 2Z 8238 BG2 Annual production: 100 Unit sales price:K.2,000,000

Source: Interview and questionnaire survey conducted by the study team.

During the study, three factories were inspected. The electric supply for all factories is unstable, and power failures for more than half the day occur frequently. Scheduled production has not been performed at all. Furthermore, sometimes raw material is not sent to a factory as planned due to AMD headquarters budget shortfalls. Scheduled production cannot be performed in many cases. At the No. 1 factory in Yangon, the production facility is old. Because of this, adequate machine production is not possible.

The sales value of factory No. 1 and No. 3 have increased, and demand of agricultural machineries by farmers is forecasted to increase in the future. The factories intend to promote the production of reapers, combine harvesters and various other kinds of implements.

These three factories have explored the forms of privatization, such as PPP (Public Private

Partnership), technical cooperation with private enterprises, or prolonged lease in private enterprises.

According to factory persons concerned about privatization, since rapid privatization or reorganization of the factory can confuse factory management, rapid change is not desired.

(2) Farm machinery factories under the Ministry of Industry

Under the Ministry of Industry (MOI), it organized two heavy industry corporations. The first heavy industry corporation factory generally produces cars, construction machineries, and agricultural machineries. The second heavy industry corporation generally produces electric parts, batteries, and turbines, etc. The agricultural machineries are produced at the 16th, 17th, and 18th factories affiliated with the first heavy industry corporation. The production outline for these factories is as follows.

Table 4-2 Production of Machinery at MOI Factories (2011-2012)

Name of Factory	16th Factory (Sinde Factory)	17th Factory (Malun Factory)	18th Factory (Inngone Factory)
Main products	Tiller 22hp (Ayeyar-1) Annual production: 2,000 Unit sales price: K.1,200,000 Diesel engine, 5 – 6 hp (KND 5B) Annual production: 1,200 Unit sales price: K.120,000 Pump 5 – 6 hp (SC 4C) Annual production: 3,000 Unit sales price: K.70,000 Pump 5 – 6 hp (SC 52) Annual production: 600 Unit sales price: K.70,000	Tractor 90hp (ZWE-9011) Annual production: 200 Unit sales price: K.5,000,000 Tractor 80hp (ZWE-80) Annual production: 500 Unit sales price: K.4,000,000 Thresher 12 – 22 hp (RTH-60) Annual production: 500 Unit sales price: K.1,000,000	Tiller 22 hp (LY-22) Annual production: 2,000 Unit sales price: K.1,550,000 Tiller 16 hp (LY-16) Annual production: 1,000 Unit sales price: K.1,090,000 Thresher 22 hp(TH-60) Annual production: 240 Unit sales price: K.1,520,000 Reaper 5hp (4 GL-120A) Annual production: 500 Unit sales price: K.990,000 Combine harvester 48 hp (DSC-48) (Knock down assembling. By Daedong Co., Korea) Annual production (Trial manufacturing): 70 Unit sales price: K 23,500,000

Source: Interview and questionnaire survey conducted by the study team.

The 16th Sinde factory was established with assistance from Japan. This factory specializes in casting work. However, casting equipment has become old and updating is required.

The 17th Malun factory has produced the tractor based on a design by the Zetor Company of

former Czechoslovakia. Although they produced 50 hp tractors before, they have produced power-up tractors equipped with 80 hp and 90 hp engines in recent years. Almost all tractors operated at AMD tractor stations are made at this factory. This factory also is becoming old.

18th Inngone factory

It was constructed by the Chinese Government and a company in 2003. Power tillers, threshers, reapers, etc. are produced by modern equipment. Recently it begun production of combine harvesters. [Ingone, Kyauhse, Mandalay Division]

The 18th Inngone factory was established by the Chinese Government and the Chinese agricultural farm machinery manufacturer, Si Fieng Company in 2003. This factory is a large-scale factory equipped with modern production facilities. At the time of its establishment, this factory was the sixth AMD factory (Myanmar Farm Machinery Factory No. 6). However, it became the 18th Inngone factory of the Ministry of Industry in June 2011.

This factory borders AMD factory No. 2, and manufactures almost the same agricultural machines, such as power tillers and threshers, as AMD factories' products. It has begun to produce the South Korean manufacturer's combine harvester. About 70 combine harvester units were produced in 2012. Sales to farmers with loans also began at this time.

Although the 18th Inngone factory was large-scale and modern without electric supply problems, many machines were not in use when surveyed. It is believed that the factory cannot secure the number of orders to fill production scale (quantity of production for the factory).

Although these three factories are exploring privatization options, such as PPP, technical cooperation with private enterprises, or prolonged leases with private enterprises like AMD factories, progress has been slow.

Transplanter of Private Manufacturer

Transplanter adapted to local conditions is being developed in collaboration with Chinese manufacturer.

[Mandalay Division]

(3) Private manufacturers

In Myanmar, repair shops or blacksmiths at the village level produce simple threshers and farm equipment, sold to neighboring farmers. Some wholesalers of agriculture machinery have their own factories with modern equipment. They assemble power

tillers and import assembled parts, such as bodies, handles, tires, gearboxes and engines from China.

Mandalay factory, owned by a big wholesaler (Good Brothers Co., Ltd), has machine tools for cutting, bending, welding, painting, assembling, and the inspection process. It does not have forging and coating process capabilities, and cannot produce axle gearboxes and engines. It imports gearboxes, axles and engines from China, and manufactures other parts, assembling the power tiller as its brand name. It uses Chinese experts on industrial engineering to improve capacity of its engineers and technicians. It sends its engineers to China for training as well. It will attempt to manufacture transplanters and combine harvesters in the near future. Research and development work, with Chinese manufacturers has been done, identifying machinery specifications suitable for cultivation conditions in Myanmar.

4.2 Distribution Status of Imported Agriculture Machinery

4.2.1 Outline of the imported agriculture machinery market

Imported agriculture machinery are divided into power tillers (body and engine), roller boats, and tractors. Roller boats are combined with small boats and rotary tillers, and mainly used in swamp areas of the Ayeyarwady area for paddling.

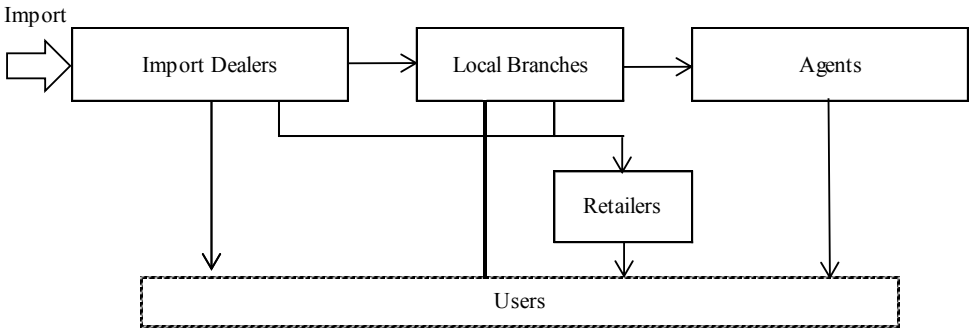
Power tillers are imported from China and Thailand, roller boats are imported from China, and 4-wheel tractors are imported from China, India (European brand), and Thailand (Japanese brand).

A Big Dealer of Agricultural Machinery
Various Chinese machines are mainly displayed and sold.
[Yangon]

Most agricultural machineries are imported at the Yangon port, but some Chinese products are imported via the northern national boarder by a land route. Machineries, manufactured in inland areas such as Yunnan province are basically delivered via the national boarder by land, while products from coastal areas such as Shanghai come via the Yangon port by ship. For power tillers, the bodies are imported by land route, but engines are carried via the Yangon port by ship. According to an interview with a retailer in Taunggyi, Southern Shan, most machines produced in Thailand nowadays are imported via the Yangon port, although some of them are still delivered via the boarder of eastern Shan.

There are 4 major import dealers, namely, Good Brothers Co., Ltd, Shwe Tun Co., Ltd.,

Yadanar Theingi Co., Ltd., and AAA Co., Ltd.[1] They handle over 80% of all import agricultural machineries, and other small dealers manage the remaining 20%. The large import dealers have branches in local cities with a high demand for machinery, and have a network of affiliate stores under the branches. Some retailers at the village level, most of which deal with spare parts and tools, have contracts with several dealers. Remarkably, there is a separate market for agricultural machinery and consumables/spare parts. Therefore, agricultural machinery import dealers do not supply consumable products and spare parts in their distribution channels. Retailers at the end of a distribution network acquire products and spare parts from both the markets.



Source: drew by JICA study team

Figure 4-1 Distribution Channel of Agricultural Machinery

Power Tiller called Upland Tiller

It is used in hilly areas, of about 10 hp engine, no seat, with cage wheels and a long handle.

General Power Tiller

It is equipped with a seat and an engine of 16 – 22 hp.

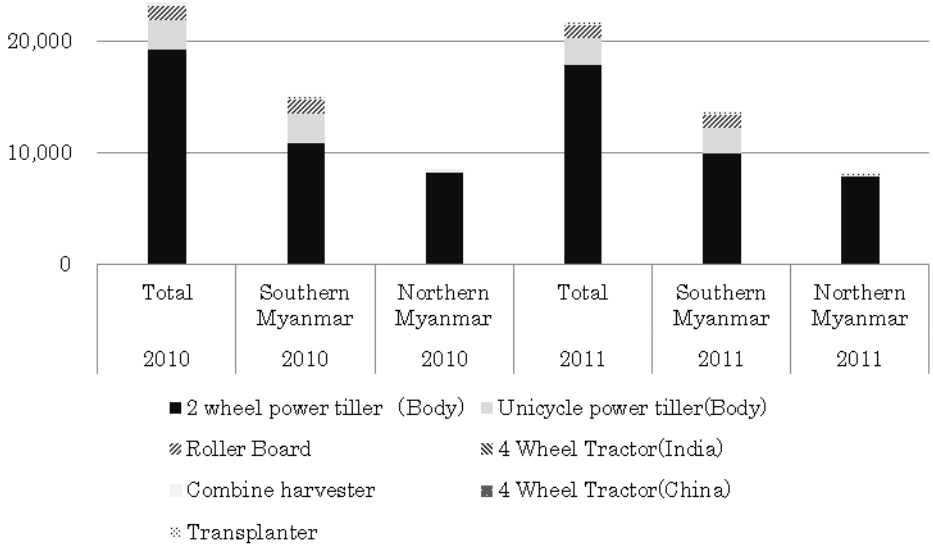
[1] There is no information about the number of agricultural machines imported by each dealer, but according to "Statistics on Import Engines in 2011(Jan.-Dec.), Myanmar Survey Research, March 3, 2012," the 4 companies dealt with 83% of the total imported diesel engines, 220,000 in 2011.

Power tillers and roller boats have been imported for years, but 4-wheel tractor imports began three years ago. The biggest wholesaler started to sell Thailand produced 4-wheel tractors one to two years ago. In addition, it began to handle Japanese products in 2012.

In regards to the transplanter and combine harvester for rice production, market demand for these machines still remains low, since it is difficult to adapt imported machines to the cultivating conditions of Myanmar. It is required to change seedling production and planting practices at the producers' level and to reform farmlands and roads to allow for efficient use of machinery.

The distribution status of agriculture machinery in Myanmar is outlined below, including the biggest import sales records of wholesale and retail companies, with 12 branches all over the country.

Figure 4-2 shows the sales of major products of Good Brothers Co. in 2010 and 2011. As generally discussed in Chapter 3 (3.1), the 2-wheel power tiller is the most popular machine in the country. The next section examines each machine, and considers regional differences in southern and northern Myanmar.



Source: Good Brothers Co., Ltd

Figure 4-2 Sales of Major Machines in 2010 and 2011

(1) The Power tiller and roller boat

Table 4-3 indicates sales of power tillers and roller boats in 2010 and 2011. Since one wheel power tillers and roller boats are sold only in swamp areas of the Ayeyarwady area, there is no sales data for northern Myanmar. Sales of these machines decreased from 2010 to 2011. Retailer analysis concluded this was due to conservative purchases caused by income decline

by lower producer paddy prices. With regard to the sale of 2-wheel power tillers, the decrease in northern Myanmar was relatively lower since in the north, rice farming is relatively smaller and influence over rice prices is limited.

Table4-3 Sales of Power Tillers and Roller Boats in 2010 and 2011

Area	One wheel Power Tiller (body)		2-wheel Power Tiller (body)		Roller Boat	
Year	2010	2011	2010	2011	2010	2011
Southern Myanmar	2,628	2,334	10,869	9,933	1,358	1,223
Northern Myanmar	0	0	8,392	7,990	0	0

Source: Good Brothers Co., Ltd

Table 4-4 estimates the sales number of power tillers in Myanmar from DAP's data (Table 3-3) and AMD and MOI factories' production. Nearly 20 % of production/sales are from AMD and MOI, while over 50 % of sales are Good Brothers sales.

Table 4-4 Market Outline of 2-Wheel Power Tillers

	Number	Share(%)
Sales of AMD production	4,500	15.0
Sales of MOI production	2,000	6.7
Sales of Good Brothers	18,500	61.7
Sales of Others	5,000	16.7
Annual number increase	30,000	

Source: Interviews, DAP "Myanmar Agriculture at a Glance 2011"

AMD and Ministry of Industry factories manufacture more than 20% of the power tillers in the market, but their main parts, such as engines or gear boxes, are manufactured in China. Although there is no reliable statistic data, it is estimated, from an import dealer comment, that over 90% of imported power tillers are Chinese products. Therefore, it can be assumed that the market share of Chinese bodies produced is more than 70%, while the Chinese engines for power tillers is over 90%. However, Thai products are a major import in the Shan State[2].

(2) 4-wheel tractors

Table 4-5 shows the sales of 4-wheel tractors (hereafter "tractor") in 2010-2011. The

[2] In JETRO's "BOP Business Potential Needs Report," 72 farmers around Yangon, and 23 farmers around Taunggyi in the southern Shan State were interviewed, regarding the tractors and power tillers' country of origin. According to the findings, there were no Thai products but mostly Chinese products (86.1%), around Yangon. By contrast, there were 43.5% Chinese products and 47.8% Thai products around Taunggyi. The remaining 12.5% and 4.3% were domestic products.

interviews revealed that retailers started to sell tractors three years ago. No record for Thailand produced tractors was collected.

While power tillers and roller boats decreased in sales during 2010-2011, tractor sales increased in small number from 12 in 2010 to 76 in 2011. Furthermore, Indian produced tractors were sold more than Chinese produced tractors, even though the Indian produced prices were higher. Indian produced tractors are European manufacturers' brands, such as New Holland. These tractors seem to be more reliable in quality than those produced in China. Most of these tractors were bought by private agriculture production companies. Furthermore, large-scale farms developed by these companies in the Dagon area of Yangon caused the number of sales in southern Myanmar to be higher than sales in northern Myanmar. Each company has more than 500 acres of farm, and produces rice. These companies prefer quality machinery to low price machinery in terms of durability, fewer machine problems, low fuel consumption, and higher work efficiency.

According to retailers, Thailand produced machines are the most reliable (Japanese manufacturers' brand), followed by Indian produced, and Chinese produced machineries. Customers purchase tractors balancing the factors of reliability and price. As a whole, the number of tractor sales increased, but this number is small since about 80 tractors were sold by the biggest retailer.

Table 4-5 4-Wheel Tractor Sales during 2010-2011

Area	4-Wheel Tractor (China)		4-Wheel Tractor (India)		Total of 4-Wheel Tractors	
Year	2010	2011	2010	2011	2010	2011
Southern Myanmar	4	10	4	37	14	47
Northern Myanmar	2	6	2	23	4	29
Total	6	16	6	60	12	76

Source: Good Brothers Co., Ltd

(3) Transplanters and combine harvesters

Sales of transplanters and combine harvesters in 2010 and 2011 are shown in Table 4-6. Sales for both machines in 2010 were few, 14 and 21 respectively. Private agriculture production companies, which produce rice, use 4-wheel tractors, but cannot install transplanters or combine harvesters because no one can operate these machines.

Sales of both transplanters and combine harvesters in southern Myanmar are larger than in northern Myanmar, but rates or increases in the north are higher than in the south. It is difficult to simply compare tractor sales numbers, because of differences in specifications and purpose

of use. However, as examples of agriculture production companies indicate, these two machines are not yet, as a whole, popular among big farmers.

Table 4-6 Sales of Transplanters and Combine Harvesters

Area	Transplanter		Combine harvester	
	2010	2011	2010	2011
Southern Myanmar	5	8	6	12
Northern Myanmar	2	6	2	9
Total	7	14	8	21

Source: Good Brothers Co., Ltd

(4) Retail price of agriculture machinery

Table 4-7 shows the retail price of agriculture machines in Myanmar. With regard to power tillers, Chinese produced power tillers generally are sold with full implements, such as plows, rotary plows and disk plows. On the other hand, Thailand produced power tillers equip only rotaries as a standard set, and farmers have to buy other implements for additional cost, if necessary. Price differences could be much larger.

Table 4-7 Retail Price of Agriculture Machinery

Product	Specification	Price (Kyats)	Origin
Power Tiller	One wheel power tiller (body) with plow	270,000	China
	2-wheel power tiller (body) with plow, rotary plow disk plow	1,320,000	China
	2-wheel power tiller (body) with rotary plow	1,500,000	Thailand (Kubota)
Roller boat	Body with rotary plow	280,000	China
Engine	25hp	350,000	China
	22hp	330,000	China
	18hp	280,000	China
	15hp	960,000	Thailand (Kubota)
	10hp	245,000	China
	8hp	155,000	China
4-wheel tractor	(ZWE-80), 80hp	4,000,000	MOI
	47hp without implements 85hp without implements 95hp without implements	17,500,000 34,000,000 37,000,000	Thailand (Kubota)
Transplanter	4-row planting	2,300,000	China
Combine harvester	Multipurpose	1,300,000	China

Source: Results from retailer interviews

4.2.2 Status of after sales services

Some big retailers own workshops, and technicians undertake repair and maintenance of agriculture machines at their branch shops. They train technicians in basic repair and maintenance skills at their workshops. Periodic maintenance services by retailers are not popular in Myanmar. But, one retailer plans to dispatch technicians with tools and equipment to villages, to maintain machines sold on a trial basis. They call it mobile service.

With regards to the guarantee of machines, gearboxes and engines, except their consumable parts, they are guaranteed for 6 to12 months, depending on retailers. Other parts, such as bodies, axles, implements and wheels, are not generally guaranteed. Retailers never guarantee spare parts, which are not guaranteed by manufacturers.

4.2.3 Procedure laws and regulations related to imports

In Myanmar, individuals and businesses that attempt to engage in import/export business are required to process an (1) import and export registration, (2) application for an "import license" in each transaction and, (3) receive an import customs clearance as follows.

(1) Import and export registration

Firstly, individuals and businesses need to establish a registered company which is allowed to engage in trading, although foreign companies have not been allowed to conduct trading since 2002.[3] Secondly, they have to apply for registration with the Directorate of Trade under the Ministry of Commerce and receive an Exporter/Importer Registration Certificate. The certificate fee is 100,000 Kyats for two years duration and 50,000 Kyats for one year.

They also need to register with the Union of Myanmar Federation of Chambers of Commerce and Industry: UMFCCI. Its member fee is US$300 (admission fee) and US$150 (annual fee). A UMFCCI registration card is required to apply for import licenses or for country of origin certificates.

(2) Import license

Registered companies receive import licenses for each transaction. To apply, they have to open a foreign currency account at the Myanmar Investment and Commercial Bank (MICB) or Myanmar Foreign Trade Bank (MFTB). After they submit the required documents, application form, and UMFCCI registration card, the license will be prepared within one to three days. The license is valid for three months. In addition, there are several considerations in regards to the application as outlined bellow.

- The fee, in accordance with the equivalent amount of CIF imported products, should be

[3] The section referred to JETRO Yangon Office's "Guidebook of Business in Myanmar," 2011 (The details can change due to current changes in politics).

paid upon arrival to the port of Yangon

- Myanmar adopted an export-first policy. Companies cannot import more volume than the range of foreign currency earned from export. Export foreign currency can be used for import. "Foreign currency export" can be traded between importers and exporters.

- Importers need to make use of a Letter of Credit (L/C). Telegram transfers (T/T) are not allowed. In principle, they have to import under CIF conditions. Issuance of import licenses also will be conducted by the Committee of Directorate of Trade.

- In Myanmar, the government is concerned about the lack of foreign currency. In some cases, it is difficult to obtain import licenses. It is necessary to confirm in advance, according to the material handling business practices.

(3) Import customs clearance

The clearance will be conducted by authorized banks (L/C issued banks). Normally MICB or MFTB and a series of processes will start after collecting the shipping documents. Companies need to provide the shipping information schedule in advance, since the process cannot be started without the documents. If the bank for the place of shipment informs MICB/MFTB of the transaction and these banks issue a “Bank Guarantee,” shipping agents will issue a Release Order. In this case, companies can start clearance without the shipping documents. But, the process of Bank Guarantee can take several days in Myanmar, (the same as waiting for shipping documents, in many cases).

The importer duty is calculated based on the customs tariff table. CIF equivalent fees and landing fees will add to the import duty (0.5% of the CIF equivalent fee). Commercial Tax will be charged as well (the rate depends on the kind of commodity). The Commercial Tax fee charged is the price of landing (the total import duty taxable amount and the amount of import duty). All charges will be issued in accordance with customs procedures.

Chapter 5

Clarification of Subjects for Agricultural Mechanization Development

Chapter 5 Clarification of Subjects for Agricultural Mechanization Development

5.1 Positive Factors and Negative Factors

Positive factors and negative factors obtained from the survey findings are summarized in Table 5-1.

Table 5-1 Positive Factors and Negative Factors

Stakeholders	Positive factors	Negative factors
Farmers	• Strong demand for agriculture machinery due to shortage of farm labor and higher labor costs. • Increase in demand for on-time work in unseasonable weather. • Demand for efficient use of farmland. • Demand for income increases by machinery service. • Demand for machine use for transportation equipment. • Demand increases in areas where two croppings can be applied with irrigation water. • Expect competition improvement among retailer services. • The development of low quality, but cheaper spare parts distribution networks.	• Lack of suitable credit system for small sale farmers. • Lack of capital for farmers. • Reluctance of cooperatives to use machinery due to improper management of old cooperatives. • Lack of knowledge and awareness of management in agriculture. • Unstable water distribution causes farmers to hesitate to buy machinery. • Efficiency of machinery and animal power is not clarified. • Animal power use can be efficient enough. • Axle width of power tillers is not adapted to furrow width. • Farmland is not suitable for mechanization (scattered small plots, lack of road access). • Income by providing machinery services decreases in areas most farmers have a machine. • Need more capital for other agriculture input, increasing land use efficiency. • Occurrence of opportunity cost (time for machinery stopping, procurement and replacing spare parts). • Farmers' reluctance towards cooperative purchases/use of machines due to negative impressions of management. • Difficulty in expanding new farmland. • Operation and maintenance (O&M) watching other farmers may shorten operating life, increasing machine problems.
Dealers of Agriculture Machinery	• Improve service level by demonstration, mobile maintenance, and repair services by big dealers. • New credit system in cooperation with banks can save extra capital for individual credit services. • Promote sales of machinery, expanding branch networks. • Invest in R&D for identifying local	• Lack of farmers' capital. • Lack of guaranteed system on products, except engines and gearboxes. • Spare parts market is separated from that of products, and machine retailers are not responsible for spare parts.

	specifications for transplanters and harvesters.	
Manufacturers of Agricultural Machinery	• Production facilities and equipment investments are actively carried out by big manufacturers. • Technical cooperation with Chinese manufacturers in research and development (R&D) and industrial engineering is actively carried out.	• Engines, gearboxes and axles are as important but not manufactured in Myanmar. • Time for turn-around in costs for investment and R&D takes a lot of time.
Rice Millers/Exporters	• Preference to export high quality rice. • Make an effort to restart the export of high quality rice. • High demand for production facilities using steam engines for high quality rice. • High demand in rice mills for export rice. • Extension of Thailand's rice milling technology. • High demand to improve parboiled rice milling. • Strong desire to expand businesses to reach the market and for export.	• High cost in using ports and warehouses due to their dated conditions. • Unable to stock stable quality/quantity of rice. • High interest rates make it difficult to keep stock of rice. • No quality standard for rice (or in practice). • Lower technology of milling in rural areas and less awareness of recovery rates and losses. • Unstable power supplies and no information in advance about black outs. • Low accessibility in rural areas and difficulty in purchasing paddy. • High cost in maintaining steam engines. • Spread of low quality spare-parts. • Lack of proper knowledge/skills in operating mill machinery. • Low quality of husk gasification plants and frequent failures (in those that are small scaled). • Diesel oil use without adequate power supplies, higher costs on financial management.
Sugar Millers	• Refined sugars are domestically produced.	• Lack of stable power supplies.
AMD Tractor Stations	• High demand in machinery after Cyclone *Nargis* since it caused the death of draught cattle. • Lack of labor may encourage farmers to use a mechanization service for harvesting.	• Old machinery causes more problems and fuel consumption issues. • Lack of spare parts for old tractors. • Lack of budget to renew machinery. • Decrease in sales year by year. • Low motivation of organizational management due to top-down procedures by the central government.
AMD Repair Workshops		• Lack of budget to stock spare parts. • Time to procure spare parts is long. • Tractors are too old to be repaired. • Repair delays because of old equipment and facilities. • Lack of knowledge of newer machinery and difficulty in repairing them.
AMD/MOI farm Machinery Factories	• Increasing demand in reapers, threshers, and combine harvesters (privatization of AMD No. 3 factory, and MOI No. 18 factory are under negotiation. The situation will possibly change).	• Old factory and new factory are located close to each other. It appears ineffective. • Unstable power supplies. • Lack of budget and delay of procurement materials.

		• Old production equipment. • Ineffective production of the same machinery at several factories. • Lower rates of equipment operation.
AMD Training Centers	• Increase participant demand in mechanization courses.	• Old teaching equipment. • Difficulty in increasing the number of trainings since there are only two facilities.
Small Scaled Repair Shops	• Sufficient supply of lower quality, but cheap spare parts. • Some repair shops try to improve capacity by introducing tools/equipment.	• Several industrial standards of spare parts (mm, inches etc) are mixed and difficult to adjust. • Some areas where spare parts are not easily purchased.

5.2 Private Sector's Subjects

Based on the factors outlined in Table 5.1 above, the section below summarizes subjects for development of agricultural mechanization by each private stakeholder.

5.2.1 Farmers

Table 5-2 shows subjects for development of agricultural mechanization, based on negative factors obtained from farmers' interviews.

Table 5-2 Subjects for Development of Agricultural Mechanization (Farmers)

Fields	Subjects
Financial Capacity	Lack of individual financing and adequate loan services (duration, interest rate and so on) to purchase machinery.
Operation and Maintenance (O&M)	Concerning operation of machinery, there are some farmers who have operator experience, but most farmers learned from watching other farmers. Incorrect operation shortens machines' life, causes machine problems, and serious accidents. In order to avoid this, operators should systematically learn about machinery operations as well as basic machine maintenance technology .
Repair and Spare Parts	In regards to the repair of agriculture machinery, most farmers, in areas where mechanization began earlier, do it themselves. They acquired skills by watching others. The farmers may cause other problems or decrease machinery durability. Farmers need to be trained properly and scientifically.
Economic Issues of Utilization of Agriculture Machinery	Introduction of agriculture machinery and transportation equipment as investment in farm management should be based on whether it is utilized to increase productivity and decrease production cost. Therefore, a farmer has to choose between purchasing or using machinery services, and also evaluate profitability in conjunction with other inputs such as seeds, fertilizers, chemicals, and labor. However, a farmer actually makes purchases without any evaluation of profitability, and there is no necessary reference for evaluation, such as operating efficiency and O&M cost for machines.
Agriculture Infrastructure	It is difficult to introduce agriculture machinery in terraced fields and small plots in slope areas. Even in plain areas, middle class machinery cannot access the field due lack of road access. Farmland reforms that improve road access are indispensable for agriculture mechanization. A farmer bought a power tiller, because irrigated water is available to his farm during the dry season. However, irrigated water was not distributed as planned, and he could not receive water to his farm due to the unstable irrigation system. This unstable operation of the irrigation system causes farmers to hesitate in investing in agriculture

	machinery. Capacity building on O&M for irrigation facilities has to be improved, so that water is distributed as planned.
Utilization of Agriculture Machinery	Power tillers are utilized for plowing, harrowing and paddling, which serve as a substitute for animal power not utilized for other works, such as ridging and weeding. This is due to a lack of appropriate implements that adapt to various cultivating conditions. If suitable implements were available, operation rates would increase.

5.2.2 Agricultural cooperative

Farmers are reluctant in a cooperative to have machinery serve members, due to the belief that there was mismanagement of a former cooperative. Cooperatives need a certain amount of time to promote collective agriculture mechanization activity. However, there is a cooperative that provides low interest credit for operating capital to members and joint purchasing of fertilizers. Promoting this activity in all cooperatives can solve the problem of lack of operating capital for agriculture input, in addition to increasing production efficiency through machinery use. Availability of low interest credit services has an important role in agriculture mechanization.

5.2.3 Retailers of agricultural machinery

Big dealers in particular provide machines in the rural areas, and demonstrate machine performance to promote machine sales. This increases sales volume of small sized machines, such as the power tiller. However, sales volume of middle-sized machines, such as the 4-wheel tractor, transplanter, and combine harvester, whose demand is anticipated to increase, has not been accepted by the market. The reason is poor development of farm infrastructure and the failure to extend cultivating technology, suitable for mechanization. Furthermore, for all machines, economic evaluation, which convinces consumers to introduce machinery, has not been carried out.

5.2.4 Agriculture mechanization service providers

Mechanization services are provided mainly by farmers and AMD tractor stations. Some private companies, who contract with farmers, also provide mechanization services as well as other agriculture inputs, but in a limited fashion. There is a dealer, who is considering moving into the machinery service business. It plans to provide mechanization services using machines that are not as popular in Myanmar as the transplanter and harvester. Its target is the small-scale farmer, who cannot afford to buy transplanters and harvesters. But the issue is service demand and road access to the field, which directly affects service profitability.

5.2.5 Repair shops

The considerations for private repair shops are listed as below.

Table 5-3 Subjects for Development of Agricultural Mechanization (Repair Shops)

Fields	Subjects
Training and Reeducation of Repair Engineers	Most engineers have not acquired basic knowledge about repair in school etc. Through repair work itself they acquired the necessary skills. Many engineers have 20 years or more experience in actual factory work and can respond to general failure and maintenance needs. Their activity is indispensable to present agricultural mechanization work. However their work has not been maximized "enabling them to move for the time being," and sometimes failures are not completely solved. In a rural area, it was occasionally seen that the overhauling work of engines is done in the dusty outdoors without roofs. Severe work under such conditions should not be carried out. The engineers should understand that such work will shorten a machine's life. In the future, import quantities of agricultural machineries from overseas will be increased. It is indispensable to improve engineers' technologies to be able to provide new imported machines. It is necessary to increase private engineers' repair technologies, while utilizing their present experiences and skills.
Repair Facilities	Except engineers using handy tools, no shops with proper and scientific equipment exist in the rural areas. It is necessary to improve their equipment in order to improve machinery maintenance technology.
Industrial Standards	Although industrial standards are enacted by the state, various standards are inconsistent and cause repair and maintenance difficulties. Consistency of industrial standards is required.

5.2.6 Post-harvest factories and processors

The subjects for development of post-harvest factories and processors are listed below.

Table 5-4 Subjects for Development of Agricultural Mechanization
(Post-Harvest Factories and Processors)

Fields	Subjects
Electric Power Situation	At all the post-harvest processing factories, the unstable electric power supply is the most serious problem. Since there is no prior announcement for power failures, production planning is not formed in the factory using electricity. There are also factories operating by diesel engines for emergency during power failures, but since the fuel cost is comparatively high compared with electric power, it raises the operation cost.
Knowledge of Rice Processing	Since rice milling yield does not link directly with rice millers who perform rice milling processing services and collect milling charges for farmers, rice millers are less interested in rice milling yield and in studying technology related to milling yield. This means loss generated through milling is neglected. Extension of proper rice milling technology is required.
Spare Parts	Many spare parts for rice processing equipment have appeared on the market, but many are of low quality. It is necessary to establish quality standards for spare parts to stop circulation of inferior quality products in the market.

5.2.7 Agricultural machinery manufacturers

The manufacturing capacity of private factories is limited to the level of metal sheet processing, which can at most produce threshers. The level of industrial engineering has improved through technical assistance from Chinese manufacturers. There is a manufacturer, who carries out R&D of transplanters and combine harvesters in cooperation with Chinese manufacturers, but the recovery cost for research and development hinders progress. This is because farmland reform is not progressing sufficiently to introduce transplanters and combine harvesters and, seedling production has to change for trasplanters. In addition, operators' skills are not sufficient to operate these machines.

5.3 Regional Subjects for Development of Agricultural Mechanization

Table 5-5 lists regional subjects for development of agricultural mechanization. In order to avoid repetition, only issues which were not previously discussed in Section 5.2, are noted here.

Table 5-5 Subjects for Development of Agricultural Mechanization (by Area)

Ayeyarwady Area
-Both farmers and repair shops lack experience operating machinery in areas where mechanization started after Cyclone *Nargis*, and their level of operation, maintenance and repair knowledge is low as well. -Farmers in the Ayeyarwady area are limited to operate machinery in the wetlands due to a lack of drainage facilities. In this area, farmers have to use and operate rather unstable small machines, such as one wheel power tillers and roller boats. -In this area, there are many rice mill plants but small/medium size rice milers do not have the technological capacity to decrease processing losses.
Central Dry Area
-It is financially unreasonable to introduce mechanization for single-season farming without irrigation. -Current farming practice is not appropriate for mechanized agriculture production, because power tillers are used in combination with animal power. As a result, power tillers are limited to plowing, harrowing, and paddling, and operating rates of power tillers remain low. -If suitable implements for ridge making, inter-tilling, and weeding attached to a power tiller are developed, operating rates could be higher.
South Shan Highland Area
-The soil type is clay soil, and power tillers tend to sink. Small and light engines have to be used in this area. This limits performance operation, and creates longer work time. -Adequate machinery use for farming various crops has not been developed although agricultural commercialization is in progress and financial capacity is high in this area. -Poor accessibility to terraced fields/wetlands.

5.4 Subjects for Development of Agricultural Mechanization for Related Organizations

This section summarizes subjects for development of agricultural mechanization by related organizations.

5.4.1 Ministry of Agriculture and Irrigation (including some Ministry of Industry Factories)

(1) AMD tractor stations and repair workshops.

Table 5-6 Subjects for Development of Agricultural Mechanization
(AMD Tractor Stations and Repair Workshops)

Fields	Subjects	
	Tractor stations	Repair workshops
Materials	Almost all operating tractors were produced from 1960 to 1990. Most tractors break down often and are fuel inefficient. Since the old machines are used, specific work cannot be performed and farmers remain dissatisfied. Because of this, sales of mechanization services have fallen every year at some stations. Moreover, since tractors are old, parts production has been discontinued and is often unavailable.	Repair and inspection equipment of workshop that was produced 20 or more years ago. The equipment is too old to perform proper repair.
Budget	Although central headquarters has received a request for new tractors from each tractor station, there is no budget and it cannot be arranged. Moreover, the budget for purchasing spare parts is limited, and maintenance is omitted from the budget entirely.	Although spare parts required for work repair are requested by AMD headquarters, sometimes it is out of stock, as the result of budget problems. Even though the spare parts are procured locally, they take time for delivery. In some repair workshops, due to the insufficient budget, parts are out of stock.
Government's/ AMD's Policy	The AMD machines are out-of-date and do not have the opportunity to be brought up to update. On the other hand, through overseas assistance, new machineries are directly distributed to the private sector, not AMD. Moreover, when the government took responsibility of overseas assistance equipment, including the determination of ownership, it was entrusted with the task for each local government. As a result, supplied equipment was owned by the private sector in some areas and owned by government in other areas. AMD should firmly establish its strategy and perform its plan. All the equipment, spare parts, personnel expenses etc. are provisioned and supplied from headquarters. Therefore local tractor stations located in each region and state do not have the motivation to organize operations and scale expansions.	Since each repair workshop is acting from AMD headquarter's instructions, each repair workshop does not have the motivation to pursue their own original ideas. On the other hand, AMD headquarters instructs production and sale of agricultural machinery at each repair workshop, and the workshop in Nay Pyi Taw has already begun production. Such instructions are questionable since the privatization of these factories is currently under consideration.

(2) Machinery factories of AMD and the Ministry of Industry.

Table 5-7 Subjects for Development of Agricultural Mechanization
(State-owned Production Factories)

Fields	Subjects
Electric Power Supply	The electric power supply to factories is unstable, and planned production cannot be performed. Power failures are not scheduled. With sudden power failures, employees frequently remain idle for more than half the day.
Budget	Since out-of-date equipment cannot be replaced due to a lack of budget, required processing cannot be performed adequately or on schedule. Moreover, provision of raw materials for machine production is overdue, and has interfered with factory production planning.
Production	The number of daily machines produced at the AMD factory is only ten units or less. This is not as much as the current level of modern mass production. The No.1 factory and No.2 factory are out-of-date. They do not have competitive power with sophisticated manufacturing techniques as in the private sector. The No. 1 and the No. 3 AMD factories are near one another, but both factories currently produce the similar machines (Table 5-8). This seems to be ineffective management.
Privatization	Three AMD factories have explored the means to privatization. In particular the No. 3 factory was established about ten years ago. The production facilities are comparatively new. The request for leases from the private sector has occurred. Moreover, the No. 3 factory has a large site, 27 ha. A private company, Good Brothers Co. was a candidate for a 30-year lease. On the other hand, there is no proposal from the private sector for the No. 2 Factory since it has only 5 ha and old facilities. The 3 factories of MOI are also seeking privatization in the same manner.

Table 5-8 Similar Machineries Produced at AMD and Ministry of Industry Factories

	AMD Factory No.1 Yangon	AMD Factory No.2 Mandalay	AMD Factory No.3 Yangon	16th Factory Sinde	18th Factory Inngone
Power tiller, 22hp	Model: DF-121 Annual production: 2,000	Model: LY-22 Annual production: 400	Dong Feng type Annual production: 800	Model: Ayeyar-1 Annual production: 2,000	Model: LY-22 Annual production: 2,000
Power tiller, 16 hp		Model: LY-16 Annual production: 100			Model: LY-16 Annual production: 1,000
Power tiller, Upland type		Model: FT009, 10hp Annual production: 750	12hp Annual production: 250		
Thresher, 16hp (without engine)	Model: TH-60 Annual production: 200-300	Model: TH-60 Annual production: 200	Model: TH-60 Annual production: 100		Model: TH-60, 22hp Annual production: 240

Source: Interview and questionnaire surveys conducted by the study team.

5.4.2 PTAC (Under MAPT, Ministry of Commerce)

The original purpose of PTAC was to contribute to the agricultural commodity market, develop proper post-harvesting technology, reduce rice-processing losses, and maintain crop quality.

PTAC officers insisted that such activities remain but PTAC only offers training courses once or twice a year, and most machines at the center, such as rice mill plants and oil mill plants are hardly

used.

PTAC management should be transformed into an adequate government organization since MAPT's main task of post-harvesting technology ceased.

5.4.3 Financial institutions

Adequate credit services play a significant role in farmers' mechanization. However, it can be said that there are no adequate financial services in Myanmar. The lack of services is one of the key obstacles towards mechanization.

As mentioned in Chapter 3, MADB, private banks, cooperatives, international NGOs, and informal moneylenders engage in rural financing in Myanmar. In particular, MADB has a nationwide network and major institutes. However, MADB loan amounts remain small, between 2,000 and 8,000 Kyat per acre, for farmers to invest in new inputs, including agricultural machinery.

Installment payments under private banks and retailer partnerships were introduced last year. Even though the new system has potential, it is too early to judge its impact. The adequacy of services, such as interest rates, duration, targets and so on, need to be monitored continuously.

While the number of MADB customers has decreased, microfinance customers by international NGOs have steadily increased. The loan amount under microfinance is higher and loan plans/accessibility are more customer friendly, compared with MADB loans. However, microfinance covers only about 10 % of the country, and a limited number of farmers actually access the service.

Credit cooperatives provide small loans as well (10,000-30,000 Kyat/acre). However, at the moment, the loans cannot serve to encourage farmers to purchase agricultural machineries and simultaneously support existing farming costs such as inputs and labor wages.

5.5 Overview of Subjects for Development of Agricultural Mechanization

To grasp the whole picture from the above discussion, Figure 5-1 presents an overview of subjects for development of agricultural mechanization in Myanmar.

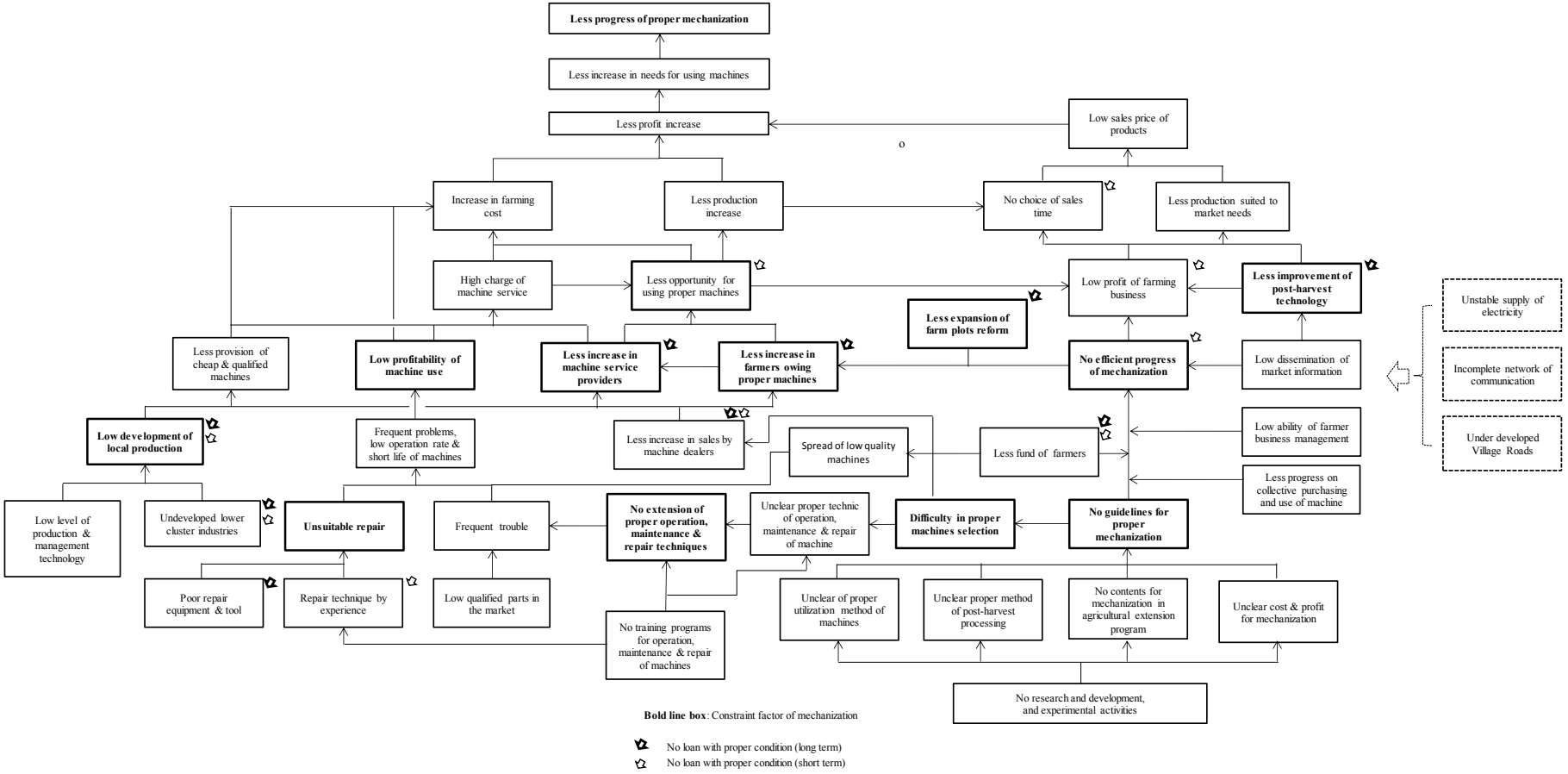


Figure 5-1 Relationship of Subjects and Conditions for Development of Agricultural Mechanization

Chapter 6

Study Questionnaire to Japanese Agricultural Machinery Manufacturers

Chapter 6 Study Questionnaire to Japanese Agricultural Machinery Manufacturers

The study questionnaire was given to 41 companies that manufacture agricultural machinery in Japan, with the cooperation of the Japan Agricultural Mechanization Association in selecting the 41 companies from its members.
The contents of the questionnaire and the results of the questionnaire are attached in Appendix-5.

6.1 Objectives of the Study

The objective of the study is to understand the conditions and constraints for sales of companies' products in Myanmar and to advance agricultural mechanization in Myanmar based on the field survey and data collected.

6.2 Summary of Study Results

The study results are summarized as follows:

- 37 companies replied to the questionnaire and the response rate was 90.2 % of the total 41 companies.
- Five companies (13.5 %) had experience selling their products in Myanmar.
- Among the five companies above, four companies sold their products after the year 2000, and two companies sold their products continuously for the last three years (2009 to 2011).
- For each of the two companies above, the products they export and sell in Myanmar are manufactured in Thailand. One company produces rice processing and plant machines and the other company produces agricultural machines, such as tractors and power tillers.
- 17 companies (45.9 %) responded that they would consider selling their products in Myanmar.
- The factors to consider are the following:
    i. Product sales in Myanmar that are produced in Japan or a third country 17 companies
    ii. Product sales in Myanmar that are produced or assembled in Myanmar 2 companies
    iii. Product sales in Japan or a third country that are produced and assembled in Myanmar. 1 company
    iv. Other (Exports to Myanmar by Japan's ODA programs) 1 company

6.3 Response to the Requests

In the questionnaire, companies answered questions regarding factors and conditions for considering selling their products in Myanmar. Companies, except two that manufacture

machines in Thailand and sell them in Myanmar, did not have enough general information concerning the agricultural machinery market in Myanmar.

The companies' comments and the selected alternative subjects that they would like more information on, along with the study team's explanations, are indicated in the following table. Additionally, information that is useful for considering selling their products in Myanmar is summarized in Section 6.4.

Table 6-1 Advice and Reference Regarding Subjects and Conditions for Considering Sales in Myanmar

	Subjects and conditions	Advice and reference parts of this report
1	Simplification of export and import procedure	Regulations and procedures concerning export and import have improved recently. They are also moving towards improving the investment and market entry environment for foreign firms. However, it takes time to actually adopt regulations and procedures in the field. The information announced by concerned organizations, such as JETRO[1] and the Japanese Chamber of Commerce in Yangon[2], will be followed. The outline of the recent procedure regarding machine imports to Myanmar is explained in 4.2.3.
2	Capability of local dealers	The survey was given to agricultural machine dealers and the survey results are described in 4.2 and in Chapter 5.
3	Improvement of restrictions on overseas remittance	Actual information about improvements was not collected in the study. The information announced from concerned organizations such as JETRO and Japanese Chamber of Commerce in Yangon, will be followed.
4	Expansion of official development support that promotes farm mechanization	The U.S.A. and European countries, including international organizations, are progressing towards resuming and expanding their support programs after the removal of economic sanctions. Japan is one of these countries and this study was conducted with this in mind.
5	Information on agricultural conditions and the situation of agricultural mechanization	The information collected in the field survey regarding the agricultural sector focuses on the agricultural mechanization field and is referred to in this report.
6	Development plan and strategy for agriculture and mechanization in Myanmar	Agricultural mechanization is one important issue in the national and agricultural development plan of Myanmar. However, the actual prospect of its development direction is unclear due to a lack of systematic strategy. Various details of these conditions are described in this report.

[1] http://www.jetro.go.jp/indexj.html
[2] http://www.jcci.or.jp/international/jcci-overseas.html

6.4 Information Summary for Reference

(1) Spread of agricultural machines and market capacity

Spread of major agricultural machines compiled by AMD, March 2012 and the number of machines used per 1,000 hectares, as of 2010/2011 are shown in Table 6-2.

Table 6-2 Spread of Major Agricultural Machines

Machines	Tractor	Power Tiller	Pump	Sprayer	Trans-planter	Reaper	Combine Harvester	Thresher
No.	10,490	206,263	182,880	126,700	67	1,569	131	41,289
/1,000 ha	0.87	11.1	14.8	-	-	-	0.01	2.84

Source: AMD

In contrast, the tilling area of tractors and power tillers is 858,000 hectares and 3,288,000 hectares relatively, and 3,288,000 hectares in total as of 2010/2011, according to the statistics of DAP, MOAI. It was 17.6% to total sawn area of 23,618,000 hectares and the mechanization rate was still below 20%. Therefore, the market capacity of such land preparation machinery can be estimated to be approximately five times the existing number of machines.

(2) Machines' country of origin

The factories under AMD and the Ministry of Industry manufacture agricultural machines. But they cannot produce elaborate machine parts, such as engines and gear boxes, or import them. Their annual production capacity is about 6,000 units of power tillers in total. Although, they plan to manufacture rice transplanters and combine harvesters with the cooperation of Chinese companies and Korean campanies, factories' plan for privatization are also under consideration. This may trigger the development of local private industry in the long term.

China produces more than 80% of the power tillers, its highest sales item, and almost all engines used for power tillers are Chinese as well, since all locally manufactured power tillers are equipped with Chinese engines. Other than Chinese power tillers, a limited number of Thai made power tillers are used mainly in the Shan State and a few power tillers are produced in various other countries, introduced by donors' projects.

However, tractor sales conditions differ from power tillers. Its sales numbers are still far less than the sales rate of power tillers. The buyers of tractors are rather big farmers with large fields. Furthermore, some private companies are entering the agricultural production businesses of large cultivated land, buying effective and high quality tractors, of high price in place of those that are cheap but of low quality. Under these circumstances, recently, Indian tractors produced by European manufacturers tend to be imported. Similar market conditions are anticipated for rice transplanters and combine harvesters.

(3) Progressive factor

The past spread of agricultural machines focusing on power tillers, was promoted mainly due to the replacement needs of machines to draught cattle, although conditions differ depending on the area. There is a trend that hired labor unit costs are also rising, in almost all areas the survey team visited. In Myanmar, public projects and activities of private companies also tend to be increasing, and when job opportunities for agricultural labor increase, mainly for landless farmers in the rural areas, lack of agricultural labor will be unavoidable. The market need for labor saving machines such as the transplanter, combine harvester, and a power thresher will increase in the future.

(4) Chinese agricultural machines

Many Chinese produced agricultural machines are sold in Myanmar. It is believed that Chinese products are cheap but of low quality. Chinese agricultural machines are an inevitable choice for farmers due to less funding resources available and limited appropriate loan programs. Not all Chinese machines are of poor quality, but some disqualified machines are sold on the market. Data on the cost of maintenance, repair and work efficiency, which could allow for proper economic analysis, is not available. Evaluation of other countries' machines cannot be conducted objectively. Market conditions will not change when there is no official function for inspection and evaluation of machines sold on the market.

Chinese machines have the benefit of allowing users to maintain and repair them easily because they consist of ordinary parts. Parts for replacement can be purchased in many village and town shops.

(5) Sales channel

Major agricultural machinery import and sales companies, mainly four big companies, have their machine sales and distribution channels for agricultural production all over the country and they continue to develop them in Myanmar. Their sales networks in Myanmar are reliable for marketing machines manufactured in third countries.

They also manufacture various machines, except those with elaborate machine parts, such as threshers and trailers, and they may be capable of being involved in the field of assembly work manufacturing.

Additionally, the spare parts market, including sales and distribution channels, also exist separately from the machinery market and covers village level of agricultural production area in Myanmar. Spare parts and consumables can be distributed to users through these channels.

(6) Needs of agricultural machinery in three areas

From the field survey findings conduced in the three areas, the Ayeyarwady, central dry zone, and the Shan State (south), agricultural machinery market needs by each area are summarized in Table

6-3 below.

Table 6-3 Agricultural Machinery Needs by Area

Ayeyarwady Area	Central Dry Area	Shan State (south) Area
<Swamp area> Light machines. Power tillers, one wheel power tillers, roller boats. Transplanters and combine harvesters cannot be used in the field without drainage systems. <Other area> Various rice farming machinery: tractors, power tillers, transplanters, combine harvesters, threshers, etc. Large scale machines can be introduced in the field after land reform with irrigation systems. Machines like harvesting machines suited for other crops than rice, cultivated in the dry season.	Low need for machines in rain-fed farming areas except irrigated areas and large cultivated areas of industrial crops. <Irrigated area> Various rice farming machinery: tractors, power tillers, transplanters, combine harvesters, threshers, etc. Large scale machines can be introduced in the field after land reform with irrigation systems. Machines like harvesting machines suited for other crops than rice, cultivated in the summer and winter season. <Upland> Large scale machines such as tractors and harvesters can be used in large cultivated areas of industrial crops.	Upland type power tiller. <Irrigated rice cultivated areas> Small scale machines such as transplanters, reapers and threshers. <Other area> Machines for horticulture. Large scale machines such as tractors and harvesters can be used in large cultivated areas of industrial crops such as sugar cane (the area is limited).

Chapter 7

Consideration of Directions and Fields for Support Programs for Agricultural Mechanization

Chapter 7 Consideration of Directions and Fields for Support Programs for Agricultural Mechanization

Based on the agricultural mechanization discussion outlined in Chapter 5, directions and fields for Japan's support programs are considered here.

7.1 Preconditions for Considering Support Programs for Agricultural Mechanization

The following preconditions are established when considering the directions and fields of support programs for agricultural mechanization in Myanmar.

(1) Conformity with the free market economy

The new government has been advancing towards an open market economy since last year. Therefore, the following precondition is established.

Condition	Approach and strategies for mechanization will be in conformity with a free market economy.

Different from the past rice production shortage in Asian countries, major food products produced in Myanmar are self-sufficient. The production quota system for farmers and the export intervention program was abolished by the government. Currently, the most important and fundamental subject in Myanmar corresponds to the needs of the local market as well as the international market. Namely, formation of a system where persons involved in the value chain, such as distributors, processors, as well as farmers, can enjoy profit through product sales, corresponding to the needs of the market. Therefore, agricultural mechanization covering various fields such as production, processing, and storage, must be promoted while maintaining evaluation through the free market economy.

(2) Fields out of consideration

As seen in Chapters 3 through 5, the circumstances surrounding the agricultural mechanization field in Myanmar contain various socio-economic factors, extending to fields beyond the agricultural sector. The study team made efforts to grasp the present conditions, focusing on agricultural mechanization, by looking beyond the field as much as possible with its limited resources. Therefore, some fields studied are difficult to analyze and draw conclusions from in this chapter due to limited information resources in the field. Even if they are important, these fields are excluded from consideration and only minimally referenced unless they are otherwise dealt with within the agricultural sector.

Table 7-1 Fields and Contents Out of Consideration

Fields	Contents as subjects
Economic infrastructure	Electricity: The unstable electricity supply is the biggest subject for machinery production factories and post-harvest processing factories. If electricity can replace diesel in the various mechanization fields, cost reduction can be expected and mechanization can spread. Roads: Farmland reform, including farm road construction, is necessary for agricultural mechanization, but village roads that connect to farm roads are still behind in development, and many roads cannot be used during the rainy season. Improvement of village roads networks is an important subject. Information infrastructure: As agricultural machines are one of the inputs, the results must be derived from proper machine utilization in view of the market economy. To do so, it is necessary that farmers access market information well and utilize it for considering purchasing and using machines. Thus, the development of information infrastructure is an important subject.
Machinery Industry	Promotion of local agricultural machine production is an important direction and subject for agricultural mechanization. The subject is related to the various development strategies in the industrial sector, such as improvement of production and management technology, development of the supply industry which supplies parts and raw materials, and unification and extension of industrial standards and etc. Thus, it cannot only be considered in the agricultural sector.
Finance	Loan provisions with appropriate amount conditions, refunding periods, interest rates, etc. are important subjects for purchasing machines, for farmers' various business improvements, and for repair shop owners and processors who do not have enough funds for investment. However, the financial conditions cannot be analyzed and considered for all stakeholders in the field of agricultural mechanization due to the diversification requirement.

7.2 Farming Circumstances and Farm Size Approach

7.2.1 Selection and use of machines due to farming circumstances

Circumstances for the use of machines focusing on land preparation differ due to farming size and socio-economic factors, as well as environmental factors. These circumstances must be classified by similar types, as the extension units for farming methods, including utilizing machines, and the appropriate farming methods, must be developed and clarified by each unit as the "guideline" for farmers.

A series of components for the farming guidelines above and the relation between them, is illustrated in the following figure.

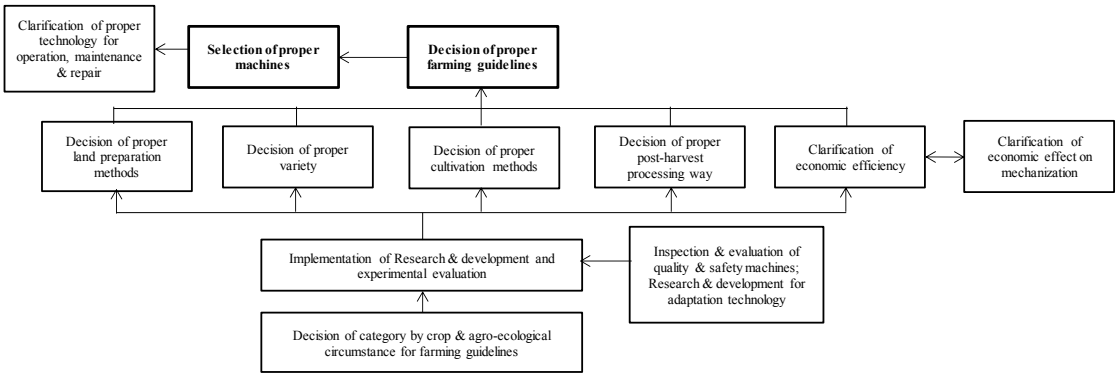


Figure 7-1 Components and Relation for Development of Farming Guidelines

Research and development activities for agricultural mechanization have not yet begun in Myanmar. An establishment of a new system for this research and development is necessary. It should be considered to collaborate activities with the Central Agricultural Research Institute (CARI). CARI has conducted research and development activities mainly in the fields of seed breeding and agronomy. Also, it is necessary to collaborate with the Department of Agriculture in charge of agricultural extension activities, which bases its results on CARI's activities, and the activities of the Yezin Agricultural University engineering department.

Essential requirements for farming guidelines development are as follows:

(1) Market needs are clarified.

As described in 8.3, if the market needs are clear, requirements of a product, including crop variety can be clarified, and economic efficiency, including cost analysis of machine use can be assessed. Therefore, a baseline survey is necessary when market needs and distribution conditions information is not available.

(2) Inspection and evaluation surveys of machines sold on the market

Since various types of machines are already used, evaluation surveys and centralized hearing surveys to users are implemented, together with practical and experimental tests for machines. The results can be used for consideration in the farming guidelines.

(3) Relation to various farming patterns

Selection and utilization methods of agricultural machines are studied and considered in various cases, such as the types of crops introduced, cropping times per year, and farmland conditions of lowland or upland, according to farming conditions in each categorized area.

(4) Use of draught cattles and manpower

It may not be economical to use machines due to the agro-ecological circumstances and farming size (relatively small). Appropriate mechanization methods must be developed, including the method of farmers not using machines through economic

evaluation, especially in areas where farmers use more animals for farming.

Manpower concentration is still popular for seeding, transplanting and harvesting in Myanmar. But there are many areas during the field survey where hiring labor has been more difficult and a unit price of labor has increased every year. Increases in public works and private enterprises are expected, according to recent economic trends. Agricultural labor will decrease even in regional areas and the need for machines will focus more on manpower savings in the future.

7.2.2 Possibility of machine use by farming size

Considering the possibility of machines purchased by farmers, bigger (relatively richer) farmers can own more machines compared to smaller farmers, due to fund capacity. In fact, small farmers and landless farmers who own machines and provide mechanization services to other farmers are barely present in the field survey. An increase in the number of mechanization service providers, even farmers or non-farmers, ensures an increase in farmers accessing machine opportunities. For example, an owner of a computer training school in downtown Magway purchased a mobile power thresher and provides threshing services to farmers in the surrounding area.

It is said that the people's collective activities mindset in the economic field is low due to their past experience. But in the case of purchasing a machine, a big initial investment, collective purchasing and use of machines among farmers seems to be a practical and economical option for the promotion of mechanization, if farmers' economic mindset will further develop in the future.

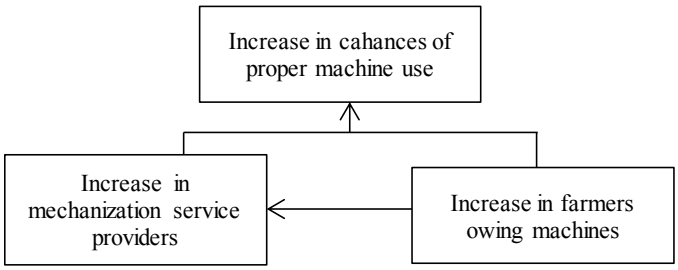


Figure 7-2 Increase in Opportunity for Using Machines by Farmers

7.3 Approach for the Value Chain

The general structure of the value chain for the rice industry, the major industry in Myanmar, together with concerned stakeholders and machines, are illustrated in Table 8-2.

Table 7-2 General Structure of the Rice Value Chain, Stakeholders, and Machines

Distribution Flow →

Value Chain	Production			Milling	Distribution
	Land preparation	Farm management	Harvesting Post-harvesting		
Machines	Tractor Power tiller (Animal) +Attachment	Tractor Power tiller (Animal) +Attachment Trans planter Seeder Weeder Sprayer	Combine harvester Reaper thresher Winnower	Rice mill	Warehouse Vehicles
Stakeholders	**Producers (Farmers)**			**Rice miller**	**Trader**

The value chain for the rice industry is reflected in distribution flow, with producers to consumers at one end of the arrow on Table 8.2, along with multiple stakeholders. The ideal development situation for the industry is to determine consumers' preferences and the maximum product value (milled rice) on the market, and to allocate proper profit to all stakeholders. Therefore, in the above situation ideal mechanization conditions should reflect that all stakeholders purchase and use appropriate machines.

As explained in the section "Farming Guideline" (7.2.1), selection and introduction of machines, even in the production stage, the most upstream position of the value chain, must be based on market needs. On the other hand, when such effort and contribution in the production stage is disregarded in the distribution or processing stage, the downstream of the value chain, producers' motivations to meet market needs may be reduced. Therefore, synchronized development must be promoted among all stakeholders in the value chain.

7.3.1 Expected effects for mechanization

Machines introduced in each stage of the value chain must be the most effective machines for producing or processing the product, meeting the needs of the market, within the conditions of each stakeholder, such as business contents and capacity. In this regard, expected effects through the use of proper machines in the rice industry are indicated in the following Table.

Table 7-3 Expected Effects of Mechanization on the Rice Industry

Stage	Expected effects
Land preparation	Sawing/transplanting on time, expansion of farm area
Farm management	Uniform growing, increases in yield, reduction in damaged rice by disease and insects, uniform ripening
Harvesting Post-harvesting	Harvesting on time, loss reduction, reduction in foreign materials contamination
Milling	Rejection of foreign materials including stones, increase in recovery, separation of broken rice
Distribution	Loss reduction during storage and transportation

7.3.2 Priority order for promotion of agricultural mechanization

There are many expected effects of agricultural mechanization. However, there are various obstacles to creating a proper industry system that ensures the effects of mechanization. To avoid these obstacles, the priority is to arrange proper order of measures. When resources used for measures are limited, measures are divided and executed by priority order.

For example, the production stage is classified by three stages, namely land preparation, farm management and harvesting, including post-harvesting, and some effects can be considered and expected for prioritizing each stage individually, but others can not be considered separately. They must be considered together to be implemented at the same time.

(i) The contents of counter measures to reject such obstacles must be considered in order to ensure profit increases for stakeholders in charge, based on investments without regard to size, and to adjust implementation order among measures on the time schedule. Additionally, (ii) the expected effect that cannot be achieved only by mechanization measures must be considered for the implementation approach collaborated with other necessary measures. (For example, to produce a uniform shape of rice, introduction of qualified seed is needed together with machines) and (iii) to ensure proper return of investment, if measures in the production stage cannot be achieved, the collaboration approach, together with other measures in the processing and distribution stage, must be considered.

As mentioned above, agricultural development focusing on mechanization is necessary to improve and develop all stages of the value chain simultaneously according to market needs. Therefore, mechanization is ideally promoted by maintaining conditions more capable of meeting market needs in downstream stages than in upstream stages.

In this regard, there is movement in Myanmar. Private enterprises,*major companies such as exporters and rice millers associations, in the downstream of the rice industry value chain aim to produce qualified and uniform milled rice through supporting rice farmers by providing farming loans, qualified seeds, and technical support for improvement of farming and mechanization services. Judging from the above theory, it is an appropriate improvement approach for the rice industry.

These enterprises operate under instructions of the government. It seems that their activities cannot effectively collaborate with government agencies, such as DOA and AMD, at the field level yet. Such collaboration must be established so that their activities will be the PPP (Public and Private Partnership) business model for modernization of agriculture in Myanmar.

*In the major rice production area of the Ayeyarwady Delta, private enterprises called “Rice Specialized

Company," major private companies, local private companies, exporters, rice millers associations, etc. joined the already established 45 companies. They contract with rice farmers and provide various inputs such as seeds, fertilizer, mechanization services and farming loans, and purchase paddy at the market price after cost deductions for inputs are provided to farmers in advance.

7.4 Official Approach for Promotion of Agricultural Mechanization

Based on the contents considered previously, an official approach for solutions to the subjects of agricultural mechanization is considered.

The main actor of agricultural mechanization is the private sector. In many developing countries, official services related to agricultural mechanization have been privatized, and public organizations and staff have disappeared or been reduced. Since the AMD organization and staff still remain in Myanmar, the fields that must be improved and strengthened for official approaches for promotion of agricultural mechanization are: (i) research and development, (ii) land consolidation and reform, (iii) training and extension of technology, and (iv) financial support.

7.4.1 Research and development

There is no organization in charge of research and development for agricultural mechanization in Myanmar. Therefore, the majority in the agricultural sector are researchers such as breeders, agronomists and soil scientists concerning crop cultivation, and agricultural engineering researchers are limited (few in number at Yezin Agricultural University).

(1) Dissemination of technical information

The ideal situation for expansion of agricultural mechanization is that a proper machine is sold in a manner where sufficient technical information is exchanged between a machine seller and buyer. Nevertheless, in Myanmar, (i) farming guidelines for farmers including utilization of machines, have not been developed and there are no subjects concerning mechanization in agricultural extension programs, and (ii) agricultural machinery dealers have not accumulated sufficient technical information for selection and use of machines suitable for farming conditions in each area.

Recently, many imported machines, mainly Chinese, as well as local machines are supplied in the market, but (i) actual capacity and use guidelines for these machines are technically unclear, and (ii) cheap machines often break down, and high quality machines, including Japanese brands have weak after sales services, including spare parts supplies.

During the transition in the market, officially concerned organizations have the responsibility to supply technical information to stakeholders.

Table 7-4 Technical Information Supplied by Research and Development Sector

Target	Contents	Necessary R&D activity
Producer (Farmers) Mechanization service providers	Guidelines for machine selection and utilization	Experimental research for machines based on cultivation system guidelines in each area.
Machine users Dealers, Manufacturers	Inspection results of machines capacity and safety sold on the market. (Issue guidance for improvement if necessary) Inspection results of quality on parts, mainly consumables, sold in the market. (Issue guidance for market rejection, if necessary) Technical requirements for proper machines.	Inspection of machines' capacity and safety sold on the market. Quality inspection of parts, mainly consumables, sold on the market.
Local manufacturers	Technical information adaptation to ordinary machines and design of attachments suited for local farming conditions.	Evaluation and experimental research for machines. Development of adaptation technology suitable for each area. Development of machines and attachments for localization.
Implementation agencies which plan to sell or provide machineries	Provide opinions and guidelines for purchasing machines, and other technical advice and recommendations.	Evaluation and experimental research for machines.

(2) Promotion of machine localization

In view of the national economy, it is important that local machinery manufacturing will be promoted as much as possible in the field of agricultural mechanization. Localization of machinery shortens the distance between manufacturers and users compared to foreign manufacturers. Localization must be promoted as an advantage to develop machines suited to local farming conditions and better after sales services.

Additionally, for tools and equipment, including attachments for draught cattles used by farmers, efficient and less labor load equipment must be developed by local manufacturers. Thus, official organizations concerned must promote the development of local manufacturers' activities by providing technical information to allow for the development of such equipment.

7.4.2 Land consolidation and reform

A fundamental constraint for agricultural mechanization in Myanmar is the limitation of reformed farmlands with farm roads that machines can access. AMD plans to expand the "Model Agricultural Mechanization Farm" all over the country. The plan has not been expanded yet and even economic effects after mechanization have not been analyzed yet.

It is necessary that economic evaluation activity be adapted to the existing plan, and additionally, the experimental research activity for using machines be included with the plan, if possible. As a result, the model farm can demonstrate mechanized technology and economic

efficiency for participating farmers in the program. Visiting farmers have a reason to follow the same method and the plan's ripple effect can be expected to impact the surrounding area.

7.4.3 Technology training and extension

Proper mechanization requires that machine users have the appropriate manners for the series of operation activities, daily maintenance and repair after purchasing machines. To do so, the technical information should be developed, accumulated and suitably disseminated, and dealers, users and persons considering a machine purchase can access such information in a timely and easy fashion. Almost all users, mainly farmers, and repair engineers, are dealing with machines by using their own experiential knowledge and the way most others do. To improve this, training support is necessary and more effective than the dissemination of information. Expected trainees and training contents are compiled in Table 8-5.

Since there are many experienced engineers in the central training centers, 99 tractor stations and 10 workshops in AMD, it is possible to establish a training system where selected engineers will be instructors after training. After establishment of such a training system, training to processors and distributors can be performed through organizing trainers' teams and by hiring instructors from other organizations, such as MAPT[1] or other manufacturers and dealers from the private sector.

Table 7-5 Contents of Training Program

Trainee	Contents	Remarks
Producer (Farmers)	Selection and utilization of machines based on farming guidelines. Economic analysis methods for machine use.	Contents for mechanization are introduced to agricultural extinction programs. (Mechanization after harvesting is especially important as it is closely related to quality needs in the market). Training of basic farm economy is needed to clarify the merit of using machines.
Farmers use machines Mechanization service providers	Operation, maintenance, and repair technology. Business management.	Actual technical level by experienced knowledge is improved and strengthened.
Processor Distributor	Improve systems of machinery and facilities and operation technology to meet market needs.	Necessary fields for adaptation to market needs, together with post-harvest processing done by farmers. Mechanization technology to be improved is subject to training.

7.4.4 Financial support

In agricultural economic activities in the private sector from producer to processor and distributor, the spontaneous self-reliance developed in the private sector is ideal. There are many entrepreneurs who consider market conditions for the development of their business.

[1] MAPT still has rice mill engineers but may not be expected to provide engineers in the field of post-harvest processing.

One of the biggest constraints to effective business development is the unavailability of loan programs with conditions suitable to the need for a refund period, adequate interest rate, assurance, etc.

Loan and subsidy programs are one of the most effective approaches to achieve agricultural mechanization. These programs can generate the most dynamic impact on development of agricultural mechanization under proper conditions. They can lead to fair development in conformity with the free market economy, avoiding risks created by official agencies' intervention to sales of machinery.

But to maximize the economic effects along the value chain, sophisticated organizational capability to plan each loan program, allocate them to various fields along a time schedule, operate and manage the flow of funds, and adjust and improve programs after evaluation, must be established across financial sectors and other concerned sectors, beyond the agricultural sector.

Expected loan programs related to agricultural mechanization directly or indirectly are listed in the following Table.

Table 7-6 Loan Programs Related to Agricultural Mechanization

Recipients	Program Purpose	Contents and Effects
<Short Term>		
Producer (Farmers)	For farming	To farm along the guidelines. (Including use of mechanization services.)
	For sales	For storage of their products and sales of a higher price. (Economic effects by mechanization are increased.)
Mechanization service providers	For operation	To keep or increase (number) spare parts and consumables. (Operational rate of machine increases.)
Repair shops	For provision of services	To keep or increase (number) spare parts and consumables and improve the services. (Operation rate of machine increases.)
Spare parts shops	For provision of services	To increase (number) spare parts and consumables and improve the services. (Operation rate of machine increases.)
Distributor Exporter	For purchasing	To expand dealing amount. To increase stock quantity (for export).
＜Long Term＞		
Producers (Farmer) /Groups	For machine buying	To buy machines.
	For quality improvement For marketing	To buy dryers or processing machines such as rice mills. To construct warehouses. To buy inspection equipment.
Mechanical service providers	For machine buying	To buy machines.
	For facility improvement	To improve or construct workshops. To improve or construct garages. (Operation rate of machines increases and machine life expands.)

Repair shops	For improvement of equipment and facility	To replace or introduce repair machines and tools. To improve or construct workshops. (Improvement of services. Operation rate of machines increases and machine life expands.)
Spare parts shops	For facility improvement	To improve or construct warehouses. To improve or construct shops. (Operation rate of machines increase.)
Processors	For machinery for quality improvement of products	To improve or introduce machinery and equipment for quality improvement of products. To introduce inspection equipment. (Economic effects by mechanization are increased.)
Processors /Groups	For modernization of facilities	To modernize or expand the factory. To construct a factory. (Economic effects by mechanization are increased.)
Distributors /Groups	For modernization of facilities	To improve or construct warehouses. To improve and increase the number of vehicles. To introduce inspection equipment. (Economic effects by mechanization are increased.)

Although actual loan conditions are small scale of funds, short periods and high interest rates, a limited number of farmers can utilize these loans and are owed for the spread of machines. On the other hand, Myanmar Agricultural Development Bank (MADB) in MOAI has many years of experience in lending money, even small units with short periods, to farmers. Their networks all over the country and business know-how, from lending money, to collections of refund money, can create the reliable infrastructure for the development of a new loan program. If enough funds and proper loan conditions, such as loan periods and interest rates suitable for farmers who purchase machines can be developed, agricultural mechanization will progress and expand effectively.

7.4.5 Public agricultural machinery manufacturing factories

At present, AMD and the Ministry of Industry produce agricultural machinery. At three AMD factories, and two Ministry of Industry factories, machines of the same or similar specifications are produced. For example, 7,200 total units of 22hp power tillers are produced at five factories annually. It seems that manufacturing efficiency can improve greatly and earning rates can increase if production is consolidated in one or two factories. Power tillers and threshers production should also be consolidated in the same fashion. The No. 1 factory and the No. 3 factory of AMD are a short distance from another; about 30 minutes by car. Since the machines currently produced are similar at both factories, it may be an improvement measure that the No. 1 out-of-date factory will close. The employees who work at the No. 1 Factory will be transferred to the No. 3 Factory.

Three AMD factories have explored privatization methods, aspects of technical cooperation with private enterprises, or prolonged leases of private enterprises. The No. 3 factory was established about ten years ago and the production facility is comparatively new. The plan for

a 30 year lease to a private company is almost finalized.

Both the AMD No. 2 factory and the Ministry of Industry 18th factory are near one other in Inngone, about 50 km south of Mandalay. The 18th factory was under AMD by the middle of 2011.

Thus, the future condition of these public factories cannot be clearly predicted. Both AMD and the Ministry of Industry appear to follow the path to privatization. However until paths become more clear, the subjects of these factories cannot be considered for support programs.

7.4.6 Administration system for agricultural mechanization

Expected approaches and programs for administrative organization for agricultural mechanization have been considered above. In order to strongly promote farm mechanization, an organization and system which can perform and manage all necessary measures across departments in the Ministry are required. AMD is suitable in the present Myanmar situation.
The government of Myanmar is undergoing reorganization to promote a free market economy and to establish a new system from the central government to communities, through regional governments (parallel to the old administration system). However, this new system will take time to function properly in the field. The central government distributed agricultural machines donated by the Indian government to local governments and asked the local governments to determine utilization methods. Since the local government did not have any machine use know-how, it was believed it would consult with AMD and DOA local staff. But the machines' distribution method and recipients did not yet decide, in the Ayeyarwady Division. In contrast, the government of south Shan State decided to allocate and entrust the machines' to an AMD tractor station. Thus, AMD had to provide different measures for the same program depending on the state or division.

Under these fluid conditions, the functions and activities that AMD will bear, regarding approaches and programs for mechanization, are itemized as follows:

(1) Research and development and training field

(a) Organization of agencies and researchers

Effective research and development systems must be established to ensure the effective capacity of activities. AMD has a plan for establishing research and development centers. DOA is necessary for this plan to organize necessary researchers at Yezin Agricultural University, CARI and other organizations.

(b) Collaboration for organization in other sectors

In the fields concerning agricultural mechanization, there are local manufacturers of machinery, and processors such as rice millers and distributors from the value chain of

agricultural products. To disseminate technical information related to these fields, the research and development agencies and specialists in other sectors, such as industry and commerce, outside the agricultural sector, will be considered when seeking to collaborate activities.

(2) Total management of agricultural mechanization

As mentioned before, the area of consideration for agricultural mechanization covers three dimensional structures, consisting of the horizontal aspect of land and the vertical depth of the value chain. Therefore, the function of AMD planning and management, from a macroscopic perspective, is necessary for effective utilization of limited resources.

Thus, the department of planning has to be strengthened as the whole in regards to both organization and staff for all aspects of planning and management programs that concern the promotion of agricultural mechanization in Myanmar.

7.5 Entire Relationship of Factors for Proper Agricultural Mechanization

The entire condition of agricultural mechanization in Myanmar, based on all factors considered in previous sections, is illustrated here (Figure 7-3). It includes progress factors and other conditions.

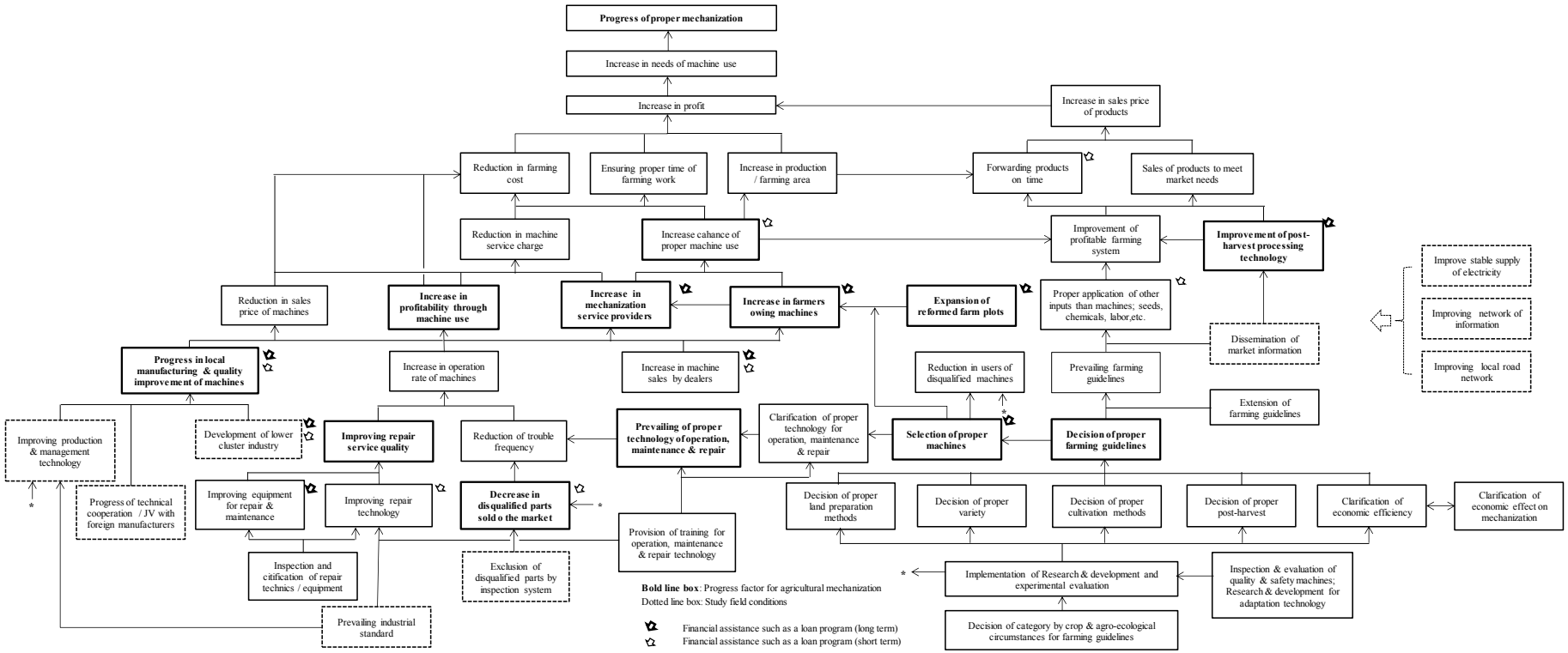


Figure 7-3 Relationship Chart of Progress Factors and Conditions

Chapter 8

Fields and Directions for Japanese Support Programs

Chapter 8 Fields and Directions for Japanese Support Programs

Following the results for Japan's support to agricultural mechanization in Chapter 7, the possible fields and directions for support programs are compiled in Table 8-1. The following are supplemental explanations according to the fields in Table 8-1.

8.1 Strengthen a Promotion System for Agricultural Mechanization

The direction for strengthening AMD's promotion system for agricultural mechanization includes training staff and formulating an agricultural mechanization plan.

(1) AMD must evolve through a greater emphasis on staff training to allow it to be flexible, manage, and efficiently use resources, including organization systems, staff, materials, and machines.

(2) A support program for the formulation of a plan or strategy for agricultural mechanization is a top priority. A plan or strategy can clarify the necessary fields and activities as a whole for the promotion of agricultural mechanization.

8.2 Strengthen Research and Development Activity

Since research and development activities for agricultural mechanization have not existed in Myanmar, the necessary direction of support programs for the creation of appropriate development and research activities are:

(1) Establishment of research and development organizations,

(2) Fostering researchers,

(3) Formulation and starting prioritized research and development activities including inspection and evaluation activities of machines sold on the market.

Machine inspection and evaluation activities sold on the market are also a direction for strengthening the market monitoring function in line with the promotion of proper mechanization. In this regard, an experienced system and know-how has developed well in Japan. Therefore, a support program can provide this activity.

8.3 Strengthen Land Consolidation and Reform Activity

Expansion of farmland that machinery can access is the basic requirement for promotion of agricultural mechanization in Myanmar. The support to expand the "model mechanization farm" program promoted by AMD is a possible direction. The farm can be used as a place for experimental research and development activities.

8.4 Strengthen Technology Extension Activity

There are two directions for support programs in this field. One is extension of appropriate farming activity methods, including using machines as a "guideline" to farmers, while the other is proper technology use for machines such as operation, maintenance and repair.

8.5 Provision of Loans

Loan programs with proper conditions to spread the availability of machines can be effective to promote sound agricultural mechanization. Since MADB has many years of experience in the management of loans to farmers, and a network all over the country, provision of funds and supports that develop proper loan conditions to MADB are justifiable.

8.6 Comprehensive Programs

To introduce and include the component for agricultural mechanization to various development programs and projects is an effective support direction for promotion of agricultural mechanization in Myanmar. For example, village or rural development models focusing on income demonstrate increases in mechanization.

Table 8-1 Possible Fields, Directions and Contents for Japanese Support Programs

Fields	**Agency in charge**	**Directions** (○: Key Directions)	**Priority***	**Short/ Long term****	**Contents and Remarks**
Strengthen promotion system	AMD	○Train staff for promotion of agricultural mechanization.	A	Long	**< Officer training>** To improve capabilities of planning, operation management and monitoring of staff、especially in the department of planning. Same function is attached to the following "Expected Support" with *.
			B	Long	< **Technical training**> To build the capacity of technical staff through providing various technical training opportunities concerning the agricultural mechanization field.
	AMD Others	○Show all prospect and promotion programs for development of agricultural mechanization.	A	Short	< **Support for formulation of agricultural mechanization plan/strategy.***> To assist in the consideration and formulation of agricultural mechanization plan/strategy together with related organizations and agencies focusing on AMD. To assist with producing agreements for collaboration activities among related organizations and agencies focusing on AMD. To improve capabilities regarding planning, operation management, and monitoring of AMD staff.
Strengthen research and development activities	AMD Others	○Research and development for proper utilization of machinery. Development of adaptation technology suited	A	Long	< **Support for establishment of research and development organizations and strengthening activities.***> To assist in the establishment of effective organization through collaboration among rated organizations such as YAU and DOA, focusing on AMD

		to local farming conditions. Inspection and evaluation of machines sold in the market.			To train researchers and staff on a series of activities, a selection of subjects, and implementation and evaluation. (Since experienced staff are limited it will take a long period)
			B	Long	< **Technical training**> To build the capacity of technical staff by providing various technical training opportunities concerning research and development of agricultural machinery.
			B	Short	**< Support for inspection and evaluation activity of agricultural machines>** To provide inspection equipment. To assist in teaching and training methods of inspection and evaluation. To assist with adaptation to international test codes and preparation of local standards. It will be activity in a section if the R&D organization is established. Since it takes time to acquire results from R&D activities, it can be implemented in advance of an R&D organization program; inspection and evaluation activities can start a short time after technology transfers and after various machines are already used in the field. Capacity and safety evaluation results for machines will be announced publicly and for disqualified machines under the standard, advice or recommendations will be given to import dealers to improve or exclude them from the market.
			B	Short	< **Support for introduction of a certification system for agricultural machines' quality and safety.**> To assist with machine quality and safety inspections through manufacturer, importer, and dealer requests To issue certification labels to qualified machines based on the above standard. If there is the rule that machines purchased for official projects or buyers using official loans require this certification, disqualified machines in the market will be gradually reduced.
Strengthen Land Consolidation and Reform Activity	AMD	○Expand farms accessible to machinery.	A	Short	< **Support for improvement and expansion of model mechanization farm program* by AMD**> To assist in showing the economic advantages to farmers after land consolidation and reform of plots by farmers' agreement, provide a series of mechanization services suited to local farming conditions and economic evaluation of

					mechanized farming. To assist with the dissemination evaluation results and promotion in other areas. (Appropriate loan programs are effective for the extension of the model program.) To assist with total management technology training programs to AMD staff, with cooperation from DOA on extending farming technology to farmers. To utilize the place for experimental R&D activities for establishing farming guidelines.
Strengthening Technology Extension Activity	AMD+ DOA	○Extension of methods of consideration including economic analysis for introduction of machines.	A	Long	<**Support for dissemination of agricultural mechanization extension programs.***> To assist in disseminating the "agricultural mechanization extension program" by compiling the results of R&D activities and achievements of model mechanization farm program to farmers. To assist in showing the experimental and practical material, including considering methods for introduction of machines and use, and utilization methods for economic use of machines.
		○Experimentation and extension of proper model mechanization systems.	B	Short	<**Support for demonstration of model mechanization farms. ***> To attach demonstration mechanized farms to ordinary DOA demonstration farms through the collaboration of DOA. To divide a farm to small, medium, or large plots by size. To assist in demonstrating effective machine, animal and labor use, by the size of each plot. The results of the above economic evaluation are shown publicly. To assist in demonstrating various post-harvest processing methods by showing comparative data of product quality and losses, if possible. To use the place for experimental R&D activities for establishing farming guidelines.
	AMD	○Improvement of operation, maintenance and repair technology for agricultural machines.	A	Short	< **Support for training of operation, maintenance, and repair technology to farmers.**> To assist in strengthening training of operation, maintenance and repair technology to farmers owning machines. To assist in the formulation of an expansion plan for the training program held in the central AMD training center, to improve training contents, and to increase the number of trainers. To strengthen training machines and equipment.
		○Improvement of maintenance and	A	Short	< **Support for training of maintenance, and repair technology to engineers of repair shops**>

		repair technology for agricultural machines.			To assist with training of maintenance and repair technology to engineers of repair shops, as developed from the above program. To assist in formulating methods for training, preparation programs, and to train instructors. To introduce training machines and equipment. To issue the certifications to trainees.
			B	Short	< **Support for formulation and implementation of repair technology authorization systems for repairing engineers.**> To provide the certification examination to repairing engineers and issue licenses to successful candidates. To assist in determining certification standards and the contents of examinations, to train examiners. To introduce equipment and materials for examinations. This program can be included with the above program.
			C	Short	< **Support for formulation and implementation of evaluation and certification systems for facilities of repair shops.**> To inspect and evaluate repair facilities including machines and tools, and provide the rank and certification. To assist in preparing checklist and to train inspectors. Inspectors go around randomly, visit to shops and provide advice for improvements after evaluations.
		Improve economic mindset for introduction of machines	B	Short	<**Support for strengthening economy management technology to farmers**> To assist with training of basic economic technology such as accounting and bookkeeping for farmers to evaluate economic effects of machines.
		Improve business management mindset concerning machinery use	B	Short	< **Support for strengthening farm economic management technology to processors.**> To assist with training and teaching basic business management technology, such as accounting and bookkeeping To assist with training in cost/benefit analysis for using machines
	PTAC/ AMD	Extension of improvement technology for rice millers and distributors.	C	Short	< **Support for formulation and implementation of market oriented model extension programs.**> To assist with demonstrating the business model of post-harvest processing, storage and rice milling, including marketing, if possible. To assist with promotion of a self-certification system for the quality of products。

Loan provision	MADB	○Provision of proper loan program for purchasing machines.	A	Short	< **Support for development of a loan program suited to machine purchasing**> To provide a fund. To assist with developing a loan program with proper conditions suited for farmers who purchase machines. The program is implemented by MADB using their network and management know-how.
Comprehensive program	AMD / Cooperatives /NGOs /other	Extension of collective use of machines as a component of village/rural development programs.	B	Short	< **Support for planning and implementation of "village/rural development programs through mechanization"**> To assist with constructing village roads, farm roads, land consolidation and reform, in a village or a community. To assist with promoting income increases through collective mechanized farming. If possible, mechanization service to other farmers can be included. To provide agricultural inputs including machines, to construct repair shops and offices, etc. To assist with training of mechanized farming, business management, operation, maintenance and machine repair technology, etc. To assist with collecting machine use charges from farmers for machine replacement and purchasing in the future. Such accumulated funds can be lent out as a short term micro-credit to members.

*Order of importance and priority from A (highest) to C (lowest) **Period of support program

8.7 Grant Assistance for Underprivileged Farmers (2KR)

Examining experiences in other countries provided with "Grant Assistance for Underprivileged Farmers" (called 2KR), provide points that apply and should be considered in Myanmar. They are described below.

(1) Implementation organizations

AMD is nominated. But AMD does not have enough experience to receive donor support programs. The person in charge of the Japanese contingent must properly explain the 2KR scheme and ensure it is understood by AMD staff. In addition, continued training and teachings are required in a timely fashion while monitoring progress at all stages

(2) Distribution conditions

AMD has 99 tractor stations (TSs). Their tractors have become too old and new replacements have not occurred. AMD may hope to distribute machines or give a priority to these TSs. But AMD was planning a TS reorganization that considered the environmental needs of each 99 TSs, including their future roles. The reorganization plan should be examined for the distribution of machines to TSs.

AMD is not capable enough in the area of machine sales and monitoring after sales. Therefore, it is one of the ways that 2KR machines will be supplied to the ongoing projects, by limiting the burden of expenditures for added activities.
Since private importers and dealers of agricultural machines have grown recently in Myanmar, it is necessary to consider methods for purchasing and distributing machines in order to avoid overlap and business impediments.

Involving the private sector in implementation will be considered through entrusting it with sales by bid, sales to users after sales to companies, and sales for spare parts supplies.
To introduce new machines in Myanmar, the system that ensures a sustainable spare parts supply should be established. In the case of 2KR, manufacturers may change, even for the same kind of machine, in each supplied year. This is anticipated for new machines in Myanmar.
Expected recipients, use conditions, and subjects for machines provided by 2KR are summarized in the following Table.

Table 8-2 Distribution Conditions and Subjects of Machines by 2KR

Recipients	Distribution	Utilization	Subjects
Farmers owning no machine	Sales via AMD tractor station	Use by oneself and provision of mechanization services to others	When sales price is adjusted to the market price, can farmers arrange purchase money and do they owe operation and maintenance costs? (If they can, they bought it from the market.) Who supplies spare parts?
	Sales via private company	same	Do they sell to the target candidates properly?
Cooperatives	Sales to cooperatives	Collective use	Do they prepare money for purchasing? Do they manage collective use properly? Who supplies spare parts?
AMD tractor station	Sales to AMD (MOAI)	Provision of mechanization service to farmers	Do they owe operation and maintenance cost? Reorganization plan shall be confirmed as mentioned above.

(3) Subject for continuous supply

Observing the condition of countries supplied with 2KR machines for many years, even if not every year, it is difficult to assess and evaluate the effects of these machines supplied in the past or to justify the contents of the new project. This is an issue for countries without practical development indices as a national agricultural mechanization plan or strategy.
If 2KR is expected to be continuously applicable to Myanmar, it is desirable that technical cooperation be required to formulate an agricultural mechanization plan or strategy.

8.8 Fields and Directions for Japanese Support Programs

Based on the contents of Table 8-1, Japan's development assistance scheme for all agricultural

fields is considered and possible support programs are indicated in it. This chart is shown in Figure 8-1. Additionally, this covered area in the relation chart regarding progressing factors and conditions (Figure 8-3) is illustrated by red line in Figure 8-2.

Agri. Development and Mechanization Plan

Project Assistance
Infrastructure Development Program
Land consolidation and reform program
Irrigation and drainage development program
Farm road development program
Mechanization model program
Model mechanization farm program
Mechanization model demonstration program
Group mechanization activity program
Agricultural market development program
Market development program
Market information system development program

Technical Cooperation (Team / Program)	
Fields Irrigation Mechanization Engineering Agronomy Economy Organization Marketing	・Planning of irrigation and drainage system suited to mechanization ・Planning of farmland consolidation and reform ・Planning of amount and application methods of inputs such as seeds, fertilizer, chemicals by each crop and categorized area ・Planning of model mechanized farming ・Planning or production to meet market needs ・Preparation of farming guideline by cropping pattern and categorized area ・Planning of organizing farmers and collective use of machines etc.

Technical Cooperation (Individual)	
Mechanization adviser	・Assist to preparation mechanization plan ・Advice to technical cooperation

Technical Cooperation (Individual)	
Policy / strategy adviser	・Assist to preparation agrcultural development plan ・Advice for technical cooperation

Technical cooperation (Experts / Trainings)	
Mechanization policy	Planning, management and evaluation of policy Operation, management and evaluation of programs
Farm business management	Farm economy (profit increase)
Irrigation facility management	Operation and management of irrigation facilities
R & D of mechanization	Development of machine utilization suited to the local condition
	Development of implements suited to the local condition
	Test and evaluation of machines sold on the market
Extension	Extension of Farming technology including mechanization
Organization	Collective use of machines
O&M of machines	Operation, management and repair of machines
Market information	Development of market information systems
Agricultural standard	Formation and extension of agricultural standards
Industrial standard	Formation and extension of industrialstandard

Financial Support (ODA loan)	
Farmers	For farming (short term) and machines purchasing (long term)
Service provider	For machines purchasing (long term)
processor	For operation (short term) and renovation of processing facilities (long term)
Distributer	For operation (short term) and renovation of storage facilities (long term)
Repair shop	For operation (short term) and renovation of repair facilities (long term)

Super Goal
・Production increase ・Export promotion ・Income increase by improvement of efficiency in production and management

Bold letters: Items compiled in Table 8-1

Figure 8-1 Possible Programs for Japan's Development Assistance Scheme in the Agricultural Sector

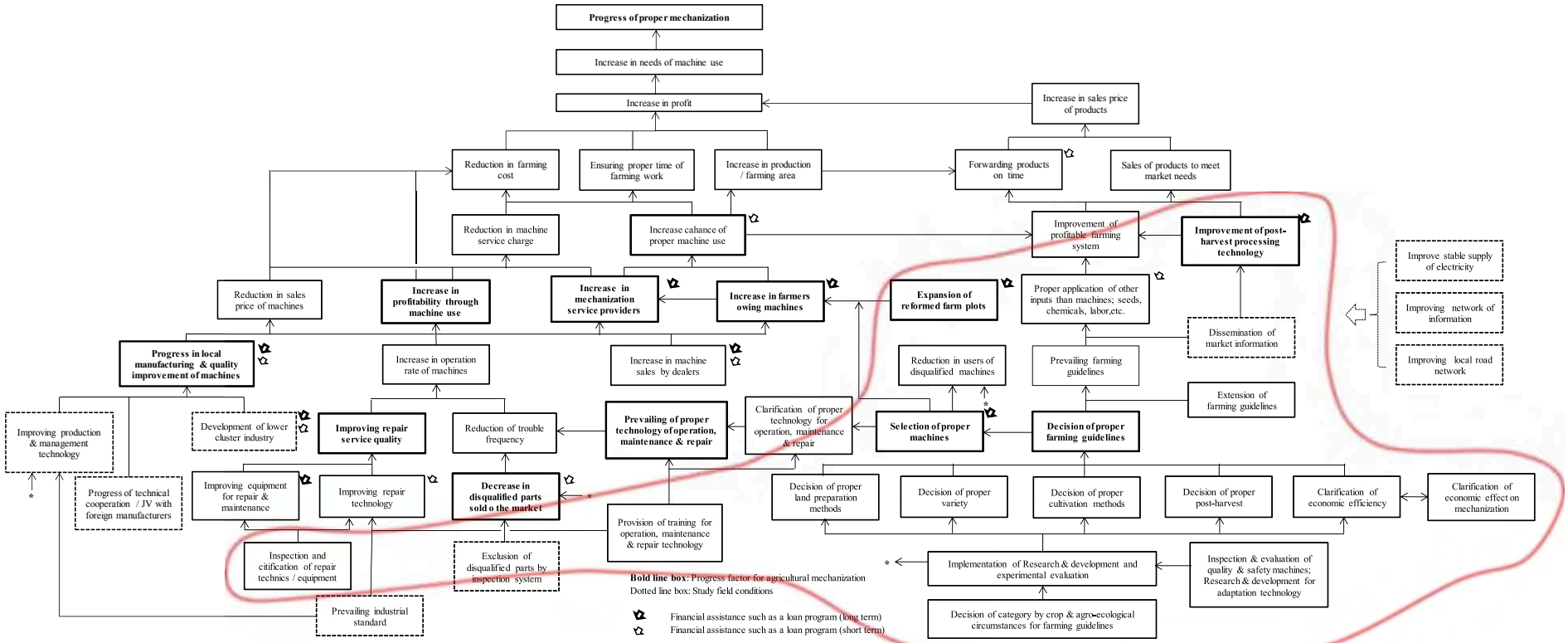


Figure 8-2 Possible Support Fields in Chart of Progress Factors and Conditions

Comment

Japan has provided support to many development assistant projects in various broad fields in Myanmar, beginning with the reparation projects of the 1960s. Japan has provided support to various fields, including plant genetic resources preservation, irrigation, and extension and post-harvest processing in the agricultural sector. Even though the capacity of Japanese assistant projects has decreased since 1988, it has continued up to the present. With the major changes promoted last year by the new Myanmar government, for a more open economy, the Japanese government decided to support the government of Myanmar, to maintain the movement's momentum, and to strengthen and expand official development assistance to Myanmar.

Under these circumstances, the study was carried out to determine possible fields and directions for Japanese assistance in the area of agricultural mechanization. Agricultural machinery is one of the inputs for agricultural production and the study needed to survey the general present conditions of the entire agricultural sector. During the survey, we met many officers engaged in various projects and who visited Japan for training programs provided with the assistance of Japan. In the course of the survey, we also visited facilities constructed by Japanese assistance projects. Japanese assistance during the past four or more decades has produced resources for facilities and people. These resources will be utilized efficiently to implement the Japanese assistance projects in the future.

In the Myanmar government organization, old habits of the previous military administration remain. Economic activities in the private sector are occurring, but the rules and system for a free market economy are still improving. However, it takes time for the necessary laws and regulations to be completed and adapted properly in the field.[1] Many subjects reflecting on this situation were found in the agricultural mechanization field. Since implementation of reparation projects, high quality and performing Japanese brand machinery have become known to almost everyone in Myanmar. However, cheap machines of low quality permeate the agricultural machinery market.

It is said that agricultural mechanization in Myanmar began when the Japanese mechanization system was introduced and established after the introduction of the Eastern European mechanization system using big machines failed. It is expected that various technical standards and systems in the fields of machinery, production, and utilization in Japan will be adopted and established in Myanmar.

The report demonstrates possible fields and directions for Japanese development assistance in

[1] Toshihiro KUDO: Speech at the seminar "Prospect of democratization and economy in Myanmar," April 12, 2012

the field of agricultural mechanization, based on the study conducted with a limited number of staff and within a short period of time. Additional studies and considerations will be required to formulate actual projects.

Appendix

Appendix－1　Schedule of JICA Mission
Appendix－2　List of Interviewees
Appendix－3　Location and the Number of Tractors of AMD Tractor Station
Appendix－4　Results of Agricultural Mechanization Service by Each Tractor Station
Appendix－5　Questionnaire and Study Results for Japanese Agricultural Machinery Manufactureres

Schedule of JICA Data Collection Mission on Agricultural Mechanization in Myanmar

Mission Members: (1)Mr. Mori, (2)Mr. Aoki, (3)Mr. Kudo, (4)Ms.Akiyama

Day	Date		Schedule	Stay
1	29 Apr	Sun	Arrival at Yangon (member #1 and #4)	Yangon
2	30 Apr	Mon	Arrival Meeting at JICA Myanmar Office Meeting with AMD No. 1 Factory, Yangon	Yangon
3	1 May	Tue	Field Survey(*) Thongwa	Yangon
4	2 May	Wed	Move Yangon to Nay Pyi Taw Visit - AMD, MOAI - Ministry of Industry - Ministry of Co-operatives	Nay Pyi Taw
5	3 May	Thu	Visit - AMD - MAPT, Ministry of Commerce -Agricultural University, MOAI	Nay Pyi Taw
6	4 May	Fri	Visit - Observation of model farms - DOA -Yezin Agricultural University, MOAI Move Nay Pyi Taw to Yangon	Yangon
7	5 May	Sat	Arrival at Yangon (member #2) Visit - Private importers and dealers	Yangon
8	6 May	Sun	Move Yangon to Pathein Field survey (*) Pathein	Pathein
9	7 May	Mon	Visit - AMD office, Pathein - AMD tractor station, big rice mill, medium rice mill, and agricultural cooperative Field survey (*) Pathein	Pathein
10	8 May	Tue	Move Pathein to Labutta Visit - AMD repair workshop Field survey (*) Myaungmya	Labutta
11	9 May	Wed	Visit - MOAI office, Labutta - Dealers of agricultural machinery Field survey (*) Labutta	Labutta
12	10 May	Thu	Arrival at Yangon (member #3) Move Labutta to Yangon	Yangon
13	11 May	Fri	Visit - AMD Factory - PTAC - Private importers, dealers, and rice millers association	Yangon
14	12 May	Sat	Visit - Private importers and dealers	Yangon
15	13 May	Sun	Move Yangon<6:30> to Nyaung U (Bagan)<7:50> Visit - AMD tractor station Field survey (*) Nyaung U	Bagan

16	14 May	Mon	Move Bagan to Magway Field survey (*) Magway	Magway
17	15 May	Tue	Visit - AMD office, Magway - MAS office, Magway Field survey (*) Pwint Phyu	Magway
18	16 May	Wed	Field survey (*) Minbu, Chauk Move Magway to Bagan	Bagan
19	17 May	Thu	Move Nyaung U<8:05> to Mandalay<8:35> Visit - AMD Factory, AMD Training Center - Private importers and dealers	Mandalay
20	18 May	Fri	Move Mandalay<8:50> to Heho<9:25> Move Heho to Taunggyi Visit - DOA office, Taunggyi Field survey (*) Taunggyi	Taunggyi
21	19 May	Sat	Field survey (*) Kalaw, Taunggyi	Taunggyi
22	20 May	Sun	Field survey (*) Nyaung Shwe	Taunggyi
23	21 May	Mon	Move Taunggyi<9:40> to Yangon<10:50> Meeting at JICA Myanmar Office Visit - Private model farm	Yangon
24	22 May	Tue	Move Yangon to Nay Pyi Taw (member #1) Visit - AMD office, MOAI	Nay Pyi Taw Yangon
25	23 May	Wed	Move Nay Pyi Taw to Yangon (member #1) Visit - AMD and DOA Document preparation	Yangon
26	24 May	Thu	Departure from Yangon(member #2) Visit - FAO Document preparation	Yangon
27	25 May	Fri	Report back to JICA Myanmar Office Report back to Embassy of Japan	Yangon
28	26 May	Sat	Departure from Yangon	
29	27 May	Sun	Arrival at Narita	

*Note: Field Survey (Hearing survey to stakeholders in the field of agricultural mechanization)

Expected stakeholders	
Farmers (owing machinery)	AMD tractor stations
Farmers (using mechanization service)	Cooperatives (collective use of machinery)
Farmers (using animals)	Repair shops
Private mechanization service providers	Processors such as rice mill and oil mill

List of Interviewees

JICA

Masahiko, Tanaka	JICA Myanmar Office	Chief Representative
Yasuyuki, Sato	JICA Myanmar Office	Representative
Minoru, Yoshida	JICA Myanmar Office	Project Formulation Advisor
U Tun Myint Thein	JICA Myanmar Office	Program Officer

Ministry of Agriculture and Irrigation (MOAI)

U Soe Hlaing	AMD	Director General
U Pale Maung	AMD	DY Director General
U Mya Thwe	AMD/Engineer Division	DY Director General
U Win Myaing	AMD/Planning Division	DY Director General
U Naing Win	AMD	DY Director
U Nyo Win	AMD/Administration Division	Director
U Ko Ko Mg	AMD/Factory & Research Division	Director
U Myint Zaw	AMD/Equipment and Store Division	Director
U Aye Naing	AMD/Finance Division	Director
U Yu Kyi	AMD/ Utilization Division	Director
U Aye Min	AMD/ Planning Division	Director
U Than Tyn Ag	AMD	Assistant Director
U Win Than	AMD	Staff Officer
U Thein Sin	AMD	Staff Officer
U Than Kyaing	DOA/Project Planning, M&E Division	Director
U Tin Win	DOA/Project Planning, M&E Division	DY Director
U Toe Win	DOA	DY Staff Officer
Dr. Tin Ohnmar Win	DOA/Agricultural Extension Division	Assistant Manager
U Sein Hla Myint	AMD Farm Machinery No.1	Factory Manager
U Naing Oo	AMD Farm Machinery No.1	DY Factory Manager
U Kyaw Tun Aye	AMD Farm Machinery No.3	Factory Manager
U Wun Maung	AMD Farm Machinery No.3	DY Factory Manager
U Win Mying Aleing	AMD (Pathein)	Chairman
U Aung Mint Tun	AMD (Pathein)	Regional Manager
U Mint Thein	AMD (Pathein)/ DOA	Regional Manager
U Tun Tun Kauing	MOAI(Labutta)/AMD	District Staff Officer

U Myint Htwe	MOAI(Labutta)/SLRD	DY Staff Officer
U Nyein Myint	MOAI(Labutta)/DOA	DY Staff Officer
U Tin Win	MOAI(Labutta)/DOA	DY Staff Officer
U Lu Myint	AMD (Magway)	DY Director
U Myint Soe	AMD (Magway)	Agricultural Mechanization Officer
U Aye Ko	AMD Training Center（Meiktila）	DY Director
Daw Myo Thida San	AMD TrainingCenter（Meiktila）	Training Section Staff Officer
U Aung Kytu Kywa	AMD(Shan State)	State Officer
U Aung Khin	DOA(Shan State)	State Officer
U Win Myint	AMD Tractor Station (Min Bu)	Head
U Myo Myint Do	AMD Tractor Station（No.9 Kyaung Gan）	Head
U Aung Kyin	AMD Tractor Station（No.29 Magway）	AMD District officer
U Lu Myint	AMD Tractor Station（No.30 Magway）	DY Director
U Aung Than Oo	AMD Tractor Station（No.51 Pathein）	DY Staff Officer
U Thein Win	AMD Tractor Station（No.52 Pathein）	DY Staff Officer
U Kyaw Thet Aung	AMD Tractor Station（No.53 Pathein）	DY Staff Officer
U Hla Htay	AMD Tractor Station（No.85 Shwenyaung）	Staff officer
U Myint Kyaw	AMD Tractor Station (No.99 Nyang Oo)	Head
U Kyau Soc Moc	AMD Medium workshop (No.8 Taunggyi)	Assistant Director
U Win Thein	AMD Medium workshop (No.3 Myaung Mya)	Staff Officer
Daw Aye Aye Mon	AMD Medium workshop (No.4 Myaung Mya)	Staff Officer
Dr.Tin Htut	Yezin Agricultural University	Rector
Prof. Dr. Myo Kywe	Yezin Agricultural University	Pro-Rector (academic)
Dr. Tin Wan	Yezin Agricultural University	M.V. Sc.

Ministry of Industry

U Zaw Tun	Heavy Industry (1)/Material Planning	Director
U Tin Tun Aung	Heavy Industry (1)/Production Planning	Director
Daw Than Than Sint	Heavy Industry (1)/Production Planning	Assistant Director
U Zew Khin	No.18 Heavy Industry (Kyause)	DY Factory Manager

Ministry of Commerce

U Kyaw Soe	MAPT	General Manager
U Myint Wai	MAPT	DY General Manager

U Nay San	MAPT	Assistant General Manager
Daw Thidar Win Htay	MAPT	Manager
U Soe Win	MAPT/PTAC	General Manager
Daw Phyu Phyu Win	MAPT/PTAC	Head of Department
Daw Myint Kyi	MAPT/PTAC	Manager
U Tae Oo	MAPT/PTAC	Assistant Manager
U Zaw Win	MAPT/PTAC	Engineer

Ministry of Co-operatives

U Aung Phyu		Director General
U Myint Thein		Director
U Tun Kyi		DY Director
U Ko Ko		DY Director
Daw Marlar Aung		Assistant Director
Daw Khin Ma Lay		Assistant Director
Daw Nyein Aye	Small Scale Industry	Chief Engineer
Daw May Phyu Win		Staff Officer
Daw May Thu Win		Staff Officer
Daw Nilar Soe		Staff Officer

Dr. Aung Swe	FAO	Assistant Representative

YangonRegion

U Sein Than	Farmer	
U Khin Shwe	Farmer	
U Nyi Nyi Kyaw	Agricultural Machinery Dealer（Good Brothers Co., Ltd）	DY General Manager
U Aung Naing Oo	Agricultural Machinery Dealer（Good Brothers Co., Ltd）	Purchasing Manager
Daw Thida	Agricultural Machinery Dealer（Good Brothers Co., Ltd）	Marketing Manager
Daw Ma Zin Mar	Agricultural Machinery Dealer（Soe Myint）	Marketing Manager
U Win Aye Pe	Myanmar Rice Miller's Association (RMA)	Managing Director
U Khin Soe	Myanmar Rice Miller's Association (RMA)	General Manager
U Thaung Win	Myanmar Rice Miller's Association (RMA)	Member
U Soe Myat	Private Model Farm (Contract Farming Project	Max Myanmar Group of Companies)

Ayeyarwady Region

U Kyaw Aung	Farmer	
U Soe Kyaw Thu	Farmer	
U Aung Kyaw	Farmer	
U Min Khaing	Farmer	
U Thwin Ko Ko Maung	Farmer	
U Si Ton	Farmer	
U Ko Than Oo	Farmer	
U Aung Kyaw	Farmer	
U Hla Wien	Agricultural Cooperative（Pathein）	
U Naing Aye	Agricultural Cooperative（Pathein）	
U Myint Awing	Agricultural Cooperative（Pathein）	
U Zaw Myo Awing	Agricultural Cooperative（Pathein）	
U Win Naing	Agricultural Cooperative（Pathein）	
U Soe Win	Agricultural Cooperative（Pathein）	
U Soe Itan	Agricultural Cooperative（Pathein）	
U Kan Saw	Agricultural Cooperative（Pathein）	
U Clit Saw	Agricultural Cooperative（Pathein）	
U Lu Kyaw	Rice Miller（No.612 Rice Mill/MAPT）	
U Nay Win Aung	Rice Miller(Than Ponnya Watty)	
U Win Myint	Rice Miller	
U Thukha Soe	Agricultural Machinery and Spare Parts Retailer	
U Aung Myo Min	Repair Shop（Myo Min）	
U Aling	Ayeyar Pathein Rice Pady Trading Limited	Vice-chairman
U Soe Win	Ayeyar Pathein Rice Pady Trading Limited	Secretary
U Nay Win Aung	Ayeyar Pathein Rice Pady Trading Limited	member
U Memg Win	Ayeyar Pathein Rice Pady Trading Limited	member
U Kyaw Htay	Ayeyar Pathein Rice Pady Trading Limited	member

MandaleyRegion

U Chif Haing	Farmer	
U Khin Mg Win	Farmer	
U Han Taung	Repair Shop	
U My Aye	Agricultural Machinery Dealer（Good Brothers Co., Ltd）	Director

U Kyaw Tint	Agricultural Machinery Dealer（Good Brothers Co., Ltd）	Manager
U Myo Soung	Agricultural Machinery Dealer（Good Brothers Co., Ltd）	Sales Manager
U Soe Moe	Agricultural Machinery Dealer（Good Brothers Co., Ltd）	Sales Manager
U Sai Kyaw Hla	Agricultural Machinery Dealer（Shwe Tun Co., Ltd）	Director

MagwayRegion

U Naing Tun	Farmer
U Hla Aung	Farmer
U Aung San	Farmer
U Hla Myint Soe	Farmer
U Tin Tun	Farmer
U My Tun	Farmer

U Htay Shein	Myanmar Golden Seeds. Co.Ltd.	Construction manager of Myanmar
Daw Margaret Thomo	Myanmar Golden Seeds. Co.Ltd.	Project Manager
U Win Naing Htay	Rice Miller	
U Myint Htay	Rice Miller	
U Aye Min	Rice Miller	
U Maung Maung Tin	Rice Miller	
U Tin Shein	Rice Miller	
U Kyaw Naing Oo	Rice/Oil Miller	
U Khin Moung Myint	Repair Shop	

U Aung Myint	Cooperative (Ponnya Wady Agriculture and General Business Cooperatives)
U Khin Mg Tun	Cooperative (Ponnya Wady Agriculture and General Business Cooperatives)
U Tin Mg Aye	Cooperative (Ponnya Wady Agriculture and General Business Cooperatives)
U Tan Hltay Ag	Cooperative (Ponnya Wady Agriculture and General Business Cooperatives)
U Min Zaw Htwe	Cooperative (Ponnya Wady Agriculture and General Business Cooperatives)
U Nyo Lay	Cooperative (Ponnya Wady Agriculture and General Business Cooperatives)
U Hlaing Soe Ng	Cooperative (Ponnya Wady Agriculture and General Business Cooperatives)
U Win Htein	Cooperative (Ponnya Wady Agriculture and General Business Cooperatives)
U Tin Htay	Cooperative (Ponnya Wady Agriculture and General Business Cooperatives)

Shan State

U Tun Wei	Farmer
U Than Phe	Farmer
U Tun Siwe	Farmer
U Tun Aung	Farmer
U Me	Farmer
U Thein Nyunt	Farmer
U Maung	Farmer
Daw Lwin Lwin Cho	Agricultural Machinery Dealer（Good Brothers Co., Ltd）
Daw Ma Ni Ni Aung	Agricultural Machinery Dealer(Myo Chit)
U Aung Thor	Rice Miller
U Shwe Ba	Sugar Miller
U Aung Zaw Oo	Repair Shop
U Ko Ni	Spare Parts Retailer
U Myint Swe	Engineer (Repair)

Appendix－3　Location and the Number of Tractors of AMD Tractor Station

No.	Region/State	Number of Station	Location	Number of Tractor (2011–12)
1	Kachin State	93	Hopin	13
		79	Myitkyina	24
		55	Mogaung	21
		90	Bamaw	21
		(sub)	Shweku	16
		(sub)	Putao	6
		(sub)	Taning	15
		(sub)	Waingmaw	8
		(sub)	Moenyin	10
	State Total			134
2	Kayah State	86	Loikaw	37
	State Total			37
3	Kayin State	20	Hpa-an	12
		(sub)	Kawtkarate	9
	State Total			21
4	Sagain Region	5	Sagain	15
		61	Wetlet	17
		3	Shwedo	22
		40	Kantbalu	15
		1	Katha	26
		42	Myinmu	16
		59	Myaung	13
		39	Chaung-Oo	11
		4	Monywa	11
		62	Budalin	14
		21	Ye-Oo	18
		2	Kalay	17
		41	Yinmabin	14
		22	Salingyi	17
		(sub)	Tamu	12
		(sub)	Kawlin	7
	Region Total			245
5	Tanintharyi Region	95	Myeik	7
		91	Dawel	10
		(sub)	Boatpyin	
	Region Total			17
6	Nay Pyi Taw Region	68	Tatkon	20
		84	Pyinmana	33
		47	Lewe	25
	Region Total			78
7	Bago Region(East)	31	Phayagyi	12
		24	Daik-Oo	28
		12	Naunglebin	18
		70	Kyauktaga	10
		87	Phyu	26
		11	Taunggoo	16
		48	Yedashay	25
		50	Waw	20
		73	Thanabin	20

		34	Ohnhne	18
		98	Oaktwin	18
		(sub)	Myohla	
	Region Total			211
8	Bago Region(West)	14	Tharyarwady	18
		76	Moenyo	14
		16	Oakpho	11
		32	Gyobingauk	16
		45	Nattalin	15
		30	Pyay	27
		58	Paukkhaung	19
		27	Minhla	15
		94	Thegone	26
	Region Total			161
9	Magway Region	29	Magway	12
		71	Taungdwingyi	31
		10	Aunglan	20
		8	Minbu	12
		46	Pwintphyu	16
		69	Sinbyugyun	12
		7	Pakokku	13
		(sub)	Gantgaw	4
		(sub)	Myothit	
	Region Total			120
10	Mandalay Region	63	Amayapuya	16
		80	Patheingyi	20
		43	Madaya	16
		74	Sintgaing	16
		81	Kyaukse	18
		23	Tada-Oo	12
		64	Myittha	61
		60	Wundwin	18
		25	Meiktila	20
		26	Thazi	16
		66	Mahlaing	19
		67	Pyawbwe	14
		28	Yamethin	20
		44	Nahtogyi	17
		6	Myingyan	20
		82	Kyaukbadaung	14
		99	Nyaung U	16
		(sub)	Ngazon	
	Region Total			333
11	Mon State	54	Mawlamyaine	18
		88	Thaton	15
		37	Beelin	18
		83	Kyaikhto	17
		(sub)	Chaungzon	
		(sub)	Yae	
	Region Total			68
12	Rakhine State	72	Sittwe	27
		89	Kyauktaw	26
		(sub)	Kyaukphyu	5
	Region Total			58

13	Yangon Region	35	Htaukkyant	16
		77	Taikkyi	17
		18	Thanlyin	31
		36	Kawhmu	9
		(sub)	Htandabin	5
			Mobile Station	30
	Region Total			128
14	Shan State(East)	92	Kengtung	18
		(sub)	Tachilate	12
		(sub)	Minesat	
		(sub)	Minepyat	
		(sub)	Mineyan	
	Region Total			30
15	Shan (South)State	85	Shawenyaung	41
		65	Aungban	20
		(sub)	Nontsan	10
	Region Total			71
16	Shan State (North)	96	Kyaukme	25
		56	Lashio	30
		(sub)	Kunlone	8
	Region Total			63
17	Ayeyarwady Region	51	Pathein	16
		9	Kyaunggone	15
		17	Yegyi	11
		15	Hinthada	17
		49	Zalon	11
		33	Danubyu	19
		13	Myanaung	15
		38	Myaungmya	13
		78	Wakema	18
		53	Mawlamyainggyun	14
		75	Kytelat	9
		19	Maubin	15
		57	Pantanaw	18
		52	Nyaungdon	17
		97	Laputta	5
		(sub)	Ainme	11
		(sub)	Laymyethnar	10
		(sub)	Ingapu	15
	Region Total			249
Union Total				2,024

Source: AMD, MOAI, 2nd May, 2012.

Note: “Division” was replaced by “Region” recently.

Appendix－4　Results of Agricultural Mechanization Service by Each Tractor Station (2011-12)

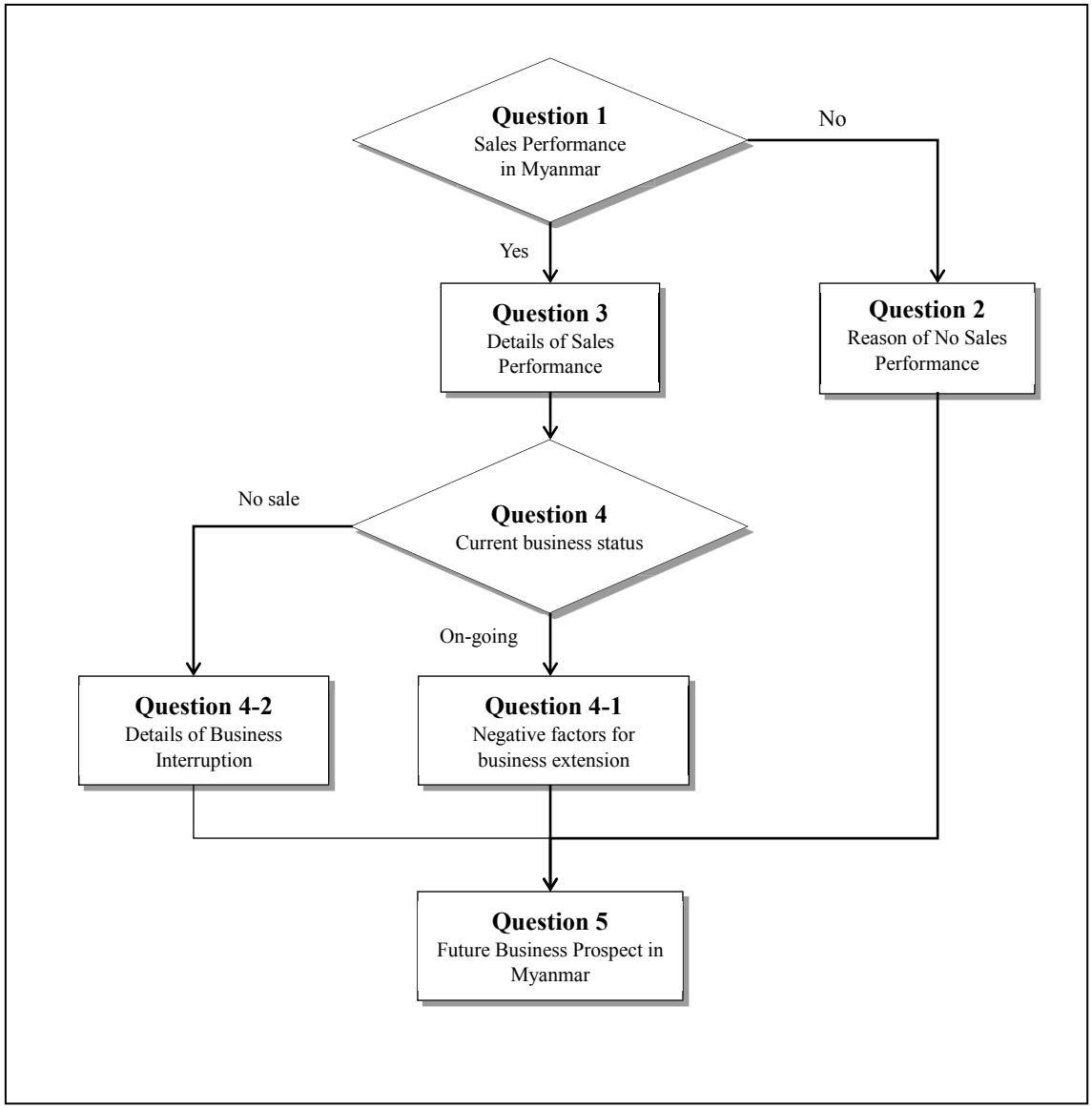
Sr No.	Tractor Station			Serviced Acres	Percentage of Service*	Sr No.	Tractor Station			Serviced Acres	Percentage of Service*
	No.	Location	Rank				No.	Location	Rank		
1	31	Phayagyi	A	2,600	123.81	61	26	Thazi	B	960	87.27
2	24	Dack-Oo	A	5,700	111.76	62	2	Kalay	B	2,430	86.79
3	29	Magwe	A	2,230	111.50	63	Sub	Kawtkarate	B	520	86.67
4	8	Minbu	A	2,230	111.50	64	39	Chaung-Oo	B	1,120	86.15
5	85	Shawenyaung	A	11,660	110.00	65	34	Ohnhne	B	1,720	86.00
6	46	Pwintphyu	A	4,240	108.72	66	89	Kyauktaw	B	3,000	83.33
7	18	Thanlyin	A	8,570	107.13	67	20	Hpa - an	B	2,320	82.86
8	87	Phyu	A	3,960	107.03	68	27	Minhla	B	1,800	81.82
9	47	Lewe	A	5,178	107.02	69	1	Katha	B	2,820	80.57
10	98	Oaktwin	A	2,751	105.81	70	Sub	Tamu	B	1,445	80.28
11	94	Thegone	A	5,040	105.00	71	3	Shwebo	B	3,604	80.09
12	77	Taikkyi	A	3,983	104.15	72	Sub	Ingapu	B	1,600	80.00
13	58	Paukkhaung	A	3,980	102.05	73	44	Nahtogyi	B	1,100	78.57
14	45	Nattalin	A	2,040	102.00	74	70	Kyauktaga	B	2,271	78.31
15	96	Kyaukme	A	6,120	102.00	75	56	Lashio	B	5,841	77.88
16	Sub	Ainme	A	2,040	102.00	76	75	Kytelat	B	1,400	77.78
17	78	Wakema	A	2,240	101.82	77	60	Wundwin	B	1,830	76.25
18	30	Pyay	A	5,901	101.74	78	63	Amayapuya	B	1,216	76.00
19	13	Myanaung	A	2,440	101.67	79	99	Nyaung Oo	B	1,060	75.71
20	51	Pathein	A	2,440	101.67	80	82	Kyaukbadaung	B	1,200	75.00
21	69	Sinbyugyun	A	2,220	100.91	81	97	Laputta	B	440	73.33
22	7	Pakokku	A	2,220	100.91	82	Sub	Tachilate	B	1,750	72.92
23	32	Gyobingauk	A	2,610	100.38	83	88	Thaton	B	1,820	72.80
24	86	Loikaw	A	8,020	100.25	84	23	Tada Oo	B	845	70.42
25	Mobile Station		A	14,810	100.07	85	74	Sintgaing	B	1,680	70.00
26	12	Naunglebin	A	2,600	100.00	86	Sub	Kunlone	B	1,040	69.33
27	50	Waw	A	2,000	100.00	87	41	Yinmabin	B	1,380	69.00
28	73	Thanabin	A	1,300	100.00	88	21	Ye Oo	B	2,130	68.71
29	14	Tharyarwady	A	2,100	100.00	89	28	Yamethin	B	2,060	68.67
30	16	Oakpho	A	1,800	100.00	90	64	Myittha	B	13,680	68.19
31	76	Moenyo	A	1,800	100.00	91	40	Kantbalu	B	1,486	67.55
32	Sub	Gantgaw	A	400	100.00	92	22	Salingyi	B	1,165	64.72
33	80	Patheingyi	A	1,800	100.00	93	17	Yegyi	B	1,280	64.00
34	37	Beelin	A	3,000	100.00	94	62	Budalin	B	1,185	62.37
35	83	Kyaikhto	A	2,700	100.00	95	59	Myaung	B	1,237	61.85
36	36	Kawhmu	A	1,200	100.00	96	72	Sittwe	B	1,820	60.67
37	35	Haukkyant	A	3,300	100.00	97	Sub	Shweku	B	600	60.00
38	Sub	Htandabin	A	600	100.00	98	43	Madaya	B	1,600	59.26
39	Sub	Nantsan	A	1,800	100.00	99	53	Mawlamyainggyun	B	1,050	58.33
40	19	Maubin	A	2,900	100.00	100	92	Kengtung	B	1,850	57.81
41	33	Danubyu	A	2,200	100.00	101	38	Myaungmya	B	1,080	54.00
42	57	Pantanaw	A	2,800	100.00	102	5	Sagaing	B	825	51.56
43	Sub	Laymyethnar	B	1,740	96.67	103	79	Myitkyina	B	2,000	51.28
44	54	Mawlamyaine	B	2,760	95.17	104	84	Pyinmana	C	2,483	49.66
45	9	Kyaunggone	B	2,080	94.55	105	Sub	Taning	C	620	47.69
46	49	Zalon	B	1,700	94.44	106	Sub	Moenyin	C	570	47.50
47	71	Taungdwingyi	B	5,000	94.34	107	93	Hopin	C	1,150	44.23
48	11	Taunggoo	B	3,018	94.31	108	42	Myinmu	C	615	43.93
49	15	Hintada	B	2,802	93.40	109	Sub	Putao	C	260	43.33
50	Sub	Kyaukphu	B	560	93.33	110	25	Mektila	C	760	42.22
51	4	Monywa	B	1,949	92.81	111	67	Pyawbwe	C	500	41.67
52	10	Aunglan	B	3,700	92.50	112	68	Tatkon	C	1,449	40.25
53	65	Aungban	B	4,000	90.91	113	66	Mahlaing	C	640	40.00
54	61	Wetlet	B	1,814	90.70	114	55	Mogaung	C	920	38.33
55	Sub	Kawlin	B	905	90.50	115	90	Bamaw	C	840	35.00
56	Sub	Waingmaw	B	900	90.00	116	Laser Levelling Unit		C	3,840	30.00
57	81	Kyaukse	B	1,440	90.00	117	95	Myeik	C	104	26.00
58	6	Myingyan	B	1,960	89.09	118	91	Dawei	C	202	25.25
59	52	Nyaungdon	B	3,360	88.42		**Total**			**290,605**	**84.11**
60	48	Yedashay	B	3,181	88.36						

Note : Contribution of Mobile Station and Laser Lebeling Unit are included.
* Coverage % to the planned target area.

Source : AMD

<Questionnaire for Japanese Agricultural Machinery Manufactures >

Outline of Questionnaires



Due Date of Answer

Please send the answer sheet by Saturday, 8th of March.

Q 1 Has your company sold agricultural machinery in Myanmar?

□ Yes ⇒ Please go to Q 2

□ No ⇒ Please go to Q 3

Q 2 Please tell me the main reasons why your company hasn't sold agricultural machinery. Please mark appropriate box (es) (Multiple answers allowed).

□ No request from Myanmar side

□ No interest in Myanmar's market

Pleases tell me the reason.....

.....

.....

□ Unable to explore retailers

□ Unable to offer after sales service

□ Others.....

.....

.....

Please go to Q 5

Q 3 Please answer the sales performance of your company.

Q 3-1 What are your main targets for sales? Please mark appropriate box (es) (Multiple answers allowed).

□ Sales in private market （Start year： ）

□ Sales through aid projects by donors （Start year： ）

□ Others.....

.....

..... （Start year ）

Q 3-2 What are (were) the main products your company sell(sold) in Myanmar. Please tell these three year performance(If interrupted, the latest three years)

Product	Country of origin	Year	Year	Year
4 wheel Tractor				
Power tiller				
Pump				

Q 3-3 Through what sales channel do yours sell your products? (Multiple answers allowed)

□ your company ⇒ trading company ⇒ local agent ⇒ users

□ your company ⇒ local agent ⇒ users

□ Others: your company ⇒.....

.....

Q 3-4 How does your company supply consumable parts for your sold products?

□ the same sales channel as above

□ Others: manufacture ⇒.....

.....

Q 4 Does your company currently sell products in Myanmar?

□ Yes ⇒ Please go to Q 4-1

□ NO ⇒ Please go to Q 4-2

Q 4-1 What do you think are the obstacles to develop your sales performance?

□ No obstacle ⇒ What do you think encourage the business to develop?

.....

.....

□ Some obstacles ⇒ What are such obstacles? Please mark appropriate box(es) (Maximum three answers)

□ Competition with other manufactures. Please mark appropriate a box.

□ price

□ quality

□ after sales service

□ Others.....

.....

□ Lack of capacity of local retailers

□ Complicated process of import business in Myanmar

□ Difficulty in money transfer from Myanmar

□ High cost of distribution (high legal expense including tax)

□ Low purchasing power of users

□ Others.....

.....

.....

Please go to Q 5.

Q 4-2 Please mention the details of your business interruption in Myanmar,

Around when did you interrupt the business?.....

What is the reason(s) of the interruption? Please mark appropriate box (es) (Maximum three answers allowed).

- □ Competition with other manufactures. Mark appropriate a box.
  - □ price
  - □ quality
  - □ after sales service
  - □ Others.....
- □ Lack of capacity of local retailers
- □ Complicated process of import business in Myanmar
- □ Difficulty in money transfer from Myanmar
- □ High cost of distribution (high legal expense including tax)
- □ Low purchasing power of users
- □ Company's own reasons（change of business policy or market strategy）
- □ Withdrawal of business partners such as trading company or local agents from Myanmar's market
- □ Decrease of aid projects
- □ Others.....

Please go to Q 5

Q 5 Taking the current political and economic change into consideration, do you have any plan of business in Myanmar? (If you already have (had) business, the plan means to expand sales or restart sales) Please mark appropriate box (es).

- □ Under consideration. Or may to consider it.
  ⇒ Q 5-1 and 5-2
- □ No such plan
  Reason.....
- □ Neither under consideration nor no-plan

Q 5-1 What a kind of plan do you consider? Please mark appropriate box (es).
(Multiple answers allowed)

- □ Sale of a product in Myanmar, which is produced in Japan or another country
- □ Sale of a product in Myanmar, which is produced or assembled in Myanmar (including a knockdown production that uses imported parts)
- □ Export of a product to Japan or other countries, which is produced or assembled in Myanmar (including a knockdown production that uses imported parts)
- □ Others.....

Q 5-2 In considering a business in Myanmar, what do you think is(are) key challenges or conditions? Please mark appropriate box (es). (Multiple answers allowed)

- □ Simplified procedures of import/export
- □ Trend of competitors
- □ Capacity of local retailers
- □ Deregulation of constrains of international money transfer from Myanmar
- □ Decrease of costs including taxes (including legal expenses)
- □ Expansion of SEZ（special economic zone)
- □ Expansion of public supports of agricultural mechanization（expansion of public supports by Myanmar, Japan and other donors)
- □ Infrastructure improvement and development such as ports, roads, power supply, water supply, and communication
- □ Others.....

Please mention any interests, information you wish to know regarding business in Myanmar, except the questions above.

Thank you so much for your cooperation（**please post it by Saturday, 8th of March**）

□In case you would like to get a result, Address_____

Results of Japanese Manufacturers' Survey Questionnaire: "Data collection survey on agricultural mechanization"

Posted to manufacturers 17/2/2012
Deadline 8/3/2012

The number of answers received by March 13
Total 41 companies
Answers 37 companies Answer rate 90.2%
Among the answered companies, 17 companies requested a result report (45.9% of those who answered the survey)
The result are the following:

Q1 Has your company sold agricultural machinery in Myanmar?

		rate
Yes	32 companies	86.5%
No	5 companies	13.5%

Q2 Please tell me the main reasons why your company hasn't sold agricultural machinery.

		negative answer rate
(1) No request from Myanmar side	20 companies	62.5%
(2) No interest in Myanmar's market	6 companies	18.8%
Reasons		
▸ Little interest in Myanmar's market		
▸ Unable to be interested in the market due to no market information available		
(3) Unable to explore retailers	10 companies	31.3%
(4) Unable to offer after sales services	10 companies	31.3%
(5) Other	9 companies	28.1%

- ▸ Unable to have retailers since Myanmar was a target of economic sanctions by western countries, such as the USA
- ▸ No information regarding agriculture and agricultural machinery of Myanmar
- ▸ No appropriate product for sale
- ▸ No appropriate target consumers who can afford to possess machinery
- ▸ No permission for large agricultural machinery which the companies who answered the survey rely on for business
- ▸ No market research conducted
- ▸ No experience exploring retailers (agents)
- ▸ "We sold products through power tillers manufacturers and tractors manufacturers in the past, but there has been no sales market in the past three years"
- ▸ No business of agricultural machinery

Q3 Please answer sales performance questions about your company.

Q3-1 What are your main sales targets? Please mark appropriate box(es) (Multiple answers allowed).

		positive answer rate
(1) Sales in private market	4 companies	80.0%
(2) Sales through aid projects by donors	3 companies	60.0%
(3) Other	2 companies	40.0%

Q3-2 What are (were) the main products your company sells (sold) in Myanmar. Please provide the last three years of performance (if interrupted, the latest three years).
The detailed answers are attached at the end.

Product	Country of origin	year	year	year

Q3-3 Through what sales channel does your company sell your products? (Multiple answers allowed.)

(1) your company⇒trading company⇒local agent⇒users	1 company	20.0%
(2) your company⇒local agent⇒users	4 companies	80.0%
(3) Other: your company ⇒	2 companies	40.0%

Q3-4 How does your company supply consumable parts for your sold products?

(1) the same sales channel as above	5 companies	100.0%
(2) Other: manufacture ⇒	0 company	0.0%

Q4	Does your company currently sell products in Myanmar?			
	Yes ⇒ Please go to Q4-1		3 companies	60.0%
	No ⇒ Please go to Q4-2		2 companies	40.0%
Q4-1	What do you think are the obstacles to developing your sales performance?			
	No obstacle ⇒ What do you think encourages the business to develop?		1 company	20.0%
	Some obstacl ⇒ What are such obstacles? Please mark appropriate box(es). (Maximum three answers.)			
			3 companies	60.0%
	(1) Competition with other manufactures. Please mark appropriate a box.			
		price	1 companies	20.0%
		quality	0 companies	0.0%
		after sales service	0 companies	0.0%
		other	0 companies	0.0%
	(2) Lack of capacity of local retailers		0 companies	0.0%
	(3) Complicated process of import business in Myanmar		2 companies	40.0%
	(4) Difficulty in money transfer from Myanmar		1 companies	20.0%
	(5) High cost of distribution (high legal expense, including tax)		0 companies	0.0%
	(6) Low purchasing power of users		0 companies	0.0%
	(7) Other		2 companies	40.0%
	‣ Unclear governmental policy for rice export			
	‣ Spread of cheaper Chinese products			
	Please go to Q5			

Q4-2 Please provide the details regarding your business interruption in Myanmar,
Around when did your business experience interruption?
What was the reason(s) for the interruption? Please mark appropriate box(es). (Maximum three answers allowed.)

(1) Competition with other manufacturers. Please mark appropriate a box.
- price
- quality
- after sales service
- other

(2) Lack of capacity of local retailers
(3) Complicated process of import business in Myanmar
(4) Difficulty in money transfer from Myanmar
(5) High cost of distribution (high legal expenses, including tax)
(6) Low purchasing power of users
(7) Company's own reasons （change in business policy or market strategy）
(8) Withdrawal of business partners such as trading company or local agents from Myanmar's market
(9) Decrease of aid projects
(10) Other

Please go to Q5

Q5 Taking the current political and economic change into consideration, do you have any plan to do business in Myanmar? (If you already have (had) business, plan means to expand sales or restart sales). Please mark appropriate box(es).

		answer rate
(1) Under consideration. Or may to consider it. ⇒ Q 5-1 and 5-2	17 companies	45.9%
(2) No such plan	10 companies	27.0%
Reason		
‣ No export business for products		
‣ No interest		
‣ Only coducting domestic sales		
‣ Necessary to scrutinize market opportunities		
‣ No strategy for international market		
(3) Neither under consideration nor without a plan	10 companies	27.0%

Q5-1 What a kind of plan do you consider? Please mark appropriate box(es). (Multiple answers allowed)

(1) Sale of a product in Myanmar, which is produced in Japan or another country	17 companies	45.9%
(2) Sale of a product in Myanmar, which is produced or assembled in Myanmar (including a knockdown production that uses imported parts).	2 companies	5.4%
(3) Export of a product to Japan or other countries, which is produced or assembled in Myanmar (including a knockdown production that uses imported parts)	1 company	2.7%
(4) Other	1 company	2.7%
‣ Export trough an aid fund by the Japanese government		

Q5-2 In considering a business in Myanmar, what do you think is (are) key challenges or conditions? Please mark appropriate box(es). (Multiple answers allowed.)

(1) Simplified procedures of import/export	10	27.0%
(2) Trend of competitors	6	16.2%
(3) Capacity of local retailers	13	35.1%
(4) Deregulation of constraints for international money transfers from Myanmar	11	29.7%
(5) Decrease of costs including taxes (including legal expenses)	3	8.1%
(6) Expansion of SEZ（special economic zone)	2	5.4%
(7) Expansion of public supports for agricultural mechanization（expansion of public supports by Myanmar, Japan and other donors)	14	37.8%
(8) Infrastructure improvement and development such as ports, roads, power supply, water supply, and communication	5	13.5%
(9) Other		
‣ Purchasing capacity in local market		
‣ High demand prospect		

Please mention any interests, information you wish to know regarding business in Myanmar, not covered in the questions above.

- ‣ Agricultural situation of Myanmar in general
- ‣ Future aid plan and policy of Japanese government in Myanmar
- ‣ Future agricultural policy of Myanmar, and the direction of agricultural mechanization in the country

The details of Q3

Answer No. 28

Q 3-1 What are your main targets for sales? Please mark appropriate box(es) (Multiple answers allowed).

- Sales in private market 2010 Started
- Sales through aid projects by donors 1984 Started
- Others Started

Q 3-2 What are (were) the main products your company sell(sold) in Myanmar? Please tell these three year performance(If interrupted, the latest three years)

Product	Country of Origin	2009	2010	2011
Rice mill plant	Thailand	4 factories	0	0
Rice mill machine with a husker	Thailand	around 20	around 2	around 30

Q 3-3 Through what sales channel does your company sell your products? (Multiple answers allowed)

- your company⇒trading company⇒local agent⇒users
- your company⇒local agent⇒users
- Others: your company ⇒ ○ your company ⇒users

A 3-4 How does your company supply consumable parts for your sold products?

- the same sales channel as above ○
- Others: manufacture ⇒

Answer No. 29

Q 3-1 What are your main targets for sales? Please mark appropriate box(es) (Multiple answers allowed).

- Sales in private market Started
- Sales through aid projects by donors Started
- Others 1999 Started

Q 3-2 What are (were) the main products your company sell(sold) in Myanmar? Please tell these three year performance(If interrupted, the latest three years)

Product	Country of Origin	2011		
Grain cleaning plant	Japan	1		

Q 3-3 Through what sales channel does your company sell your products? (Multiple answers allowed)

- your company⇒trading company⇒local agent⇒users
- your company⇒local agent⇒users ○
- Others: your company ⇒

A 3-4 How does your company supply consumable parts for your sold products?

- the same sales channel as above ○
- Others: manufacture ⇒

The details of Q3

Answer No. 31

Q 3-1 What are your main targets for sales? Please mark appropriate box(es) (Multiple answers allowed).

- Sales in private market — Started
- Sales through aid projects by donors — Started
- Others — 2011 Started

Q 3-2 What are (were) the main products your company sell(sold) in Myanmar? Please tell these three year performance(If interrupted, the latest three years)

Product	Country of Origin	2011		
Mobile glass cutter	Japan	2		

Q 3-3 Through what sales channel does your company sell your products? (Multiple answers allowed)

- your company⇒trading company⇒local agent⇒users
- your company⇒local agent⇒users
- Others: your company ⇒ ○ your company ⇒users

A 3-4 How does your company supply consumable parts for your sold products?

- the same sales channel as above ○
- Others: manufacture ⇒

Answer No. 35

Q 3-1 What are your main targets for sales? Please mark appropriate box(es) (Multiple answers allowed).

- Sales in private market — 2010 Started
- Sales through aid projects by donors — 1984 Started
- Others — Started

Q 3-2 What are (were) the main products your company sell(sold) in Myanmar? Please tell these three year performance(If interrupted, the latest three years)

Product	Country of Origin	2009	2010	2011
4 wheel tractor	Thailand	0	0	0
Power tiller	Thailand	2,935	6,640	7,545
Combine harvester	Thailand	0	0	0
Diesel engine	Thailand	1,011	1,832	2,558

Q 3-3 Through what sales channel does your company sell your products? (Multiple answers allowed)

- your company⇒trading company⇒local agent⇒users
- your company⇒local agent⇒users
- Others: your company ⇒ ○

A 3-4 How does your company supply consumable parts for your sold products?

- the same sales channel as above ○
- Others: manufacture ⇒

Answer No. 36

The details of Q3

Q 3-1 What are your main targets for sales? Please mark appropriate box(es) (Multiple answers allowed).

- ▸ Sales in private market 1950 Started
- ▸ Sales through aid projects by donors 1995 Started
- ▸ Others 1950 Started

Q 3-2 What are (were) the main products your company sell(sold) in Myanmar? Please tell these three year performance(If interrupted, the latest three years)

Product	Country of Origin	1995	1996	1999
4 wheel tractor	Japan	0	0	49
Power tiller	Japan	36	270	0
Pump	Japan	100	0	0
Combine harvester	Japan	0	0	2

Q 3-3 Through what sales channel does your company sell your products? (Multiple answers allowed)

- ▸ your company⇒trading company⇒local agent⇒users
- ▸ your company⇒local agent⇒users
- ▸ Others: your company ⇒ ○ your company ⇒users

A 3-4 How does your company supply consumable parts for your sold products?

- ▸ the same sales channel as above ○
- ▸ Others: manufacture ⇒

Answer No.

Q 3-1 What are your main targets for sales? Please mark appropriate box(es) (Multiple answers allowed).

- ▸ Sales in private market Started
- ▸ Sales through aid projects by donors Started
- ▸ Others Started

Q 3-2 What are (were) the main products your company sell(sold) in Myanmar? Please tell these three year performance(If interrupted, the latest three years)

Product	Country of Origin	Year		

Q 3-3 Through what sales channel does your company sell your products? (Multiple answers allowed)

- ▸ your company⇒trading company⇒local agent⇒users
- ▸ your company⇒local agent⇒users
- ▸ Others: your company ⇒

A 3-4 How does your company supply consumable parts for your sold products?

- ▸ the same sales channel as above
- ▸ Others: manufacture ⇒