

**EXPERT ON SMALLHOLDER
FARMERS' ACCESS
TO AGRICULTURE MECHANIZATION
IN GHANA**

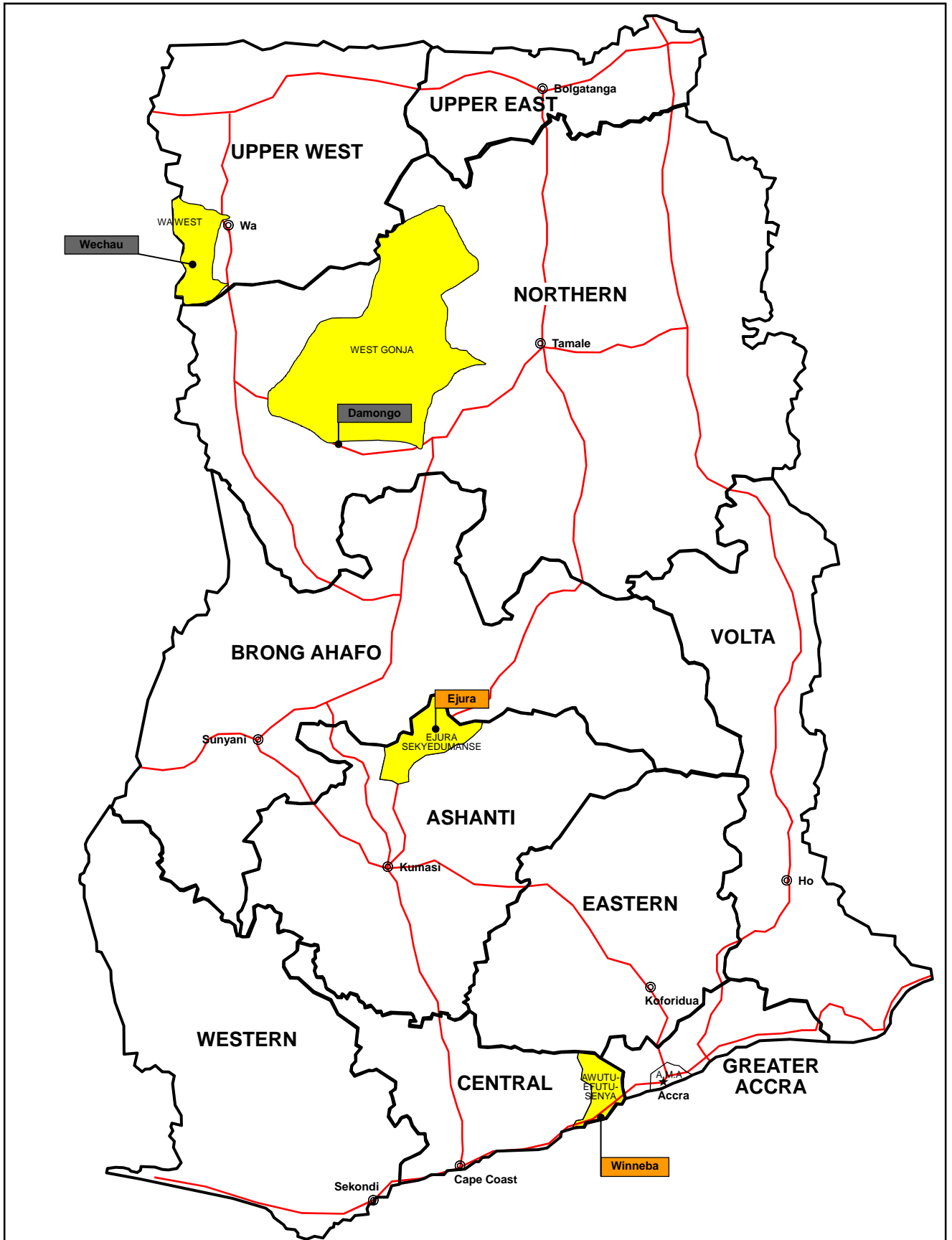
PROJECT COMPLETION REPORT

AUGUST 2015

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
TASK CO., LTD.**

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Map of Project Area



Summary

1. Outline of the Project

1.1. Background

Although the ratio is decreasing, the rural population in Ghana is still at a high level similar to other sub-Saharan countries. And most of them are engaged in agriculture.

Eighty percent of agricultural production in Ghana is generated by a majority of farmers of a small scale with only conventional knowledge and technology. The Ministry of Food and Agriculture reports 2.74 million farmers engage in agriculture or livestock farming in Ghana.

The Food and Agriculture Sector Development Policy II (FASDEP II) was issued in 2008 as a policy of high order within the agricultural development policy. Medium Term Agriculture Sector Investment Plan (METASIP) has aimed to attain the development target concerning investment in the agricultural sector. Promotion of agricultural mechanization through collaboration with the private sector is emphasized, especially in the agricultural mechanization and strengthening capability of the private sector. AMSEC (Agricultural Mechanization Service Centers) program was executed as a main program of the MOFA from 2007 to establish AMSEC in collaboration with the private sector. However, such constraints like a limited budget, shortages of concerned personnel, relevant systems and regulations with lack of government authority and commitment are causing the policies and strategies to be executed ineffectively in Ghana.

Agricultural Engineering Service Directorate (AESD) under Ministry of Food and Agriculture (MOFA) is in charge of agricultural mechanization in Ghana. Capacity of AESD needs to be developed in order to sustain AMSEC business model. MOFA requested JICA (Japan International Cooperative Agency) to dispatch JICA expert as a business management adviser for AESD and AMSEC.

1.2. Framework of the Project

1.2.1 Purpose and Substance of the Project

The purpose of the Project is to enhance the capability of AMSEC to provide agriculture mechanization services to smallholder farmers. JICA experts advise AESD about the following activities for capacity development of counterparts:

To review current status of agricultural mechanization in Ghana,

To select methodology and activity to enhance sustainability of AMSEC business, and

To examine the appropriate service plan and affordable service fees by conducting a pilot project which improves smallholder farmers' access to mechanization services.

Overall Goal, Purpose, Outputs and Activities / Inputs are as mentioned below:

(1) Overall Goal:

Accelerating the agricultural mechanization sector in Ghana to be aligned with METASIP and FASDEP II

(2) Project Purpose:

The availability of machinery and mechanization services to smallholder farmers as and when needed and at affordable rates in the identified priority areas

(3) Outputs:

- 1) Present condition of agricultural mechanization is clarified.
- 2) Pilot projects / interventions to support AMSEC services are identified.
- 3) The identified pilot projects which improve smallholder farmers' access to AMSEC are implemented.

(4) Activities / Inputs:

- 1)-1 Study existing mechanization policy and statistics
- 1)-2 Review past study
- 1)-3 Study the state of agro-processing
- 1)-4 Study the mandate and services of AESD
- 1)-5 Study the repayment situation of AMSEC
- 1)-6 Study the payment status of AMSEC service fee
- 2)-1 Analyze the problem and identify the possible intervention on mechanization
- 2)-2 Identify area of capacity development of AESD & AMSEC
- 2)-3 Identify the approaches to enhance smallholder farmers' to access AMSEC
- 2)-4 Suggest the approaches to accelerate AMSEC, and suggest 2KR (Second Kennedy Round: Grant Assistance for Underprivileged Farmers) program
- 3)-1 Implement necessary trainings for improvement of management to AESD and AMSEC
- 3)-2 Promotion of information sharing between farmers and AMSEC for better access to machinery service
- 3)-3 Implementation of pilot projects
- 3)-4 Suggestions for the development of AMSEC management Guideline

1.2.2. Implementation Structure

Agricultural Engineering Service Directorate (AESD) under Ministry of Food and Agriculture (MOFA) is an implementing agency.

1.2.3. Target Area

Target area is the entire country of Ghana.

1.2.4. Target Group

Target groups are AESD, AMSEC and Farmer or Famer based organizations (FBOs).

1.2.5. Project Period

The Project consists of the first year and second year stage. The period of the first year and second year stage are shown as below:

The first year stage: from April to October 2014

The second year stage: from March to August 2015

2. Prospects of Achievement of Project Purpose

Project Purpose:

To enhance access of machinery and mechanization services to smallholder farmers as and when needed at affordable rates in the identified priority areas.

A base for capacity development of AMSEC was built in AESD. The base means that a series of trainings for AMSEC managers and operators, teaching materials, and capacity of AMSEC units to conduct the training. The training consists of initial capability on understanding the business status of one's own company through record keeping for managers, and primary technical skills on the operation and maintenance for operators. AMSEC managers, then, have to analyze their business and tackle issues. AMSEC managers learned methods to analyze business status and to find issues to be tackled, but only 1 set of trainings is not sufficient to practically conduct work for managers. In this year, only one of twenty AMSEC managers could prepare Profits and Losses statements by themselves at the follow-up training. Even this AMSEC manager could not prepare a Balance Sheet yet. Managers need to be trained for two or three years to obtain at least the knowledge and skills as a company manager. Operators also need further trainings to improve their capability, repeating training and practice on the field.

In order for smallholder farmers to access machinery service, Agriculture Extension Agent (AEA) who knows the machinery service demands of smallholder farmers is a key person. Through AEA, AMSEC and smallholder farmers can share information on demand and supply. To expand information sharing between demand side and supply side, a regional engineer who is appointed by AESD facilitates AMSEC and AEA to contact each other at the district level.

An AMSEC management guideline was prepared reflecting two-year project activities, but it has not been distributed to AMSEC. Feedback from AMSEC will be necessary to improve content.

Expansion of machinery service to smallholder farmers depends on reactivating operation of unserviceable tractors in AMSEC. Since it is difficult for AMSEC to receive funds from financial institutions, AMSEC has to increase earning retention from sales of serviceable tractors.

3. Recommendation

3.1. Recommendation to AESD

3.1.1. Budget Allocation for Training Program

In the next batch of the AMSEC program, enough of a budget for the training program has to be allocated, even if cutting the budget for equipment procurement. MOFA also should consider decreasing the level of subsidy and increasing the budget for the training program instead. Cost sharing by beneficiaries is also important. There are many AMSECs and 2KR beneficiaries who want their operators to participate in the training to avoid machine problems, even if they pay a participation fee. It is necessary to improve the capacity of operators at the national level. There are donors to provide agriculture machinery in their project. MOFA has to announce that they will commence a training program to stakeholders in agriculture sector.

3.1.2. Support AMSEC at Regional Level

According to the AMSEC Policy Guideline, AESD has responsibilities to supervise and monitor AMSEC business. Since AESD does not have enough of a budget and a clear role of AESD staff at the regional and central level, supervision and monitoring were not carried out, and the status of AMSEC business had not been reported. Information sharing between FBO and AMSEC was done cooperating with AEA. The status of AMSEC business was also clarified through a series of training and monitoring. In order to continue these activities, a demarcation of roles of MOFA staff at the district, regional and central level has to be made, and a necessary budget has to be prepared.

3.2. Recommendation to AMSEC Program

The basic concept of the AMSEC program is acceptable for promoting agriculture mechanization and increasing access to smallholder farmers who cannot afford to buy machinery, utilizing the private sector's efficient business management skills. In fact, most AMSECs do not have a basic level of knowledge and management skill to continue their machinery service business, and their business is poorly managed. The low repayment of loans and the number of unserviceable equipment is proof as well. This has been caused by the increasing number of machinery without human resource development. The Government has a

plan to expand the AMSEC program in the future, and human resource development is a key issue to sustainable agriculture mechanization. Recommendations for the AMSEC program and AESD, the implementing organization, are stated in order of priority as follows.

3.2.1. Human Resource Development

(1) Owner/ Manager

The Agriculture Machinery Service Provider, especially running a business as an enterprise, like AMSEC, needs to have a certain level of business skills. Managers have to prepare company strategy, organize and conduct their staff, have access to the market, and make a profit, analyzing various internal and external business environments.

However, even though demand exists, there are not many AMSECs with sound managing status. Through the project activities, we met about 20 AMSECs. They do not have a business plan, do not know much about their financial status, and cannot forecast their business. Even they acknowledge that their business is not good, but do not know how analyze and improve their business. The AMSEC manager as a businessperson has to acquire at least a level of business skill, or the submission of planned financial documents and a business plan has to be an obligation when they propose to be an AMSEC, and the review of them in an approval procedure to judge the capability of business management skills.

(2) Operators and Mechanics

Operators less than early 40s in age did not have opportunities to formally learn about operation, maintenance, and adjustment of agricultural machinery and equipment, and their skill level is low. As a result, their wrong operation caused machine problems and breakdowns sometimes, as well as the shortening of machinery life. It may also affect crop production through insufficient soil turning and unlevelled harrowing. Development of systematic training programs and capacity building of operators is an urgent issue for proper operation and maintenance of machineries.

For farmers who own a tractor, individual machinery service providers and even most AMSECs, which have a number of tractors, do not employ a mechanic. They rely on workshops outside for repair work, and operators often take maintenance work. Tractor mechanics, who received basic and practical training, have to be appointed

(3) Trainer of Training

Since the government withdrew from the machinery service, a formal training program for operators and mechanics has not been held by both the public and private sectors. Instructors in 1980-1990, in their late 50s or early 60s in age, have not had instructors following them since the late 1990s. The number of these skilled instructors is now very low. It is important to foster a new generation of instructors transferring knowledge and techniques from skilled instructors.

(4) Farmer

A farmer also would remove stumps and stones from their farmland which cause machine breakdown. Stumps can be marked where an operator can get around. They also try to get information on machinery service providers through Agriculture Extension Agents.

3.2.2. Appropriate Number of Equipment

Most AMSECs bought 5 sets of tractors and implements. Even though demands exist, AMSECs cannot provide machinery service in a sustainable manner without sound financial stability and well-managed operation. It should be considered that AMSECs start with two or three tractors then increase the number of tractors depending on their financial and management capacity.

3.2.3. Selection of Equipment for AMSEC Program

A series of implements and equipment, such as the plough, harrow, planter, sprayer, harvester, and postharvest equipment, has to be equipped in order for AMSEC to continuously provide machinery service to farmers. It is also favorable for service providers to increase the working efficiency of machines (decrease idle time), especially tractors, and the stability of sales, for operators to secure steady employment. This also motivates owners to train their operators for capacity building. For a farmer, it also promotes expansion of farmland, eliminates the farm labor shortage issue, and contributes to efficient production. Meanwhile, the skill level of operators to handle these implements is inadequate at the moment. It is obvious that implements do not work as well as farmers require, or are broken down. Especially, the planter and sprayer, which are not well introduced to AMSEC, are needed to correct the implement adjustment and the proper volume of input application based on acreage of the farm. Since the structure of the equipment differs, it will brake down easily compared to the plough and harrow.

It is therefore recommended to pay attention to the skill level of the operators who AMSEC employs, and hand over equipment, after giving operators the necessary training.

3.2.4. Selection Procedure of AMSEC

MOFA tightened up the payment term, the 70% down payment and the 30% loan with the bank guarantee, from the third year of recruitment of AMSEC, because of the low repayment rate of the first and second batches. The selection procedure should be more strict in business management capability (submission of planned financial documents and the business plan) rather than payment terms. As for loan repayment, a minimum interest at a level of the inflation rate should be charged. Otherwise, only delinquent payments get the benefit of inflation, but AMSEC repays as scheduled and the government loses.

3.2.5. Spare Parts Supply Network

Genuine spare parts cost more than triple its own non-genuine spare parts. AMSEC tends to buy

non-genuine ones. However, cheaper non-genuine or reuse parts may cause machine problems and shorten machine life, eventually incurring high costs.

AESD has to provide the price list (US dollar base) of spare parts at the time of AMSEC recruitment for them to understand how costly maintenance and repair are. Periodic monitoring by AESD, including the status of their business, as well as parts, is recommended so that spare parts are smoothly supplied to users.

3.2.6. Repair of Equipment

Repair of unserviceable tractors is a big challenge for AMSEC. The project supported 2 AMSECs to repair their tractors with 1,000 USD each. As a result, one repaired tractor could provide more than 180 acres of smallholder farmers' fields. If AMSEC cannot receive funds from outside, they have to increase earning retention by improving their business to repair unserviceable tractors. If the Government promotes AMSEC to repair tractors, the Government provides a bank guarantee, and can make an environment AMSEC can easily access to fund financial institutions. Even in this case, AMSEC needs to prepare and submit necessary documents (business plan and financial documents) to financial institutions. It is not recommended that the Government directly give funds to AMSEC.

3.2.7. Strengthening Financial Stability

Most AMSECs participating in the training have not received any funds from financial institutions, because of a high interest rate and low creditability. At the beginning of a season and a time of unexpected equipment problems, they often need cash. AMSEC tries to achieve credibility of financial institutions, repeating borrowing and repaying with small amount of funds. They need to prepare necessary documents (business plan and financial documents) as well.

3.3. Recommendation to Investors Entering to Ghanaian Market

In the field of agriculture mechanization, investors who intend to enter the Ghanaian market must note the following.

(1) Find a Reliable Partner who has:

- Human resources of sales persons and mechanics,
- Enough funds to purchase machinery and spare parts for sales and stock,
- Adequate facilities for an office, a workshop and a warehouse, and
- Sufficient experiences and skills of selling agriculture machinery, vehicle, or construction machinery.

(2) Necessary Support to Local Agents

- Technical support for human resource development (sales person, mechanic)

- Technical support for sales management and inventory control
- Technical support for selection of sales priority area

(3) Cost Reduction of Parts and Equipment

- Development of Ghanaian version equipment which is adapted to environments of crop cultivation and equipment usage
- Cost-reduction by localization of parts and implement production

(4) Flexibility of Payment Terms

Since there are few farmers who can afford to pay, various payment terms must be considered;

- Provide a loan by manufacturer or public institutions,
- Provide a bank guarantee to customers' loans,
- Provide a finance lease, and
- Provide a machinery service.

4. Project Activity

4.1. Policy on Agriculture Mechanization

Regarding the agricultural mechanization policy and the current situation in Ghana, the project collected data and information from many sources, and prepared "Agriculture Mechanization in status in Republic of Ghana."

In FASDEP II, it is mentioned that the objective of agricultural mechanization is to facilitate the access of farmers and agro-processors to mechanized services at an affordable cost. To achieve this, METASIP plans that at least one (private sector led) mechanization center established in each district by 2015 will provide diversified services to all types of farmers and agro-processors (small, medium and large). This plan materialized as an establishment of AMSEC.

On the other hand, NRDS (National Rice Development Strategy) emphasizes enforce supply of farm machineries and accessibility to postharvest / processing equipment as a short term strategy, and the necessity of enforcing the role of private sectors and the importance of technical training for personnel engaging in the work concerning agricultural machineries (operators, mechanics, and etc.).

As mentioned above, METASIP and NRDS both attach a high value on agricultural mechanization, especially in the enhancement of the related private sector. Therefore, it is demanded to promote agricultural mechanization through the utilization of the private sector for Ghanaian agricultural development.

4.2. Roles of AESD in AMSEC Program

According to the AMSEC Policy Guideline, MOFA/AESD plays three roles, supervision, monitoring and Training under the AMSEC program. Actually, MOFA MOFA/AESD only plays

the role of training for operators in some places, and the role of supervision and monitoring are not implemented because of budget limitations. Due to these circumstances, MOFA MOFA/AESD was not able to perceive the actual situation of AMSEC.

4.3. Service Status of AMSEC

Seventeen AMSECs were established in the initiation year of 2007 (distribution started in 2008). Fifty-two AMSECs, the most in number, were established in 2009. The numbers declined afterwards, and just 5 AMSECs were established in the final year of 2011. Regarding the distribution of AMSEC by region, Northern region has 28 AMSECs at most, followed by 13 AMSECs in BA region, 10 AMSECs in Eastern region, and 9 AMSECs in Volta region. Western region has only 1 AMSEC, and GA region has 3 AMSECs.

In order to grasp the present situation of the AMSECs, a field survey was conducted targeting 29 of these AMSECs in June 2014. Generally, the oldest AMSEC tends to indicate a higher cost for maintenance and repair. But AMSECs that were established in the year 2009 had the highest average cost. The reason for these discrepancies seem to be due to the low level of management skill of the AMSEC because numerous AMSECs were established in 2009 and many of them might not have adequate level of skills to manage them.

When 5 to 6 years past after the installation, 37 % of the total number of tractors are not in operation. These inoperative tractors are at a comparatively higher level than other machinery. It can be seen that some AMSEC cannot use any machinery currently.

Most of AMSECs provide services below 300 hectare with all tractors. Seven AMSECs provided less than 50ha, and it is considered less of a number of serviceable tractors.

Payment for agricultural machinery service

Payment methods for machinery services are generally by cash or in-kind. Payment terms are classified with prepayment, payment after the service and payment after the harvest. Although the payment method and payment terms vary, service providers tend to choose a customer who can pay by cash in advance or payment after the service for risk alleviation. In terms of service costs, for ploughing service, 70GHS/acre in Central and Upper West regions, 45GHS/acre in Northern and Ashanti regions. Within the same region, service fees are varied depending on soil type, levels of competition, and distance from the station.

4.4. Repayment Status of AMSEC

Investigation for the condition of payment for equipment by AMSEC

The price of the equipment for AMSEC was half the market price. Equipment was sold with a 10-30% down payment with a 5 year no interest loan for the rest (at least 1 payment per year) in 2008 and 2009. For 2010 and after, the down payment was increased to 70% or the full amount in a single payment. Payment for the rest of the amount is the same as before, for a 5 year no

interest loan (at least 1 payment per year). However, the government required a bank guarantee for 30% of the remainder.

As a result of the study on repayment of equipment sold during 2008-2010, as of June 2014, the payment period for 2008 loans already ended in 2013, and also the 2009 loan period will end in 2014; however, the collection rate is only 17.2% for 2008 loans and 44.9% for 2009 loans. These collection rates are not even half of their total amounts. Also, 32% of the total loans set for AMSEC have not made any payment at all after the down payment. The total amount of the sales that decreased in 2010 probably is because many with AMSEC choose to make a single lump sum payment after the change in payment policy.

The repayment rate of AMSEC could be lowered even more than the figures in the accounting report when considering the following situations, such as the decrease in the exchange rate of the local currency (GHS) to 1/3 in USD and that the inflation rate has increased about 4.8 times while the loan charges no interest. Therefore, the loan holders can take advantage of this by postponing the repayment. On the contrary, the value of uncollected loan assets for the government is decreasing every year for the GHS base.

AESD are not obligated to monitor loan payments. Therefore, AESD has not performed any monitoring and has no information concerning the repayment situation from AMSEC.

4.5. Approaches to Strengthening of AMSEC Business Management

(1) Present Situation and Issues on AMSEC Service

Aiming to improve farmers' access to agriculture machinery service, 89 AMSECs were established from 2008 to 2011. In order to grasp the present situation of AMSECs, a field survey was conducted targeting 29 of these AMSECs in June 2014. About 37% of tractors have been retired even in the common life time of a tractor (10 years). It is considered that a number of AMSEC tractors will be decreased with accelerating speed under the same situation.

In our survey, as a problem and constraint, one third of managers indicated a small number of skilled operators and cash management. High maintenance costs and account receivables affect cash management. Half of surveyed AMSECs showed difficulty in record keeping. Few AMSECs have a clear business plan, but only 4 AMSECs answered problems on business planning. It seems that they do not acknowledge the importance of the relationship between the importance of record keeping and business planning.

(2) Selection of approaches to improve AMSEC business management

Based on the results of the AMSEC survey, the internal and external environment of AMSEC were identified, and finally four approaches for improvement of AMSEC were analyzed by cross SWOT analysis.

According to the survey results, there are many AMSECs who need to take W/O approach which has room for improvement on management, and operation and maintenance. And,

considering the purpose of the AMSEC establishment, W/T approach should not be taken into consideration.

In terms of importance and urgency, W/O approach will be given first priority to be tackled by AMSEC.

1) S/O Approach

- To expand ploughing, harrowing and transportation service by increasing the number of tractors.
- To expand service varieties by increasing variety of implements, such as planter, sprayer, and sheller and combine harvesters.
- To rent out or transfer equipment from AMSEC in low demand areas to AMSEC in high demand areas or increase the number of AMSECs.

2) W/O Approach

- To increase service volume and improve profitability by decreasing breakdown and repair through capacity improvement of operator and mechanic and their treatment.
- To achieve spare parts stock and quick repair by improvement of cash management through improvement of management skills.

3) S/T Approach

- To seek service demands nearby presently servicing small plots.
- To advise farmers to improve their farmland condition suitable for mechanization.
- To stock expensive spare parts in partnership with neighboring AMSECs
- To provide cultivation techniques to farmers as well as machinery service to improve crop productivity.

4) W/T Approach

- To stop machinery service at small plots.
- To stop machinery service to remote farms.
- To stop machinery service farms that are not suitable for mechanization (stumps and stones).
- To stop machinery service farmers who are behind on their bills.

4.6. Approaches to improve smallholder farmers' access to AMSEC service

The machinery service provider prefers good conditions and large scale farmland where high working efficiency can be expected as well as farmers who have a high affordability of service fees. Under the situation of a lack of a tractor, the smallholder farmer has to try to make preferable conditions as follows for service providers. In the first year, FBOs near the host AMSEC were advised.

- (i) The farmer who has a small plot or remote plot would cooperate with adjacent farmland, so that gathering machinery service can be provided. Smallholder farm lands aggregation to be encouraged and intensified.

- (ii) The farmer would remove stumps and stones from their farmland which cause machine breakdown. Stumps can be marked where an operator can get around.
- (iii) The farmer tries to improve productivity following appropriate cultivation technology, and application of enough inputs (seed, fertilizer and chemical) to be affordable to pay for the service fee.

In the second year, the project facilitated AMSEC and FBOs being supported by AEA (Agriculture Extension Agent) to share information at both the supply and demand sides of machinery service. Furthermore, to increase service capacity of the host AMSEC, the project repaired an unserviceable tractor with about 1,000 USD, and the host AMSEC provided machinery service to above FBOs. The project monitored AMSEC performance on this service. As a result, the host AMSEC (Wa West) in Upper West region could provide machinery service to 182 acres of smallholder farmers. Of which, this AMSEC provided only 45 acres of FBO's farm, because the agreed payment term, cash after the work, were not made known to FBO members. Many members thought the payment term as in-kind after the harvest. Therefore, the AMSEC stopped providing service to the FBO, but provided service to other individual farmers instead. The host AMSEC (Sakfos) in Northern region provided only 46 acres in the season, because the repaired tractor had other problems, and became unserviceable afterwards. Shortening the service period by late rainfall in this season caused less service acreage as well. Sakfos, however, has a plan to provide maize shelling service in the harvest season. They will recover seasonal sales by this service.

In order to increase farmers' access to machinery service, repairs of unserviceable tractors are necessary. Since the first batch of AMSECs were established, seven years have passed, and equipment need major maintenance of the engine, hydraulic system, and transmission system, which are very expensive. Most AMSECs do not have access to fundraising.

4.7. To conduct necessary trainings for improvement of management to AESD and AMSEC

An one-day management training for AMSEC managers and two-day operation training for operators were conducted in each target region. The following table shows the number of attendees at the trainings. Other than these AMSEC people, two extension staff in charge of the area and one regional engineer participated in the training as an observer.

	Place	Target AMSEC
1st Year	Ejura, Ashanti region	5 AMSECs (5 managers and 9 operators)
	Winneba, Central region	4 AMSECs (5 managers and 11 operators)
2nd Year	Wa West, Upper West region	5 AMSECs (5 managers and 13 operators)
	Tamale, Northern region	5 AMSECs (5 managers and 13 operators)

(1) Results of the Trainings

Business Management

In the training for managers, participants said most of the training content is understandable, but they are not familiar with usage of planning and financial management at a practical level. In order to understand practical skills, it is recommended to repeat a set of small trainings and practice rather than expand the duration of a single training.

In the second year, a one-day pre-season training was conducted, but more time for practical work was allocated. The participants requested even more time for both theoretical and practical trainings. Therefore, a two-day training would be suitable for managers.

In the follow-up (post-season) training, all AMSECs that participated in pre-season training gathered and presented their business activities during the season. All participants presented the service area (planned and actual), number of farmers, sales, and costs referring to the records maintained. Only one AMSEC completed a Profits and Losses Statement. Even this AMSEC could not prepare a Balance Sheet. All participating AMSECs finally maintained various records, because the monitoring team visited all participants periodically and advised them on how to carry out record keeping during the season. Practical advice for individual AMSECs was effective to understanding how to maintain records, but visiting each AMSEC periodically is costly and takes time. It is difficult for AMSEC managers to gather often in certain places because they are busy during the season. So, it is recommended to conduct a set of trainings during the pre-season and post-season for two or three seasons.

Machinery Operation and Maintenance

In the newly developed field in Central region, high weeds are common. The farmer wants the operator to both cut and plough this field. So, the farmer does not care about the quality of the ploughing.

The participating operator was not following techniques he learned at the training, because the farmer does not require quality ploughing service unless they do not introduce the planter and boom sprayer.

Regarding the operator's behavior, the AMSEC manager reported the improvement of maintenance activity. Since most operators have never participated in formal training on operation and maintenance, they understand how they handle their equipment through the training. On the other hand, through the observation of monitoring activity by JICA expert and AESD staff, it is believed that the handling skill of operators, especially younger operators, is not high enough. The improvement of operation skills depend on their working environment and their own motivation for work.

In the northern area, some farmers expressed the quality of ploughing service, and that they were satisfied with AMSEC service performance. The monitoring team measured the plough

and harrow service using a GPS receiver. The results showed that the performance of the operator that participated in the training was better in work efficiency and fuel consumption than the other operator who did not. However, it was not assured that the operator's skill was improved by the training because we did not compare his performance before the training. Operators need to participate in the refresh training periodically even in a short periodically even in a short period.

Contents

Map of Project Area

Summary

Contents

Abbreviations / Units of Measurement

1	Outline of the Project	1
1.1	Background.....	1
1.2	Framework of the Project	2
1.2.1	Purpose and Substance of the Project.....	2
1.2.2	Implementing Agency	3
1.2.3	Target Area	3
1.2.4	Target Group.....	3
1.2.5	Project Period	3
2	Project Activity	4
2.1	Output 1: Current Situation of Agricultural Mechanization Approach is Confirmed	4
2.1.1	Activity 1: Investigation of Agricultural Mechanization Policy and Current Situation	4
2.1.2	Activity 2: Review of the Previous Research Related to Agricultural Mechanization.....	5
2.1.3	Activity 3: Perceiving current circumstances of postharvest	7
2.1.4	Activity 4: Research on the AESD's role.....	8
2.1.5	Activity 5: Research about AMSEC services situations	9
2.1.6	Activity 6: Investigation for the condition of payment for equipment by AMSEC.....	11
2.2	Output 2: Experimental Methods and Activities to Improve Sustainability of AMSEC Services are Clarified	13
2.2.1	Activity 1: Approaches to Strengthening of AMSEC Business Management	13
2.2.2	Activity 2: Identification of Training Contents for Capacity of AESD and AMSEC.....	14
2.2.3	Activity 3: Improvement of Access to Machinery Service by Promotion of Information Sharing between AMSEC and FBO	16
2.2.4	Activity 4: Reflection of Successful Machinery Service to 2KR and AMSEC Program	17
2.3	Output 3: The identified pilot projects which improve smallholder farmers' access to agriculture mechanization is implemented.....	18
2.3.1	Activity 1: To conduct necessary trainings for improvement of management to AESD and AMSEC	18

2.3.2	Activity 2: Promotion of information sharing between farmers and AMSEC for better access to machinery service	33
2.3.3	Activity 3: Implementation of pilot projects.....	35
2.3.4	Activity 4: Recommendation on AMSEC program and AMSEC Management Guideline	40
3	Prospects of Achievement of Project Purpose	42
4	Issues and Lessons Learned on Project Management.....	43
4.1	Issues.....	43
4.2	Recommendation for Project Management	43
4.3	Lessons for Project Management.....	44
5	Recommendation	45
5.1	Recommendation to AESD.....	45
5.1.1	Budget Allocation for Training Program.....	45
5.1.2	Support AMSEC at Regional Level	45
5.2	Recommendation to AMSEC Program.....	45
5.2.1	Human Resource Development	46
5.2.2	Appropriate Number of Equipment.....	47
5.2.3	Selection of Equipment for AMSEC Program	47
5.2.4	Selection Procedure of AMSEC	47
5.2.5	Spare Parts Supply Network.....	48
5.2.6	Repair of Equipment.....	48
5.2.7	Strengthening Financial Stability	48
5.3	Recommendation to Investors Entering to Ghanaian Market.....	48

Attachment

Attachment I:	Working schedule	A-1
Attachment II:	Manning schedule	A-3
Attachment III:	Machinery and Equipment Imported by MOFA since 1990.....	A-5
Attachment IV:	SWOT and Cross SWOT Analysis.....	A-7
Attachment V:	List of AMSEC.....	A-9
Attachment VI:	AMSEC Operational Guideline.....	A-17
Attachment VII:	AMSEC repayment status	A-35
Attachment VIII:	Participants list of the training.....	A-42
Attachment IX:	Result of questionnaire after the training	A-44
Attachment X:	List of repairs for targeted AMSEC as a pilot project	A-58
Attachment XI:	AMSEC financial status	A-59
Attachment XII:	Pictures.....	A-66

Abbreviation

Abbreviation	Official Titles
2KR	Second Kennedy Round: Grant Assistance for Underprivileged Farmers (Former Grant Aid for the Increase of Food Production)
AESD	Agricultural Engineering Service Directorate
AMSEC	Agricultural Mechanization Service Centers
CARD	Coalition for African Rice Development
FASDEP II	Food and Agriculture Sector Development Policy
FAO	Food and Agriculture Organization of the United Nations
FBO	Farmer Based Organization
GOG	Government of Ghana
IFPRI	International Food Policy Research Institute
JICA	Japan International Cooperation Agency
METASIP	Medium Term Agriculture Sector Investment Plan
MOFA	Ministry of Food and Agriculture
NRDS	National Rice Development Strategy

Units of Measurement

Units	Title	Description
< Area >		
ha	Hectare	1ha = 0.01km ² = 2.4711ac
ac	Acre	1ac = 0.404686 ha
km ²	Square kilometer	1km ² = 100ha = 247.11ac
< Power >		
hp	Horse power	1hp = 0.7456 kW
kWt	Kilo watt	1kW = 1.34102hp
< Currency >		
GHS	Ghana cedis	1GHS = ¥33.753 (As of August 2015, JICA)
USD	U.S. Dollar	USD1.00 = ¥124.21 (As of August 2015, JICA)

1 Outline of the Project

1.1 Background

Although the ratio is decreasing, the rural population in Ghana is still high, similar to other sub-Saharan countries. And most of the population is engaged in agriculture.

Eighty percent of agricultural production in Ghana is generated by a majority of farmers, of a small scale, with only conventional knowledge and technology. The Ministry of Food and Agriculture reports that 2.74 million farmers engage in agriculture or livestock farming in Ghana.

The Food and Agriculture Sector Development Policy II (FASDEP II) was issued in 2008 as a policy of high order within the agricultural development policy. Six sector objectives were listed in the policy as follows: i) food security and emergency preparedness, ii) improved growth in incomes, iii) sustainable management of land and environment, iv) increased competitiveness and enhanced integration into domestic and international markets, v) application of science and technology in food and agriculture development, vi) effective institutional coordination.

Medium Term Agriculture Sector Investment Plan (METASIP) has aimed to attain the above development target concerning investment in the agricultural sector. Promotion of agricultural mechanization through collaboration with the private sector is emphasized for agricultural development in Ghana, especially in the agricultural mechanization and strengthening capability of the private sector concerned with agricultural mechanization regarding METASIP. AMSEC (Agricultural Mechanization Service Centers) program was executed as a main program of the MOFA from 2007 to establish AMSEC in collaboration with the private sector.

The policy concerning agricultural mechanization is considered one of the main pillars of agricultural development policy in Ghana, the same as other sub-Saharan countries. Therefore, the above agricultural mechanization policies have been executed. However, constraints such as a limited budget, shortages of concerned personnel, unestablished relevant systems and regulations with a lack of government authority and commitment are causing the policies and strategies to be executed ineffectively in Ghana.

Agricultural Engineering Service Directorate (AESD) under Ministry of Food and Agriculture (MOFA) is in charge of agricultural mechanization in Ghana. The capacity of AESD needs to be developed in order to sustain AMSEC business model. MOFA requested JICA (Japan International Cooperative Agency) to dispatch a JICA Expert as a business management adviser for AESD and AMSEC.

1.2 Framework of the Project

1.2.1 Purpose and Substance of the Project

The purpose of the Project is to enhance the capability of AMSEC to provide agriculture mechanization services to smallholder farmers. JICA experts advise AESD about the following activities for capacity development of counterparts:

To review current status of agricultural mechanization in Ghana,

To select methodology and activity to enhance sustainability of AMSEC business, and

To examine the appropriate service plan and affordable service fees by conducting a pilot project which improves smallholder farmers' access to mechanization services.

Overall Goal, Purpose, Outputs and Activities / Inputs are as mentioned below:

(1) Overall Goal:

Accelerating the agricultural mechanization sector in Ghana to be aligned with METASIP and FASDEP II

(2) Purpose:

The availability of machinery and mechanization services to smallholder farmers, as and when needed, and at affordable rates in the identified priority areas

(3) Outputs:

- 1) Present condition of agricultural mechanization is clarified.
- 2) Pilot projects / interventions to support AMSEC services are identified.
- 3) The identified pilot projects which improve smallholder farmers' access to AMSEC are implemented.

(4) Activities / Inputs:

- 1)-1 Study existing mechanization policy and statistics
- 1)-2 Review the past study
- 1)-3 Study the state of agro-processing
- 1)-4 Study the mandate and services of AESD
- 1)-5 Study the repayment situation of AMSEC
- 1)-6 Study the payment status of AMSEC service fee
- 2)-1 Analyze the problem and identify the possible intervention on mechanization
- 2)-2 Identify area of capacity development of AESD & AMSEC
- 2)-3 Identify the approaches to enhance smallholder farmers to access AMSEC
- 2)-4 Suggest the approaches to accelerate AMSEC, and suggest 2KR (Second Kennedy Round: Grant Assistance for Underprivileged Farmers) program
- 3)-1 Implement necessary trainings for improvement of management to AESD and AMSEC

- 3)-2 Promotion of information sharing between farmers and AMSEC for better access to machinery service
- 3)-3 Implementation of pilot projects
- 3)-4 Suggestions for the development of AMSEC Management Guideline

1.2.2 Implementing Agency

Agricultural Engineering Service Directorate (AESD) under Ministry of Food and Agriculture (MOFA) is an implementing agency.

1.2.3 Target Area

The target area is the whole country of Ghana. The JICA Experts will be based in AESD Head Office. Actual status and financial condition of AMSEC in nationwide, farming system and demands of farmers on agricultural machinery services are surveyed under the Project. Based on the result of the survey, the Winneba area in Central region, Ejura area in Ashanti region are selected as pilot project areas for the first year of the Project, and Damongo area in Northern region, Wa West area in Upper West region are also selected for the second year.

1.2.4 Target Group

Target groups of the project are AESD, AMSECs and Farmers or Farmer based organizations (FBO) who can access AMSEC in the target area. The first year of the Project mainly targets AMSEC managers and machine operators in the pilot project area (1st year: Winneba and Ejura; 2nd year: Damongo, Wa West).

1.2.5 Project Period

The Project consists of a first year and second year stage. The Project started from April 2014 and will be finished by August 2015. The period of the first year and second year stages are shown below:

The first year stage: from April to October 2014

The second year stage: from March to August 2015

2 Project Activity

2.1 Output 1: Current Situation of Agricultural Mechanization Approach is Confirmed

2.1.1 Activity 1: Investigation of Agricultural Mechanization Policy and Current Situation

As for the agricultural mechanization policy and current situation in Ghana, the project team collected data and information from many sources, and summarized it as the AMSEC survey report and agricultural mechanization status. The data collection methods included: commissioned questionnaire interview research of 29 sampled AMSECs, direct interview of AMSECs by the project team, direct interview of agricultural machine dealer, direct interview of AESD staff and literature research. By conducting this research, the project team investigated how agricultural mechanization is placed and implemented in agricultural policies, the current situation of agricultural machineries in the country, and the current status of each AMSEC business.

In FASDEP II, it is mentioned that the objective of agricultural mechanization is to facilitate the access of farmers and agro-processors to mechanized services at an affordable cost. The following four challenges about mechanization are pointed out in the policy.

- Low level of mechanization due to limited availability and access to appropriate agricultural machinery, equipment and mechanized services.
- High cost of agricultural machinery and equipment.
- Inadequate human resources in agricultural mechanization.
- Inadequate post-production infrastructure (i.e. storage, processing, transport etc.).

Although specific strategies which aim to address the above issues are established in FASDEP II, METASIP has also aimed to attain the above development target concerning investment in the agricultural sector. In METASIP, the following targets are mentioned as mechanization relating to point one.

- At least one (private sector led) mechanization center is established in each of the 216 Metropolitan Municipality District Assemblies (MMDAs) by 2015 to provide diversified services to all types of farmers and agro-processors (small, medium and large).
- The private sector is facilitated to establish mechanization service centers (for production and processing) in specific areas where rainwater harvest is a major source of water for farming (e.g. Fumbisi, Katanga, Nasia, Nabogu and Soo valleys).

On the other hand, NRDS (National Rice Development Strategy) was issued under the purpose of FASDEP II and CARD (Coalition for African Rice Development) to double the production of rice by 2018. The FASDEP II listed rice as an important commodity. It also listed the

improvement of accessibility for agricultural machinery as a sub-sector strategy.

NRDS emphasizes enforcing supply of farm machineries and accessibility to postharvest / processing equipment as a short term strategy, and the necessity of enforcing the role of private sectors and the importance of technical training for personnel engaging in the work concerning agricultural machineries (operators, mechanics, etc.).

In the context of these agricultural mechanization policies, a 4-year program was executed as the main program of the MOFA from 2007 to establish AMSEC (Agricultural Mechanization Service Enterprise Centers) in collaboration with the private sector.

As mentioned above, METASIP and NRDS both attach a high value on agricultural mechanization, especially in the enhancement of the related private sector. Therefore, it is demanded to promote agricultural mechanization through the utilization of the private sector for Ghanaian agricultural development.

As shown in Attachment-I, MOFA procures agricultural machinery from governments including Japan since 1990 and promoting agricultural mechanization. The machines selling for AMSECs are also these kinds of assistance materials.

2.1.2 Activity 2: Review of the Previous Research Related to Agricultural Mechanization

The project team reviewed previous research reports related to Ghanaian agricultural mechanization to perceive current circumstances.

FAO's (Food and Agriculture Organization of the United Nations) report, "Agricultural mechanization in Mali and Ghana: strategies, experience and lessons for sustained impacts" (2010) mainly focuses on the agricultural mechanization policy based on the macro policy level. The following major constraints were identified in both Mali and Ghana: (i) poor access of farmers to mechanization technologies; (ii) lack of skilled tractor operators; (iii) infant commercialization of agricultural produce (no guaranteed markets, low market prices, etc.); (iv) poor availability of spare parts; (v) farmers usually do not consider agriculture as a business but as a way of life; and (vi) the existing land tenure system. Also, one of the main constraints encountered in both countries was the lack of data to determine the long-term impacts of mechanization. Where data existed, it was generally not very reliable. On the other hand, the strength of Ghana is that the country already has relatively good infrastructure, numerous training institutions in agricultural engineering, a good extension service and a fairly well staffed Agricultural Engineering Services Directorate. Considering these factors and agricultural development policy, the report states the importance of macro policies to implement agricultural mechanization by setting proper agricultural mechanization strategy along with agricultural

development policy and national development policy.

In 2013, IFPRI: International Food Policy Research Institute, published “Agricultural Mechanization in Ghana.” In this report, IFPRI analyzed the promotion of agricultural mechanization by providing machinery service and whether AMSEC project has development potential by using profit frame analysis and current data. According to the report, the low level of the tractor operation rate which was caused by the limitation of the numbers of operational tractors, is the critical constraining factor of the AMSEC project. The report concludes that increasing the number of tractors in operation is the most important factor to develop the agricultural machinery service market in Ghana which has a dominant number of small-scale farmers. Besides, not only the current machinery provision by the government, but also promoting the introduction of the private sector to the agricultural machine market will encourage the expansion of the entire agricultural machinery market.

As for the Japanese research report regarding agricultural mechanization, the reports of grant assistance for underprivileged farmers were published in 2005, 2007 and 2009. And these preparatory research reports were also published in 2012 and 2014. The reports explain the current situation and issues about the agricultural sector in Ghana, the past results of 2KR and the effects, adequacy evaluation and suggestions for future effective 2KR promotion. According to a recent report, there are suggestions about strengthening the machinery maintenance system, the role of government and public sector related to accessibility of spare parts, necessity of farm management and correspondence about residual implements.

In 2006, Japan Agricultural Development and Extension Association published a research report, “The Direction of Technical Cooperation for Agricultural Mechanization in Ghana” as a commissioned project from the Ministry of Agriculture, Forestry and Fisheries of Japan. This report describes challenges and the direction for improvement regarding the following issues based on the field research in Ghana to indicate the direction of Japanese technical cooperation: (i) development and production of agricultural machinery in the country; (ii) machinery utilization, repair and maintenance; (iii) training and extension system. Furthermore, the report includes the technical guideline for the proper use of agricultural machinery.

JICA published a research report called “Agricultural Mechanization Research Support Policy Study in Africa” in 2012. The report is based on the field research in Senegal, Ghana, Tanzania and Uganda, and it explains lessons and issues for Sub-Saharan African agricultural mechanization cooperation, considering the actual situation in these countries.

Especially in the mechanization of rice cultivation, “The Study for the Promotion of Domestic Rice in the Republic of Ghana” was implemented from 2006 to 2008, and the technical

cooperation project, “Project for Sustainable Development of Rain-fed Lowland Rice Production in the Republic of Ghana” was launched from 2008. Both project reports explain the importance of improving production efficiency and volume by using agricultural machinery, including postharvest machines through Japanese international cooperation, which aims to increase rice production in Ghana.

2.1.3 Activity 3: Perceiving current circumstances of postharvest

Most AMSECs are not providing agricultural services related to postharvest such as threshing, drying, rice milling, flour milling and storage. They only provide ploughing, harrowing and some maize threshing services only. To improve the operation rate of the tractor in the future, maize threshing, operated during a different seasons will be one of the solutions. Hence, the team is going to collect basic data about other agricultural machinery in the pilot project area next year.

According to “the study for the promotion of domestic rice” (JICA) in 2010, the main issue of the rice postharvest is “low quality level of milled rice.” This issue is caused by inadequate quality control during the process between paddy rice production and rice milling. Especially, delay of harvesting and threshing causes serious a decline in the quality of the paddy. In addition, the research also pointed out that the rice miller’s technical and management obstruction factors impede the self-reliant development of rice processors, creating difficulty regarding quality improvement of milled rice.

The following are the main points of the research.

- As harvesting and threshing are implemented with inappropriate timing, paddies are over dried or insufficiently dried, which causes high humidity defects. Also, deterioration of paddies is caused by inadequate storage. These issues are caused by inappropriate treatment before the rice milling process and produce low quality materials; therefore even if rice processing technologies are improved, the quality of polished rice still remains at a low quality level.
- Processing costs for rice milling are based on uniformity volume standards regardless of polished rice quality and yield rate. Therefore rice milling operators are not willing to improve the quality of them because of the low incentive to do it.
- The polished rice which is processed by using Engelberg rice huller and a one-pass rice milling machine has less competitiveness than imported rice from the perspective of quality level.

According to the survey of the milled rice by JICA Ghana office, it was claimed that the quality of domestic rice, especially of small-scale rice millers, are at a significantly low level. (The ration of head rice is almost half compared to imported rice.)

Project Completion Report

Currently, some farmers under the JICA project, “Sustainable Rainfed Rice Production Development Project,” are producing a high quality level of rice and they significantly improve the volume of production and incomes from them. Also, some distributors in the Northern region are purchasing high quality rice by paying higher prices.

According to a dealer who manages a Chinese rice milling machine in Accra, demands for a small-scale rice milling plant are gradually increasing apart from the one-pass rice milling in the urban neighborhood rice production area in recent years. These kinds of rice milling plants are generally purchase paddies and they complete the process until the final products packaging process, which is not only a milling service, and then it distributes it to retailers.

Considering the current situation of rice postharvest in Ghana, some signs to improve the quality of rice are emerging in recent years.

2.1.4 Activity 4: Research on the AESD’s role

According to AMSEC Policy Guideline, MOFA/AESD plays three roles under the AMSEC program.

1. Supervision

MOFA/AESD shall during the operation period of the center, have supervisory responsibility. This is to ensure that the machinery and equipment are applied effectively for the purpose in which Government delivered them.

2. Monitoring

MOFA/AESD shall institute effective monitoring procedures to ensure that best practices are adopted during the operation phase

3. Training

MOFA/AESD shall continue to offer periodic and regular training in care handling and operation techniques to ensure extended operational lives of machinery and equipment. Also, training will cover enterprise management, including financial management and institutional development and marketing.

Actually, MOFA/AESD only plays a role in training operators currently, and the role of supervision and monitoring have not been implemented. Due to these circumstances, MOFA/AESD is not able to perceive the actual situation of the AMSEC.

Although the main reason for this failure is budgetary deficit, the shortfall is caused by inobservance of planning and budget calculation. Regarding monitoring and training for managers and operators, planning of monitoring (when, what, who and how will it be) and calculation of the monitoring budgets have not yet been enforced. Therefore it is going to be difficult to apply and secure a budget.

Project Completion Report

The current selection process of the AMSEC is the following procedure: 1) MOFA/AESD advertises for the AMSEC program, 2) applicants are selected by each regional MOFA/AESD division, 3) regional director provides recommendation letter and selected applicants submit it to AESD, 4) applicants pay deposit down money, 5) applicants receive machinery after the contract. However, there is no obligation to submit financial statements and a management plan.

2.1.5 Activity 5: Research about AMSEC services situations

In June and July 2014, a commission for research survey aimed at 29 sampled AMSECs out of 89 established nation-wide regarding their business conditions was implemented. According to this survey, AMSECs are classified into the following three categories.

- Machinery services from machine holding farmers to neighboring farmers
- Machinery services from private business operators
- Collaborative purchases by FBOs

Application of the AMSEC establishment is limited to a private company, agricultural service providers, and FBOs. Majority of the AMSECs which were established until now are private companies or personal machinery service business operators, and participation of FBOs which MOFA promotes to enter the AMSEC program are still limited.

The number of AMSECs established in each region is shown as table 2-1. Seventeen offices were established in the initiation year of 2007 (distribution started in 2008). Fifty-two offices, the most in number, were established in 2009. The numbers declined afterwards, and just 5 offices were established in the final year of 2011.

Table2-1: Number of AMSEC Established by Region and by Year

Region	2008	2009	2010	2011	Total by Region
Western	0	1	0	0	1
Central	1	2	1	0	4
Greater Accra	1	2	0	0	3
Eastern	2	6	2	0	10
Volta	1	6	0	2	9
Ashanti	5	0	0	0	5
Brong Ahafo	2	8	3	0	13
Northern	2	16	8	2	28
Upper West	2	3	1	1	7
Upper East	1	8	0	0	9
Total	17	52	15	5	89

Source: AESD

Project Completion Report

Of the surveyed AMSECs, 5 AMSECs were established in 2008, 20 AMSECs in 2009 and 4 AMSECs were established in 2010, which were selected to be proportionate to the total established numbers.

Figure 2-1 indicates AMSEC's average maintenance and repair cost in 2013 by the past year after the establishment. Generally, the oldest AMSECs tend to indicate a higher cost for maintenance and repair. But AMSECs that were established in the year 2009 had the highest average cost. The reasons for these discrepancies seem to be due to the low level of management skill of the AMSEC because numerous AMSECs were established in 2009 and many of them might not have an adequate level of skills to manage them.

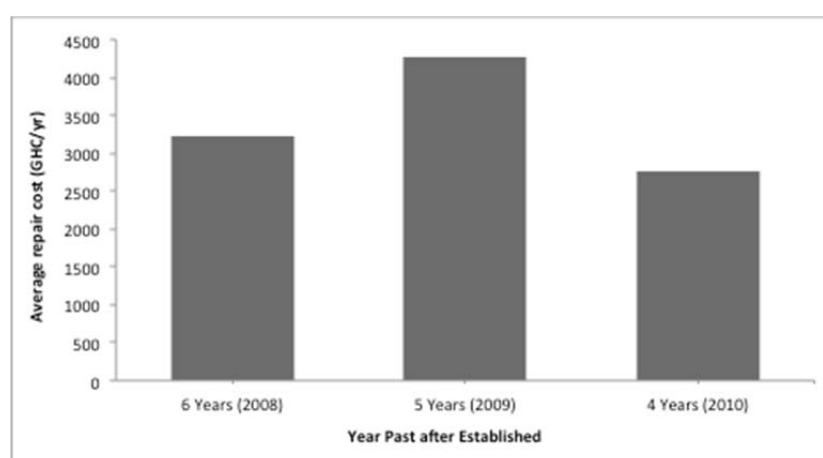


Figure2-1: Annual Maintenance and Repair Cost by the Year Past after Established (2013)

Source: Questionnaire Survey against AMSEC

Table 2-2 shows the current machinery situation of surveyed AMSECs. Five to 6 years passed after the installation, 37 % of the total numbers of tractors are not in operation. These inoperative tractors are of a comparatively higher level than other machinery. It can be seen that some AMSECs cannot use any machinery currently, and those AMSECs seem not to have a sufficient level of business management ability as agricultural machinery service providers.

Table 2-2: Condition of Machinery, Implements and Equipment

Equipment	Original number	Working equipment	Unserviceable equipment	Damaged equipment %
Tractor	162	102	60	37.0%
Plough	112	94	18	16.1%
Harrow	59	51	8	13.6%
Trailer	20	18	2	10.0%

Source: Questionnaire Survey Against AMSEC

Figure 2-2 indicates the annual ploughing service acreage. This figure shows that most of services are concentrated on below 300 hectare with 5 tractors, if all are serviceable.

Project Completion Report

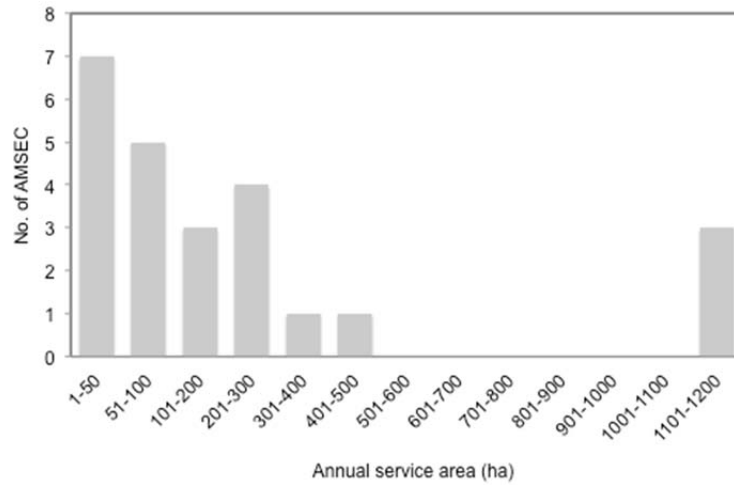


Figure2-2: Annual ploughing service by AMSEC

Source: Questionnaire Survey against AMSEC

Service fee for agricultural machinery service

Payment methods for machinery services are generally by cash or in-kind. Payment terms are classified with prepayment, payment after the service and payment after the harvest. Although the payment method and payment term vary, service providers tend to choose a customer who can pay by cash in advance for risk alleviation. In terms of service costs, in 2010, the national average price for ploughing was 46 USD per one hectare. The prices are different from 42 USD in savanna area, 47 USD in forest area, and 50 USD in coastal savanna area. According to the questionnaire survey for AMSEC in 2014, the AMSEC in Central region charges 70 GHS for ploughing per acre (about 48 USD / ha), and another AMSEC in Ashanti region replied that the ploughing service cost is 65 GHS / acre (about 30 USD). Generally, the price for harrowing service is almost half of the ploughing service fee anywhere. However, it is expected that the service price may fluctuate depending on the rising costs of fuel led by inflation.

2.1.6 Activity 6: Investigation for the condition of payment for equipment by AMSEC

The establishment of AMSECs started in 2007, the provision of agricultural machinery to them was implemented for four years from 2008 to 2011. The price of the equipment was half the market price. Sales were made with a 10-30% down payment with a 5 year no interest loan for the rest (at least 1 payment per year) in 2008 and 2009. For 2010 and after, the down payment was increased to 70% or the full amount in a single payment. Payment for the rest of the amount is the same as before, for a 5 year no interest loan (at least 1 payment per year). However, the government required a bank guarantee for 30% of the remainder.

On the other hand, 2KR equipment raised their down payment from 50% to 70%. It also began to require a bank guarantee for the amount of the remainder, similar to AMSEC. Moreover, the

Project Completion Report

loan period for 2KR was shortened to 3 years since the program requires a funding period for the revolving fund.

Table 2-3 indicates the condition of the payment of sold equipment for AMSEC during the past 3 years, 2008-2010, with the data acquired in June 2014. Full payments in cash aside from the loans are not included in this figure. Loans included in this figure are all in the 10% - 30% down payment range of the total amount with a 5 year no interest payment. The payment period for 2008 loans already ended in 2013, and also the 2009 loan period will end in 2014; however, the collection rate is only 17.2% for 2008 loans and 44.9% for 2009 loans. These collection rates are not even half of their total amounts. Also, 32% of the total loans set for AMSEC have not made any payment at all after the down payment. The total amount of the sales that decreased in 2010 is probably because many AMSECs choose to make single lump sum payment after the change in payment policy.

The repayment rate of the AMSEC could be lowered even more than the figures in the accounting report when considering the following situations, such as: the decrease in the exchange rate of the local currency (GHS) to 1/3 in USD and that the inflation rate has increased about 4.8 times while the loan charges no interest. Therefore, the loan holders can take advantage of this by postponing the repayment. On the contrary, the value of uncollected loan assets for the government is decreasing every year for the GHS base.

Also, the problem was identified from the results of the survey the questioner conducted for the designated 29 AMSECs that 37% of distributed equipment is not in operation due to mechanical failure. This loss of revenue could be considered a factor of delayed loan repayment for the government from AMSEC.

One of the factors for the low debt collection rate is that no monitoring system has been instituted to follow-up on the loan payment. AESD prepares contract and allocates equipment, but they are not obligated to monitor loan payments. Therefore, AESD has not performed any monitoring and has no information concerning the repayment situation from AMSEC since AESD has not been allocated a budget for monitoring. MOFA should periodically provide information on the repayment status of AMSEC to AESD for monitoring AMSEC activity, as well as a necessary budget.

Table 2-3: The Payment Situation of Machinery Sales Proceeds (GHS)

Year	Cost of goods (GHS)	Repayment (GHS)	Repayment (%)	Balance (GHS)
2008	1,531,200	263,602	17.2%	1,267,598
2009	3,502,900	1,573,969	44.9%	1,928,931
2010	744,000	260,100	35.0%	483,900
Total	5,778,100	2,097,671	36.3%	3,680,429

Source: MOFA

2.2 Output 2: Experimental Methods and Activities to Improve Sustainability of AMSEC Services are Clarified

2.2.1 Activity 1: Approaches to Strengthening of AMSEC Business Management

(1) Present Situation and Issues on AMSEC Service

Aiming to improve farmers' access to agriculture machinery service, 89 AMSECs were established from 2008 to 2011. In total, 462 sets of tractors and implements (plough, harrow and trailer) were sold with subsidized prices to these AMSECs. In order to grasp the present situation of AMSECs, a field survey was conducted sampling 30 of these AMSECs in June 2014. Twenty-nine AMSECs answered the questionnaire. In total, 157 sets of tractors and implements were sold to these 29 AMSECs. Of which, 112 tractors are currently serviceable. This means that about 30% of tractors have been retired even in usual lifetime of a tractor (10 years). It is believed that the number of AMSEC tractors will decrease with accelerating speed under the same situation. Several reasons for this breakdown are pointed out in past surveys and reports, such as the improper operation by low skilled operators, a weak spare parts supply network, stumps and stones in farmland, and low durability of tractors.

In our survey, as a problem and constraint, one third of managers indicated a small number of skilled operators and cash management. High maintenance costs and accounts receivable affect cash management. Half of surveyed AMSECs showed difficulties in record keeping. There are a few AMSECs that have a clear business plan, but only 4 AMSECs answered that there are problems in business planning. It seems that they do not acknowledge the importance of the relationship between record keeping and business planning.

(2) Internal and External Environment and Approaches for Improvement of AMSEC Business Management

Based on the results of the AMSEC survey, the internal and external environment of AMSEC was identified, and finally four approaches for the improvement of AMSEC were analyzed by cross SWOT analysis (See Attachment II).

1) S/O Approach

- To expand ploughing, harrowing and transportation service by increasing the number of tractors.
- To expand service varieties by increasing the variety of implements, such as the planter, sprayer, and sheller and combine harvesters.
- To rent out or transfer equipment from AMSECs in low demand areas to AMSECs in high demand areas or increase the number of AMSECs.

2) W/O Approach

- To increase service volume and improve profitability by decreasing breakdown and repair through capacity improvement of operators and mechanics and their treatment.

Project Completion Report

- To achieve spare parts stock and quick repair by the improvement of cash management through improvement of management skills.

3) S/T Approach

- To seek service demands nearby presently servicing small plots.
- To advise farmers to improve their farmland condition suitable for mechanization.
- To stock expensive spare parts in partnership with neighboring AMSECs
- To provide cultivation techniques to farmers as well as machinery services to improve crop productivity.

4) W/T Approach

- To stop machinery service at small plots.
- To stop machinery service remote farms.
- To stop machinery service farms that are not suitable for mechanization (stumps and stones).
- To stop machinery service farmers who are behind on their bills.

(3) Selection of approaches to enhance AMSEC skills of management and operation

Each AMSEC has different internal and external environments, and appropriate approaches have to be taken considering their individual environments. AMSECs who can take a S/O approach are good enough on skills of management, operation and maintenance. They do not need technical assistance, but need financial assistance to expand their business. According to the survey results, there are many AMSECs who need to take a W/O approach which has room for improvement on management, and operation and maintenance. The S/T approach needs individual diagnosis or longer term assistance. And, considering the purpose of the AMSEC establishment, the W/T approach should not be taken into consideration.

In terms of importance and urgency, the W/O approach will be given first priority to be tackled by AMSECs.

2.2.2 Activity 2: Identification of Training Contents for Capacity of AESD and AMSEC

(1) AESD

1) Capacity of monitoring and evaluation of AMSEC programs

AESD has to monitor and evaluate AMSEC programs in terms of both management and operational skills. Then appropriate actions such as advice and training can be taken for AMSEC capacity building.

2) Capacity of conducting training for AMSEC

As the time of the AMSEC establishment, operation and maintenance training was conducted, but business management training was not carried out even though it is planned in the program

Project Completion Report

paper. Basic knowledge on business management has to be adopted by officials involved in the AMSEC program as well as operation and maintenance.

3) Capacity of facilitation of AMSEC network

In order to share equipment or stock spare parts in the partnership, AESD needs to facilitate revitalization of AMSECs networks at the regional and national level.

4) Capacity to allocate budget for above activities

The amount of investment for each AMSEC program from MOFA is huge, but most of them are for machinery procurement. However, the budget for AMSEC training and monitoring, effective at utilizing these machineries is quite limited. It is needed to ensure enough of a budget to improve the quality of each AMSEC program.

(2) AMSEC

The following is the expected capacity of each AMSEC.

- 1) Capacity to develop a short and medium term business plan and investment plan.
- 2) Capacity to make a detailed operation plan at a seasonal and weekly level.
- 3) Capacity to administer daily business operations (record keeping).
- 4) Capacity to manage business (organizational arrangement, appropriate operation of machinery, spare part stock).
- 5) Capacity to maintain customer relationships (manage customer information, communication).

As a result of the Pilot Project:

- Few managers could fully understand the content of the training, but levels of the above content are too high for most AMSEC managers. Most AMSECs provide machinery services to non-irrigated farms, and it is not necessary to conduct daily based planning, because the service plan often has to be changed due to weather conditions. It is better to know the maximum service capacity from the past year's records, in order to avoid overbooking.
- A manager has to know information regarding a customer's farm (location, acreage, soil condition, and availability of stones and stumps), so that operators and farmers cannot cheat regarding the acreage and service fee.
- Labor management is also important by salary to enhance motivation on the careful handling of equipment.
- More time is needed for practical operation training of operators, especially for the planter and boom sprayer.

Project Completion Report

2.2.3 Activity 3: Improvement of Access to Machinery Service by Promotion of Information Sharing between AMSEC and FBO

Sharing of information on both the supply and demand side was promoted by the facilitation of AEA (Agriculture Extension Agent) to gather smallholder farmers' group (FBO) inquiries, so that they can receive machinery services easily. On the other hand, the tractor repair program was provided by the project to host AMSECs to respond to the above additional inquiries of selected FBOs. Then, costs and benefits of this repaired tractor were analyzed at each host AMSEC in the Northern region and Upper West region as a pilot project. During the pilot project period, staff of the AMSEC unit and JICA experts took the initiative to facilitate information sharing among stakeholders, but it is not feasible that AMSEC units facilitate all AMSECs and FBOs to share information within the entire country. The regional engineer who is appointed by AESD will likely be a facilitator for sharing information between AMSEC and AEA/FBO. (Refer to the following illustration.)

The following conditions were used for selection of target FBOs.

- Mainly organized by farmers who has farm less than 5ac.
- No members who have a tractor.
- Female members are included.
- There is a leader or a contact person who knows a members' farm acreage and crop well, and can adjust members' needs with the AMSEC.
- An FBO that has difficulty in accessing machinery services (quantity and timing).
- Members can afford to pay a service fee. (Payment terms are decided by negotiation between the AMSEC and FBO.)
- Farms are located in a certain area, not scattered.
- Farmers agree to remove stones and stumps before receiving a service.

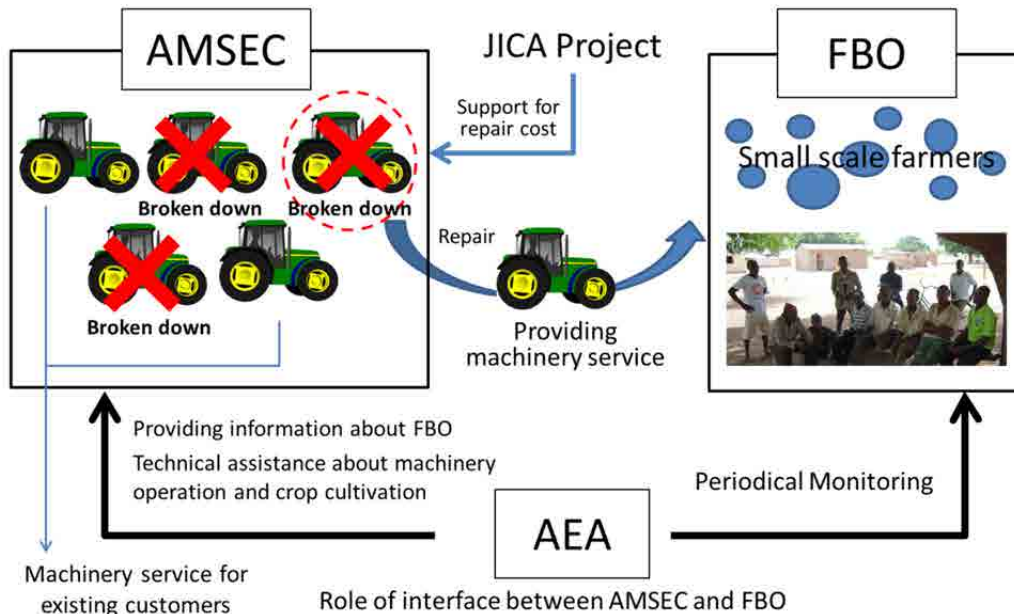


Figure 2-3: Approach to Stakeholders in Pilot Project
Source: JICA Expert

Project Completion Report

Five FBOs (total 487ac) in Northern region and Four FBOs (total 317ac) in Upper West region were selected, and host AMSECs provided machinery services to them. The service schedule and payment terms were discussed by AMSEC and FBO; the AMSEC tried to provide efficient services as desired by FBOs.

Total acreages of each selected FBO varied, but all FBOs have service needs more than 50ac, which is enough acreage for AMSECs to provide services. Stones and stumps were removed, not completely but better than before, because FBO leaders repeatedly noticed it.

2.2.4 Activity 4: Reflection of Successful Machinery Service to 2KR and AMSEC Program

In order to collect lessons learned from 2KR programs, interviews were conducted of beneficiaries of 2KR programs in the northern and southern area. In general, one set of equipment was sold to one farmer in the 2KR program. So, the farmer uses the tractor for his own farm, then provides machinery services to the neighboring area. The service fee equivalent to the service fee of other service providers. It depends on the region and cultivating crops

Beneficiaries in the southern area tend to cultivate cash crops on a large-scale farm, and they use the tractor mainly for their farm. Meanwhile, in northern regions, beneficiaries provide machinery services to 40-60% of the total land area in which a tractor works. A church, in Upper West

region, provides machinery services on 94% of the farm land in which a tractor works.

Regarding the payment terms of 2KR equipment, it has become strict, with a 100% payment in advance. So, 2KR equipment were sold to beneficiaries who can prepare cash easily, like middle to large-scale farmers cultivating cash crops. All visited beneficiaries in southern regions grow pineapples on large-scale farms, and they intend to buy more tractors.

They have problems similar to AMSEC with technical skills of operation and maintenance, spare parts supply, and availability of skilled operators, and access to a dealer mechanic. The 2KR program sells single equipment (tractor or power tiller) to one farmer. The beneficiary can control the number of equipment depending on their management and financial capability. The government can lower a bad debt risk, as well as farmers can avoid the risk of future insolvency. This can be introduced to the AMSEC program.

The need for a training on operation and maintenance of 2KR beneficiaries is as high as AMSEC. There are beneficiaries who can pay for training. They think it will be cheaper than the cost of repair and opportunity costs. It is necessary to improve the technical capacity of operators through periodic refreshment training.



Distributed tractor of 2KR in 2012

Project Completion Report

2.3 Output 3: The identified pilot projects which improve smallholder farmers' access to agriculture mechanization is implemented

2.3.1 Activity 1: To conduct necessary trainings for improvement of management to AESD and AMSEC

AMSEC unit staff in AESD are needed to learn monitoring and evaluation skills about AMSEC business management, and the basics of operation and maintenance about tractor and other implements. There are only 3 staff in the AMSEC unit, so the technical transfer of those skills was achieved through job training.

Training for targeted AMSECs is classified into business management training for managers and machinery operation and maintenance training for operators. The below information are the numbers and areas of targeted AMSECs for the training.

	Venue	Target AMSECs
1st year	Ejura, Ashanti region	5 AMSECs (5 Managers, 9 Operators)
	Winneba, Central region	4 AMSECs (5 Managers, 11 Operators)
2nd Year	Wa, Upper West region	5 AMSECs (5 Managers, 13 Operators)
	Tamale, Northern region	5 AMSECs (5 Managers, 13 Operators)

The training is essentially the same as the 1st year's, but there are some changes based on the results of previous training. The following are improvements from the first year.

- An increase in the practical training of tractor operation on the field to establish enough operation time for all participants
- An increase in the training days of tractor operation from two days to three days
- AMSEC managers also need to participate in the operator's training to recognize the importance of tractor maintenance
- Preliminary research for targeted AMSECs will be implemented before the training to understand the skills of managers and operators.

Preliminary research for targeted AMSECs

In the second year, preliminary research for targeted AMSECs was conducted to understand the current business and machinery status. Furthermore, the AMSEC project team including the AESD AMSEC unit and JICA expert visited MOFA regional office to explain the summary of the training and pilot project and request the cooperation of the regional director and regional engineer in each Northern region and Upper West region.

The information of target AMSECs based on the preliminary research are as following.

Project Completion Report

Table 2-4: Information about Target AMSECs in Upper West region and Northern region

【Upper West region】

Name of AMSEC	Participants		Location	Grant year	Repayment status (GHS)		
	Manager	Operator			Total	Paid	Balance
Wa West Dist. Assembly	1	5	Wichau (Wa west)	2009	58,500	48,100	10,400
Wa East Dist. Assembly	1	2	Wa east	2009	58,500	20,000	38,500
Nadowli Dist. Assembly	1	2	Sambo (Nadowli)	2009	58,500	20,000	38,500
Nyivori Tona Dist. Assembly	1	2	Mangu	2008	116,000	23,600	92,400
Jirapa Dist. Assembly	1	2	Ullo (Jirapa)	2009	58,500	58,500	0

【Northern region】

Name of AMSEC	Participants		Location	Grant year	Repayment status (GHS)		
	Manager	Operator			Total	Paid	Balance
Sakfos Farms	1	5	Damongo	2009	63,000	55,000	8,000
Laangu Farmers Association	1	2	Janga	2009	63,000	20,000	43,000
Kurbandi Farms	1	2	Tamale	2009	63,000	20,000	43,000
Tijo Farms	1	2	Tamale	2009	63,000	12,000	51,000
Fathi Agro-Forestry Cooperative	1	2	Tamale	2008	116,000	20,000	114,000

Source: Results of interview by project team

According to the results of the preliminary research, there are no AMSECs who had finished the repayment of machineries in the Northern region. Even in the Upper West region, only one AMSEC has finished the repayment. The research also showed that there are many broken down tractors after they were distributed by MOFA. These poor machinery conditions lead to a decrease of machinery service capacities, and a decline in AMSEC's business revenue. An increase in repair costs and income decline creates difficulties for the repayment to MOFA. Each AMSEC emphasized that every AMSEC needed not only to improve their business management and operator's skills, but also to repair their broken down tractors. According to one AMSEC manager, there was an operator who abandoned the tractor when the operator broke it down. The managers, especially in Upper West region also insisted that there are difficulties in buying spare parts for the machinery and they have to go to big cities such as Tamale and Kumasi to purchase them.

Some AMSECs do not recognize their current repayment status due to the low frequency of monitoring by AESD and low level record keeping. There were monitored by AESD for one or two years after the machinery distribution around 2008. Therefore, some AMSECs were maintaining their service records during that time period. But currently many AMSECs are not

Project Completion Report

maintaining their records correctly and continuously. Many managers requested monitoring constantly for business management, including record keeping and technical advice for the tractor operator.

Training Content

(1) Training briefing, Training plan

1) Training for AMSEC managers (lecture, 1st and 2nd year: one day)

< Record keeping for the Manager and Planning & Management >

- Simple financial record (income and expenditure)
- Machinery service record (date, operator, farmer, acreage, charge, fuel)
- Maintenance and repair record (date, type of maintenance and repair, replaced parts, cost)
- Customer list (name, address, area, cultivating crop, service history)

< Business Planning >

- Skills for management strategy planning (Short / Middle-term business plan: 1~3 years)
- Skills for business planning (investment plan, business plan: Short / Middle-term)

< Business Operation >

- Driving operation management (Machinery operation management, Employee's management)
- Customer management (Record keeping, Customer communications)

2) Training for AMSEC operators (lecture and practical, 1st year: 2 days, 2nd year: 3 days)

Technical skill improvement for the Manager and Operators

- Tractor operation
- Implements operation (plough, harrow, maize planter, and boom sprayer, trailer)
- Maintenance of tractor and implements
- Record keeping

3) Monitoring

After the pre-season training, the JICA experts and counterparts visited target AMSECs periodically and monitored their operation and whether they followed the subjects they learned during the training. Additionally, the experts and counterparts advised AMSECs on management and operation of machinery service.

4) Data collection about the capacity of operating tractors and implements

Working efficiency and fuel consumption of each type of service are necessary for investment analysis. The data of boom sprayer and maize sheller could not be collected due to procurement of the implements and seasonal limitation.

Project Completion Report

5) Pilot project

The project team supported to repair broken down tractors for Sakfos in Northern region Damongo and Wa West in Upper West region as a pilot project. These approaches aim to expand target AMSECs' machinery service capacity and provide machinery land preparation services to FBOs, organized by smallholders.

6) Implementation of Post-Season Training 1st year: 1 day, 2nd year: 2 days

- Confirmation of the status of record
- Comparison plan and achievement
- Feedback of next season planning
- Machinery maintenance

(2) Pre-Season Trainings

1) Pre-Season Training

Period: From 4th to 6th August 2014 in Ejura, Ashanti region

From 11th to 13th August 2014 in Winneba in Central region

From 7th to 10th April 2015 in Wa, Upper West region

From 13th to 16th April 2015 in Tamale, Northern region

Participants of the training are managers and operators of targeted AMSECs in each region. The following table is a description of the pre-season training participants.

Table 2-4: Description of Pre-Season Training Participants

1st year	Ejura, Ashanti region		Winneba, Central region	
	Manager	Operator	Manager	Operator
Day 1	3	—	5	—
Day 2	4	10	8	11
Day 3	4	7	5	10
2nd year	Wa, Upper West		Tamale, Northern region	
Day 1	5	—	5	—
Day 2	3	16	5	17
Day 3	1	14	3	17
Day 4	1	15	4	17

*These numbers of participants are only invited target AMSECs' participants
Source: Project team

Other than the above, the AEA, regional engineer, and technicians also participated in the training.

Project Completion Report

(i) Training for the AMSEC manager

In this training, participating managers learned the basic knowledge of business management and financial management, such as the PDCA management cycle, maintaining a series of records, the utilization of records for service planning, making profit and loss statements, balance sheets, and financial analysis. In the service planning session, servicing small and remote farms and gathering other farms nearby was recommended. The following opinions were expressed by participants during the discussion after the training.

- Most of training content is understandable, but they are not familiar with how to use planning and financial management at a practical level.
- They want to know more about daily management knowledge and techniques.
- An one-day training is an acceptable length, and would like the opportunity for a training twice a year (May and August), including a follow-up training.
- It is difficult to obtain skilled operators.
- Managers are skeptical of the skill of operators.
- It is difficult to keep permanent operator to a limited operation period (there is only the plough and harrow).
- Because of temporary employment, operators' feeling of belonging to an AMSEC is very low. It causes dishonest behavior when it comes to service fees and the careless handling of equipment.

In the second year, the content of the pre-season training changed to concentrate on basic skills and locating more time for practical work, so that participants better understand their daily management practice. Participants, however, evaluated that they need more time for both theoretical and practical work. During the follow-up training, one day was added for reviewing their work during the season, as well as for the maintenance training. So, both the pre-season training and follow-up training needed 2 days to secure a certain level of training benefit.

Regarding the managers' knowledge about operation and maintenance of agriculture equipment, they could understand equipment they are familiar with, but did not know much about operation, maintenance, and adjustment of equipment which have not been generally introduced in Ghana, such as the planter, sprayer (both in northern and southern regions) and harrow (especially in northern regions). Content managers are interested in: detail business planning, financial



Training for managers in Wa

Project Completion Report

management, maintenance and maintenance planning. Participants thought that the timing of the training held was suitable, and they are willing to receive periodic training.

The difficulty in obtaining skilled operators is a common issue among AMSECs. Many managers feel skeptical of the skill of operators. Reasons why operators' skill is low is due to limited operation period (only plough and harrow), permanent employment cannot be offered to operators. Therefore operators' feeling of belonging to AMSEC is very low, and dishonest behavior regarding service fees and careless handling of equipment occur, while owners and managers do not have the strong motivation to train operators. Apart from that, in order for operators to utilize knowledge and skills learned during the training, managers have to maintain their motivation by a fair evaluation of work and reward.

High price and poor availability of spare parts were also challenges for AMSECs. Meetings with AESD and tractor dealers were held in Accra. The dealer pointed out that improper operation is a main cause of machine problems. The dealer promised it would send staff to the AMSEC who has problems, then promote repair of broken equipment with the decreasing spare parts price. On the other hand, AMSEC should make an effort to decrease costs for repair by improving the skills of operators, establish a maintenance and repair plan and allocate a budget it.

Information on the farm they provide services to, such as location, acreage, soil type, availability of stone and stump, has to be checked by a manager in advance. This activity was added to the training for managers in the second year.

(ii) Training for AMSEC operators

During the training, AMSEC operators learned about the types of tractors and implements, and the structure and function of implements in a classroom lecture. They also practiced maintenance, adjustment and operation of a tractor and implements (plough, harrow, planter and sprayer) in the field.

Most operators have never received this kind of formal training, and they have learned from more experienced operators or by watching their work. Even operators who have participated in a training have not learned systematic operation and maintenance. They have experience, but it means nothing if proper knowledge and skills are not acquired. They do not know much about how to maintain, adjust, and operate equipment. It is understandable that the number of AMSEC tractors are broken down. The following was learned during the training.

- Daily maintenance before and after the operation
- Periodic maintenance of equipment
- Adjustment of plough disk depending on soil condition
- Adjustment of level of harrow disk and gang angle
- How to use a hand-throttle

Project Completion Report

- How to adjust an engine revolution
- How to handle implements when turning the tractor
- Driving rout of a tractor on farmland considering the direction of the plough and harrow disk

The trainings for operators were held for two full days in the first year, and three full days in the second year. It was observed that participants in the northern regions listened more, with higher attention spans than operators in southern regions. The questionnaire indicated that operators in northern regions have less opportunity to participate in trainings than southern regions; it may be one of the causes of higher attention spans at the trainings.

In the second year, since the trainings were held near the regional capital, unexpected people (officials from the regional agriculture department, ordinary operators) participated in the training, and the number of participants reached more than 20. Although all participants worked actively with practical training, it is necessary to not exceed the set number of trainees from the view point of securing enough time per person for practical work, and understanding lecturers' guidance. In terms of increasing the number of participants per single training, it is effective for training performance (quantity of participants), but it is not recommended from a view point of the retention of knowledge and skills (quality of the training), because per person time for practical work becomes short. Ten to 15 participants are acceptable for 2 lecturers depending on a level of operators' skill.

According to the interviews and questionnaire survey, operators were required to fix a combination of operator-tractors, because it takes time for adjustment for unfamiliar equipment and it is unclear who is responsible for problems. Most operators want to receive periodic training to learn more about operation and maintenance, and the adjustment of inexperienced implements such as the planter and sprayer. Operators were also pleased to have an opportunity to exchange views with managers about issues AMSECs are facing.

Dealers generally conduct a maintenance training. In the case of a John Deere, a dealer can provide training to operators, but they can invite a lecturer from South Africa where their branch office is located. It is too costly (2,000USD/2days per participant) for AMSECs to organize it by themselves. The government has to provide the opportunity for operators to learn basic knowledge and skills on operation and maintenance, utilizing domestic human resources with a low cost.



Learning adjustment of plough (Wa)

Project Completion Report

Number of days for training

From the second year, training days for tractor operation were increased from two days to three days because most of the operators' skills were lower than expected. In order to learn correct tractor operation through enough practical training of all participants, at least three days training, an adequate number of participants and more than two tractors with an experienced trainer for each are needed. Especially, ploughing and harrowing operations which are the basic the machinery service, so two days of training are mainly for land preparation, including a lecture. The planter and sprayer need more careful handling, adjustment and maintenance than the plough and harrow, therefore a one day training for this session is not enough to master these implements. At least two more days are needed to learn the planter and sprayer operation at a useable level. Two to three days training as a pre-season training, practical work for one season and two days follow-up training are adequate training cycles for agricultural machinery training.

Lecturer

Through the project period, Mr. Abukari who was the former AESD official and Mr. Abudlai who was a lecturer at Faculty of Agriculture, University of Ghana, were in charge of both theoretical and practical trainings. Both of them were not only familiar with agriculture machinery, but also had a lot of experience training as a lecturer. Furthermore, they can teach illiterate participants in the local language. Their ages are in the sixties, and it is necessary to raise younger trainers to follow them. In the second year, the project invited Mr. Abu to the operator trainings in northern regions and put him in charge of a part of the lectures. He is a young engineer of AESD and also a candidate for master trainer. Since he was the only candidate of master trainer of agriculture machinery, the government should raise some more engineers for the candidate of master trainer.

MOFA has a plan to expand the AMSEC program with the support of the Brazilian Government. Once the program starts, demand for skilled operators will increase all over the country. In the short-term, the number of operators who have basic knowledge and skills have to be increased while master trainers who will train trainers for trainings will be necessary in the long-term.

The JICA expert was in charge of lectures for business management through the project period, because the lecturer had to develop and revise training materials and conduct lectures understanding the agriculture machinery service business well. The AMSEC guideline and training materials are now ready to use. So, if a suitable talent is available, she/he can work for the training on business management. Since the project started, the project has recruited a lecturer, but it has been difficult to find a suitable lecturer with an affordable price. Finally, National Board for Small Scale Industry (NBSSI), a counterpart agency of JICA Project for Formulating a Strategic Model for Quality/Productivity Improvement through Strengthening

Project Completion Report

BDS for MSEs, could provide one expert on business management to the AMSEC training program. He was invited to the follow-up training in Tamale, and through the discussion and advice to AMSECs, the project confirmed that he has enough capacity to conduct training on business management.

Training Materials

AESD has not systematically edited training materials on operation and maintenance of agriculture machinery. Until now, they have conducted trainings with gathered copies of operation manuals, textbooks, and references. In this project, a systematic textbook for operation and maintenance of a tractor and implements were developed for the operator training. Since the Twi language was needed to explain the operator training, it is believed that English manuals prepared by dealers are not useful for some operators. In the future, it is expected to develop a textbook using more figures and illustrations in order to be easily understood by illiterate people. Practical training is also important for operators.

A newly developed textbook on business management consists of theory and a practical workbook that is adapted to the AMSEC business type.

2) Monitoring

1st Year (Central region Winneba and Ashanti region Ejura: August and September 2014)

JICA/AESD team constantly monitored AMSECs who participated in the pre-season training during the land preparation season. The team checked the status of their record keeping and tractor operation and whether operators are ploughing and harrowing correctly as they learn. And also lecturers of the tractor operation training were accompanied and advised on technical assistance as a follow-up to the training on the field.

< Monitoring content >

- Advise AMSEC managers on record keeping
- Monitor the condition of the machinery service provided by participating training operators
- Data collection of machinery performance

(i) Field environment of machinery service

In the newly developed field, high weeds are common. The farmer wants the operator to do both cut and ploughing at the same in the field. So, the farmer does not care about the quality of the ploughing.

The participating operator was not following



Ejura, Ashanti region

Project Completion Report

techniques learned during the training, because the farmer does not require quality ploughing service, unless the planter and boom sprayer are not introduced.

(ii) Acreage of service field

Whether intentionally or not, farmers often do not inform the AMSEC of smaller acreage service fields. In the case of the monitored farm, almost half of the actual acreage was declared to AMSECs. According to the operator, farmers sometimes refuse measuring their field before servicing. The AMSEC manager has to measure farmland size and record the size on the customer record to prevent false declaration by operators or farmers.

2nd Year (Upper West region Wa West and Northern region Damongo: May to July 2015)

In the second year of the project, JICA/AESD team monitored targeted AMSECs: Sakfos in Damongo in the West Gonja district of the Northern region and Wa West in Wa West district of the Upper West region. And the project team repaired targeted AMSECs' broken down tractors to expand machinery service capacity and provide machinery land preparation services to FBOs, organized by smallholders as a pilot project. The initial monitoring period was the middle of May, with rainy season commencing in May in the northern area, but the team monitored the status of record keeping and implemented target FBO selection for the pilot project in May, and monitored actual machinery service in June to July, due to the delay in rainfall.

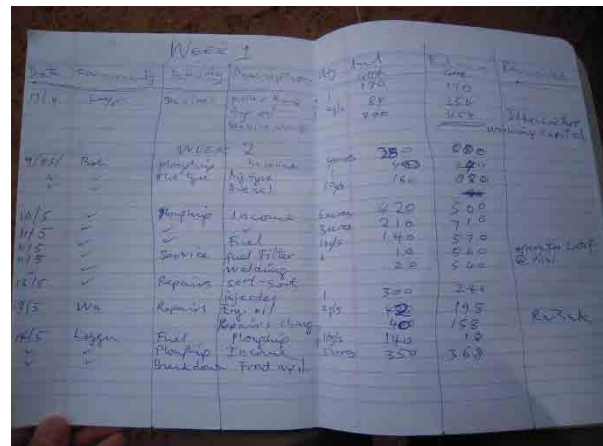
< Monitoring Content >

The following content is added to the 1st years' content.

- Confirmation of the condition of the repaired tractor
- Selection of FBOs for machinery service by repaired tractor
- Implementation of a stakeholder meeting (target AMSECs, JICA/AESD team, MOFA regional office including regional director, regional engineer and AEAs)

(i) Check Records

The monitoring team checked records maintained by Sakfos, host AMSEC of Northern region and Wa West, host AMSEC in Upper West region, and provided some advice to improve their record keeping. All participating AMSEC managers understand the importance of records keeping, and they started to maintain records. They are, however, not accustomed to maintaining records,



Monitoring of records

and many questions, such as the difference between repair and maintenance, why records of tractor movement are necessary, occurred during the visits. The understanding of visited managers was enhanced through providing advice with the actual records.

(ii) Monitoring of the condition of ploughed farmland

The JICA/AESD team visited ploughed farmland where a training participated operator provided machinery service. The team evaluated the result of their service and interviewed farmers about the condition of the field. Farmers replied that the ploughed farmlands were more uniform than last year and they were satisfied with the machinery service. But some farms were not ploughed in the right direction due to lack of farmers' and operators' knowledge. The direction of ploughing should be vertical against the direction of rainfall flowing on the ground. If the ploughing direction were horizontal against rainfall flow, soil runoff will be furthered. The team advised farmers and operators regarding the basic way of thinking about ploughing direction. This kind of instruction which related to crop cultivation should be conducted by AEAs, so the JICA/AESD team requested AEAs to monitor it when they visit the field constantly.

One of the AMSEC managers explained that his operator refused to be monitored by the JICA/AESD team during the land preparation season and quit the AMSEC. According to the manager, this is because the operator used to operate more than he declared to the manager and cheated the payment of additional work. The manager insisted that the operator might be afraid, as evident by the monitoring.

(iii) Monitoring by AEA

Information of selected FOBs was shared by AMSEC and DADU, then the monitoring system of the pilot project was discussed. It was agreed that at the time AMSEC provides ploughing service to selected FBO, AEA monitors the progress of the service every one or two weeks. AEA would measure acreage of the farm, condition of the farm, operation skills, working time etc. The JICA/AESD monitoring team visited sites every two weeks, and checked the results of AEA's monitoring and records maintained by AMSEC and instructed AEA about the monitoring work.



Stakeholders Meeting (MOFA regional director, AEA, AMSEC manager, Project team)

Project Completion Report

As for the close cooperation among AMSEC, AEA and FBO, in the case equipment are idle in AMSEC, AEA collect information of the demand side (service type, location and acreage of farms), and share this information with AMSEC. In the year where the rainfall pattern is unusual, AMSEC has to seek information of service demand through AEA to increase the operation rate of the tractor.

3) Post-season training for AMSEC manager

Post-season trainings for the AMSEC managers were held on the 10th and 14th October 2014 in Winneba, Central region and Ejura, Ashanti region respectively in the first year. In the second year, the follow-up training was extended from a one day training to two days and held on 3rd and 4th August 2015 in Wa, Upper West region and 6th and 7th August in Tamale, Northern region.

The number of participating managers are as follows. Other than managers, extension agents and regional engineers participated as well.

Table 2-5: Description of Follow-Up Training Participants (Manager)

1st year	Ejura, Ashanti region	Winneba, Central region
Day 1	4	2
2nd year	Wa, Upper West region	Tamale, Northern region
Day 1	2	3
Day 2	3	4

Source: Project Team

Other than these AMSEC people, agricultural extension staff in charge of the area, regional engineers, and MOFA regional staff also participated in the training as observers. Main topics of the follow-up training were below.

- Record keeping
- Service plan and result
- Feedback for next season
- Operator's behavior on maintenance and operation
- Result of tractor's performance test (working capacity/ efficiency and fuel consumption)
- Lecture on tractor maintenance (from the second year)

(i) Record keeping

Each AMSEC manager was supposed to report the result of their machinery service during the minor season. In the first year, only one AMSEC in the Central region and two AMSECs

Project Completion Report

reported their service activity. Other AMSEC do not record their service activity. But all managers looked interested in their records and the content of the reporting in the discussions after the reporting. Many questions on operation and maintenance were raised.

Based on this result, the team monitored the conditions of record keeping of all participating AMSECs in the second year. Therefore all AMSECs showed obvious improvement about the record keeping.

(ii) Service plan and result

Since rainfall in the season delayed and necessitated the revision of service planning, detailed planning is not necessary, but at least monthly and seasonal basis planning is required for budget planning at the beginning of the season. AMSEC managers who reported the result made both monthly and seasonal service plans.

(iii) Operator's behavior on maintenance and operation

Regarding the operator's behavior, the AMSEC manager reported improvement of maintenance activity and reduction in the frequency of breakdowns of the tractors/ equipment. Since most operators have never participated in formal training on operation and maintenance, they understand how they handle their equipment due to the training. On the other hand, through the observation of monitoring activity by the JICA expert and AESD staff, it is believed that the handling skill of operators, especially younger operators, are not good enough. More practical training would be necessary.

(iv) Service to small and remote farms

The project team advised not to refuse small, remote and scattered farmland the service due to its low profitability, but to try to stimulate machinery service demands by gathering surrounding small farmlands. The AMSEC in Ejura which is a FBO based, of AMSEC reported that they provide machinery service to small and remote farms of their members gathering adjacent to other farms. Also in the northern area, most the farmers are smallholders who have 2~3 acres of farmland, so it is popular to provide machinery service to smallholders by gathering adjacent farms in the same area.

(v) Profit and Loss statement

In the second year, the JICA/AESD team monitored each AMSEC periodically to check their service records. In a follow-up training, each AMSEC manager presented their current business status and implemented comparison analysis of profit and loss statements by using basic data of accounting. In the 2015 land preparation season, the rainfall in the northern area was significantly lower and shorter than the normal years. Due to the strict climate condition, every AMSEC who participated in the training provided a limited farmland area and the revenues from the machinery services were lower than the normal years. There are many reasons of each

Project Completion Report

AMSECs' financial issues, but a profit and loss statement analysis is a very effective way to discover their financial problems. Every AMSEC managers realized the importance of the analysis through follow-up training.

Comparison of the profit and loss statement is in the below Table 2-6. The fuel cost of Wa West in the Upper West region accounts for comparatively less than other AMSECs but the figure seems too low considering fuel consumption and ploughed farmland size. This means there might be omissions of fuel costs on the record. Since repair costs include JICA's support which cost 3,500 GHS, actual Wa West's balance of payment has a surplus in the season of 2015. Also, future surplus from the following year can be expected because the AMSEC could repair their tractors from JICA's support which includes expensive spare parts and they will save on future repair costs. Therefore, if the AMSEC could secure a certain scale of service farmlands, they can expect more benefit than this year. Nyvori Tona in the same region has many broken down tractors, and is unable to provide machinery service except for one tractor. Therefore, the AMSEC needed to minimize repair costs for one workable tractor, and to try to return to the black by enlarging service farmlands. If this cycle continues smoothly, the AMSEC can produce repair costs for other broken machinery one by one. Wa East purchased a new Massey Ferguson tractor which supported 70% of the market price by a USAID grant this year. The new tractor contributes a large amount of income to create positive a figure, but their repair costs are relatively high considering that two tractors are totally new. So Wa East also should try to reduce their repair cost to secure continuous stable earnings.

Although Sakfos in the Northern region repaired one of their tractors from JICA's support, the tractor has broken down again when it worked about 50 acres which is less than 15% of the initial plan. Since the AMSEC has several maize shellers, they can increase their revenue and reduce the heavy deficit by shelling service in the harvesting season if they finished tractor repair at that time period. Fathi has many workable tractors, but they operated only one tractor this season because there is strict price competition with other service providers in the Tamale area and they have to maintain their service rate at a low level at around 40 to 50 GHS/ acre. Also, the influence of drought in this season limited their workable areas for ploughing, except for going to very remote areas. Initially, Laangu had more than 1,000 acres service demands on the plan, but this AMSEC is also affected by heavy drought because many farmers reduced their cultivation areas or changed their crop type to less water requiring crops, like the cowpea.

In the 2015 land preparation season, many AMSECs were faced difficulties of income decline due to serious drought and high expenditure of repair costs. From next season, the managers should try to secure earnings by resetting the machinery service rate, decreasing the repair costs and providing more machinery service to farmlands. Also, AMSEC managers who have no maize sheller should consider future investment for the machine to diversify their income

Project Completion Report

resource by remaining in the surplus for several years and increasing the retained ratio. Although the investment in maize sheller will cost about 7,000 GHS (about 2,000 US dollars), the maize shelling service during the harvesting season can expand a tractor's annual operating days and the employment period of operators. In summary, investment in new machinery especially the maize sheller can be an effective business strategy to verify and stabilize their income resources.

Table2-6: Profit and Loss Statement of trained AMSECs in 2015

Name of AMSEC	Upper West Region						Northern Region					
	Wa West		Nyvori Tona		Wa East		Sakfos		Laangu		Fathi	
Machine Type	JD5303		FT70		JD5303&MF435extra		JD5303(2tractors)		JD5303		MF385	
Serviced area	182ac		103ac		492ac		292ac		238ac		102ac	
Sales	11,815		6,475		34,440		20,150		10,725		4,870	
Fuel	1,899	16.1%	2,475	38.2%	10,110	29.4%	4,005	19.9%	4,104	38.3%	1,765	36.2%
Operator	910	7.7%	880	13.6%	3,444	10.0%	1,851	9.2%	900	8.4%	500	10.3%
Maintenance	660	5.6%	1,071	16.5%	2,573	7.5%	2,094	10.4%	355	3.3%	332	6.8%
Depreciation	1,600	13.5%	1,600	24.7%	5,300	15.4%	3,200	15.9%	1,600	14.9%	0	0.0%
Sub total	5,069	42.9%	6,026	93.1%	21,427	62.2%	11,150	55.3%	6,959	64.9%	2,597	53.3%
Gross Profit	6,746	57.1%	449	6.9%	13,013	37.8%	9,001	44.7%	3,766	35.1%	2,273	46.7%
Repair	4,671	39.5%	3,602	55.6%	5,459	15.9%	7,697	38.2%	5,400	50.3%	1,713	35.2%
Monitoring	340	2.9%	410	6.3%	0	0.0%	0	0.0%	0	0.0%	487	10.0%
Payroll	1,800	15.2%	0	0.0%	2,574	7.5%	6,000	29.8%	0	0.0%	0	0.0%
Others	203	1.7%	0	0.0%	0	0.0%	2,140	10.6%	0	0.0%	0	0.0%
Sub total	7,014	59.4%	4,012	62.0%	8,033	23.3%	15,837	78.6%	5,400	50.3%	2,200	45.2%
Net profit	-268	-2.3%	-3,563	-55.0%	4,980	14.5%	-6,837	-33.9%	-1,634	-15.2%	73	1.5%

*Depreciation cost is regarded as 10 years machine life and divided by every year for all AMSEC statements except for Fathi who are using the tractor more than 10 years.

Source: Financial records of AMSECs

(vi) Lecture of tractor maintenance for AMSEC managers

AMSEC managers need to maximize and expand the performance and its mechanical life of their machinery holding to some extent as much as possible. In order to monitor operators, whether they are managing the tractors properly, AMSEC managers have to learn basic knowledge about tractor maintenance. The JICA/AESD team encouraged managers to participate in pre-season training for operators especially for tractor maintenance, but some managers couldn't attend because of their time limitation. For this reason, the follow-up training for managers in the second year included a lecture about tractor maintenance which managers should know from the aspects of business management.

2.3.2 Activity 2: Promotion of information sharing between farmers and AMSEC for better access to machinery service

The following three actions which FBOs can take for better access to machinery services were identified in Chapter 2.2.3. The project made interviews and advised FBOs which cannot access machinery service.

- (i) The farmer who has a small plot or remote plot may cooperate with adjacent farmlands, so that gathering machinery services can be provided. Small holder farm land aggregation to be encouraged and intensified.
- (ii) The farmer may remove stumps and stones from their farmland which cause machine breakdown. Stumps can be marked that an operator can get around.
- (iii) The farmer tries to improve productivity following appropriate cultivation technology, and application of enough inputs (seed, fertilizer and chemical) to be affordable to pay service fees.

Present status regarding machinery service;

- Since machinery service demand is absolutely higher than supply of service, it is difficult to access service. One FBO in Ejura reported that even though farms of FBO members are gathered, they are ready for advance payment, the farm location is not very far from center of the district (13km), and they do not receive the machinery service.
- Farms of FBO members are not always located near each other.
- Farms where FBO members practice shifting cultivation are scattered, and it is difficult to receive machinery services.
- Machinery service providers generally have priority in preferable farms, such as adjacent areas, larger acreage, and quick paying farmers.
- Some FBOs do not know the contact of the AMSEC in their district, and farmers ask operators passing their village for their services. Villages in which the Government program provides support, extension agents often contact the AMSEC for the FBOs.
- In case of rainfall shortage or late rainfall, some farmers cannot receive machinery services, even though their order is accepted.

Under the conditions as reported above, it is indispensable for fundamental solutions to increase the number of machinery service providers and to construct an irrigation facility. What the AMSEC can do is to prevent accepting more orders than their performance by analyzing their maximum service acreage from the results of past years and maintaining their equipment well, so that farmers do not develop problems.

AEA (Agriculture Extension Agent) has an important role as an intermediary between the

Project Completion Report

AMSEC and FBOs. The AEA has to be invited to the AMSEC training, and encouraged to play this role.

One FBO showed interest in purchasing a tractor for servicing their members. There are, however, still remaining issues, the necessity of the basic knowledge of management, operation and maintenance, skilled operators, and the responsibility of management. If the equipment of the FBO breaks down and there is discontinued machinery service with a loan balance, MOFA will also have difficulties. It is necessary to assess carefully their performance, when the FBO makes proposals to the AMSEC.

In the second year, the pilot project was implemented to promote information sharing between small scale farmers and the AMSEC for better access to machinery service based on the result of the FBO interview. The project team tackled issues which described the above by following approaches to verify whether machinery repair for broken down tractors can be an effective approach to expand machinery service for smallholders.

Challenges	Approaches of pilot project
Shortage of absolute numbers of tractors of service providers	The project supports each host AMSEC to repair one unserviceable tractor to increase service capacity to target FBOs with the repaired tractor.
Difficulty of machinery service to remote FBOs Scattered and remote farmland from FBO community	Firstly, FBOs which have a certain level (more than 50 acres in total) of a service demand are selected, so that AMSEC service is profitable although the AMSEC station and FBO farms are far apart. In case FBO's farms are far from the community, they are advised that they gather several farms into one inquiry.
Service provider tends to prioritize the customer who has bigger farmland, accessible farmland and longstanding reliable payment records	The repaired tractor has to be used for selected FBOs as priority.
Some FBOs doesn't know contact of AMSECs (therefore they cannot make plan for machinery service)	Through selection of FBOs and stakeholder meetings, AMSEC establishes a relationship with FBOs to share information. AEA will play special roles to provide AMSEC information to FBOs and to convey enquiry to AMSEC for FBOs.
Sometime there are many stones and stumps which cause tractor breakages on the requested farmland	Through selection of FBO and stakeholder meetings, FBO is advised that preparation of farm (removing stones and stumps) has to be done before a machinery service, so that FBO can reduce risks to miss proper service timing by efficient machinery service.
Some customer cannot meet the payment condition (cash payment in advance or immediate after the service)	During the selection of FBO, FBO is advised to disseminate payment terms are basically in cash before a service. Just before a service provision, AMSEC and FBO confirm payment terms. AMSEC tends to allow payment term as in cash before or after a service especially for new customers. If the customer can pay in cash before a service several times, the credit rating of the customer is thereby enhanced, and it is expected that AMSEC allows them to pay favorite payment term in kind after the harvest.

Project Completion Report

2.3.3 Activity 3: Implementation of pilot projects

(1) Selection of target AMSEC for pilot project

The target AMSECs of the pilot project selected one from Winneba in the Central region of the coastal area and Ejura in Ashanti region of middle area in the first year, and Wa West in Upper West region and Damongo in Northern region in northern area in the second year. Criteria of the selection was as following.

- The AMSEC who has a strong motivation to cooperate in the pilot project
- Condition of their holding machinery (the AMSEC who has implements for the performance test or can borrow from neighbors)
- Location of the AMSEC for training and monitoring (affordable location for training and monitoring)

The target group is the AMSEC and Farmer or Famer based organization (FBO) who can access the AMSEC. The first year of the Project mainly targets AMSEC managers and machine operators in the pilot project area (Winneba and Ejura).

(2) Smallholder farmers organization approach

In the second year of the project, the project team repaired targeted AMSECs' broken down tractors to expand machinery service capacity and provide machinery land preparation services to FBOs organized by smallholders as a pilot project. In order to encourage the connection between target AMSECs and selected FBOs, the project team involved AEAs with the role of interaction between them.

Target FBOs for the pilot project are noted in the following table.

【Wa West, Upper West region】

Name of FBO	Membership	Farmland size	Service demand	Crops
Suma Farmers Group	60 (♂:35,♀:25)	Average♂:5ac, ♀:2ac	155 ac	Maize, Sorghum, Cowpea, Groundnut
Summali Farmers Group	20 (♂:15,♀:5)	Average♂:8ac, ♀:2ac	126 ac	Maize, Groundnut, Millet, Cowpea
Maalima Nuoriye	13 (♂:10,♀:3)	Average♂:5~6ac, ♀:3~4ac	120 ac	Maize, Groundnut, Soybean, Sorghum
Dikumuni Group	18 (♂:15,♀:3)	Average 5ac	86 ac	Groundnut, Maize, Cowpea, Soybean

【Damongo, Northern region】

Name of FBO	Membership	Farmland size	Service demand	Crops
Unity Farmers Group	21 (♂19:,♀:2)	Average 6~7ac Max:15ac,Min:2ac	155 ac	Groundnut, Maize, Cowpea, Yam
Suguru Farmers Group	15 (♂:10,♀:5)	Average 7ac	126 ac	Maize, Groundnut, Cowpea, Yam, Cassava

Project Completion Report

Asuntaaba Group	20 (♂:15,♀:5)	Average 5ac	120 ac	Groundnut, Maize, Cowpea, Yam
Awurunkeni Farmers Association	35 (♂:27,♀:8)	Average 3~4ac	86 ac	Maize, Millet, Cassava, Yam, Cowpea, Groundnut
Sankafil Group	14 (♂:11,♀:3)	Average 3~4ac	50ac	Maize, Rice

5 FBOs in the Northern region which has approximately 317 acres demands the ploughing service and 4 FBOs in Upper West region which has approximately 487 acres demands were selected and applied the land preparation tractor service.

Under the initial plan, the AMSEC estimated 300 to 400 acres per one tractor as an affordable ploughing service farmland size, but both AMSECs couldn't achieve those levels of expected size because of the lengthy delay in rainfall in the northern area and the AMSEC had to wait until the time when soil got wet from rain for the machinery service.

Regarding the payment condition of the service, the FBO and AMSEC agreed on the cash payment in advance or immediately after the service at first, but some farmers couldn't pay the fee by cash after the service because they recognized that payment deferment will be accepted after the harvesting. These circumstances were caused by a lack of communication between the FBO leader and members. Basically AMSEC discusses the payment condition with the FBO leader and it is not realistic to discuss with all the FBO members the condition before servicing. Therefore, it needs to get across the payment condition of the AMSEC machinery service in each FBO before the servicing. Although some AMSECs accept in-kind payment, basically in-kind payment is limited to reliable longstanding customers due to payback risk. Thus it seems that the failure of payment condition will be improved to foster a trusting relationship between the AMSEC and FBO by providing service each time.

In the second year, the team supported a maximum of 1,000 US dollars to repair target AMSECs' broken down tractors as a pilot project and provided machinery services to selected FBOs, but an unexpected issue had occurred during the land preparation season. When frequency of the repaired tractor operation increased, some parts which were not repaired by the project broke during the services. This means that 1,000 US dollars were not enough to complete the entire repairs of the broken tractor, so not repaired low priority parts were broken by heavy loading operations. Although it cannot be said unconditionally, approximately 1,500 to 2,000 US dollars will be needed to cover all necessary repairs of broken down tractors. (E.g. one new rear tire for the tractor costs 500 to 800 US dollars.)

Detailed information about machinery services by repaired tractors in each AMSEC as follows.

Project Completion Report

【Wa West, Upper West region】

Name of FBO	Planned farmland size	Ploughed farmland size	Achieved percent %	Note
Suma Farmers Group	155 ac	25 ac	16%	Cash payments after the services were not fully implemented due to lack of information sharing in FBO about the payment condition
Summali Farmers Group	126 ac	2 ac	1.6%	Adequate timing of land preparation was unavailable by drought
Maalima Nuoriye	120 ac	14 ac	11.7%	Actual demands of machinery service were less than estimated due to miss communication and lack of information sharing in FBO
Dikumuni Group	86 ac	8 ac	9.3%	Adequate timing of land preparation was unavailable by drought

【Damongo, Northern region】

Name of FBO	Planned farmland size	Ploughed farmland size	Achieved percent %	Note
Unity Farmers Group	85 ac	24.5 ac	28.8%	Another broken down has occurred during the service
Suguru Farmers Group	50 ac	—	0%	Could not provide land preparation service on adequate timing by drought and machine broken down
Asuntaaba Group	62 ac	—	0%	Could not provide land preparation service on adequate timing by drought and machine broken down
Awurunkeni Farmers Association	70 ac	—	0%	Could not provide land preparation service on adequate timing by drought and machine broken down
Sankafil Group	50 ac	—	0%	Could not provide land preparation service on adequate timing by drought and machine broken down

(3) Cut down cost by proper use of equipment

Major costs of the AMSEC business are labor costs, fuel costs, consumable costs, and repair costs. In terms of cost reduction, repair cost is the first priority to be reduced. Especially, cost of repair cases caused by absent operation and poor maintenance. During repair work, the machine cannot work and sales decrease due to opportunities lost.

It is necessary to improve awareness and skills of managers and operators on maintenance activity. In the first year pilot project, the AMSEC managers reported the improvement of maintenance activity after the training. In the second year pilot project, improved training content was testified and finalized. As well as awareness and skills, some types of financial

Project Completion Report

incentives are recommended, for example, if an operator who uses a tractor without any trouble in a season can receive a bonus.

(4) Sharing information on maintenance and access to spare parts

Regarding equipment sold to the AMSEC, only one dealer as a supply source of spare parts for each manufacturer is available in Ghana. So, all AMSECs know where they can buy spare parts. Issues of spare parts supply are price and availability. AMSECs were not informed of the price of spare parts before they entered the AMSEC business. So, compared to the subsidized price of equipment, they believe that the price of spare parts is very expensive. Furthermore, import tax is exempted for spare parts for agriculture equipment, but about 50% of an import tax was often imposed, even though it is mentioned in shipping documents that those parts are spare parts for agriculture equipment.

Spare parts which are needed for regular replacement are stock in dealers, but other parts which generally are not often replaced, such as the gear box, clutch plate, radiator, are not in stock and dealers place an order to the manufacturer upon the customer's order. It takes 2 to 3 weeks for the AMSEC to receive the parts after their order. A period of 3 weeks in the rainy season is very important for the AMSEC to earn their main sales as a demand peak of land preparation service. Most dealers are located in Accra and its outskirts, and it is also inconvenient for the AMSEC in the local area as well.

Under the above circumstances, what the AMSEC can do is to minimize serious machine problems and to maximize the operation period in the season through proper maintenance and handling of equipment. Therefore, it is necessary to enhance their capacity on the operation and maintenance by conducting trainings for AMSEC managers and operators.

As for maintenance, most AMSECs do not have a mechanic and operators maintain equipment. In the case of problems, the AMSEC takes equipment to a workshop outside. Therefore, if operators are not well trained, they miss small malfunctions or they may not regularly replace parts. As a result, serious problems occur. Serious problems sometimes occur due to ignorance of the AMSEC manager on maintenance. In the second year pilot project, AMSEC managers' participation in maintenance training was strongly made.

(5) Income increase model of AMSEC by expansion of type of service

Currently, the AMSEC provides machinery services for land preparation (ploughing and harrowing). In order to extend the period of tractor operation, various types of services, such as planting, spraying, and shelling, are considered. For the decision making of adding types of services, both the external and internal environment have to be carefully analyzed as well as the investment analysis.

Project Completion Report

External environment	Need of service type (type of service, quality, price), service demand (acreage), competition
Internal environment	Knowledge and skills for operating and maintenance of equipment needed, affordability to purchase equipment

Income increase model of AMSEC can be achieved by expansion of service type. In addition to the ploughing and harrowing service, planting (drilling), spraying and shelling services are considered. This can increase the turnover of fixed assets (decrease idle time) as well as increase sales. This affects reducing risks relying on the single service type.

For operators, the cultivation season around service can secure steady employment. This also motivates owners to train their operators for capacity building. For a farmer, it also promotes on-time work, eliminates the farm labor shortage issue, and contributes to efficient production.

Meanwhile, from the results of observation of AMSEC operators in the last 2 years, there are no operators that having experience working with these implements, and the skill level of operators to handle these implements is inadequate at the moment. It is obvious that implements do not work as well as farmers require, or are broken down. Since the structure of the equipment differs, it will break down easily compared to the plough and harrow. Therefore, it is recommended to pay attention to the skill level of the operators, and hand over equipment after giving the operators the necessary training.

There are two types of maize sheller: the engine driven type and PTO driven type. Both types are produced in Ghana, and it costs about 2,000 USD/unit. Since data on working efficiency and fuel consumption of the maize sheller are not available, collection of basic data and investment analysis will be necessary.

Regarding the harvester, it is believed that a rapid introduction is difficult in Ghana, because large initial investment is necessary, and few skilled operators and mechanics are available in Ghana. Maize and rice milling services are processing services. Investment and operation costs, knowledge and skills of operator, and actual demand have to be considered before the investment. Since the above harvesting and processing machines are single machines, they do not directly contribute to the increase in a tractor's working efficiency.

From a sales amount point of view, adding the type of machinery service is important for AMSEC. It can increase sales and the operating rate of equipment by extending the period of tractor operation. It is also expected that stable employment is provided to operators and the maintenance level is improved by through a higher sense of belonging.

Working efficiency and fuel consumption of each type of service are necessary for investment analysis. These figures were measured in the pilot project and are shown in Table 2-7.

Project Completion Report

Table 2-7: Working Capacity/ Efficiency and Fuel Consumption Efficiency

1st year	Winneba, Central region		Atebubu, Brong Ahafo region	
Work / Implement	Working efficiency (ha/hr)	Fuel consumption (liter/ha)	Working efficiency (ha/hr)	Fuel consumption (liter/ha)
Ploughing / Disc plough	0.40	9.87	0.80	9.10
Harrowing / Disk harrow	0.59	8.21	0.72	7.79
2nd year	Damongo, Northern region		Wa Wes, Upper West region	
Work / Implement	Working efficiency (ha/hr)	Fuel consumption (liter/ha)	Working efficiency (ha/hr)	Fuel consumption (liter/ha)
Ploughing / Disc plough	0.52	6.04	0.42	3.93
Harrowing / Disk harrow	1.06	6.00	0.54	8.58
Planting / Planter	1.20	2.21	-	-
Movements:				
a) Good feeder roads	23.43 km/hr	0.12 liter/km		
b) Rough / Bad roads			16.00 km/hr	0.33 liter/km

Source: Based on the Field Research by Project Team

2.3.4 Activity 4: Recommendation on AMSEC program and AMSEC Management Guideline

The team developed an AMSEC management guideline based on the result of project activities. The AMSEC management guideline describes significant affairs from the application of AMSEC establishment to business management after the start-up. The following is the draft table of contents of the guideline. (Detailed information of the guideline is included in the attachment.)

1. Before Applying AMSEC
 - 1.1. Customer and Demand
 - 1.2. Skilled Operator and Mechanic
 - 1.3. Facility and Equipment

Project Completion Report

- 1.4. Workshop for Repair
- 1.5. Investment Analysis
- 1.6. Funds for Establishment of AMSEC
2. After the Proposal was Accepted
 - 2.1. Preparation of Mid and Long-Term Business Plan
 - 2.2. Preparation of Annual Business Plan
 - 2.3. Capacity Development of Staff (Manager, Operator and Mechanic)
 - 2.4. Preparation of a Series of Records Form
 - 2.5. Announcement to Customer
3. Implementation Stage
 - 3.1. Order
 - 3.2. Preparation of Monthly Work Plan
 - 3.3. Weekly Planning
 - 3.4. Monitoring and Adjustment of the Weekly Plan
 - 3.5. Monitoring of Records
4. Periodic Work
 - 4.1. Daily Management
 - 4.2. Weekly Management
 - 4.3. Monthly Management
 - 4.4. Works After the Season
 - 4.5. Works at the End of the Year
5. Human Resource Development
 - 5.1. Strengthening of Human Resource Development
 - 5.2. Labor Management
6. Customer Management
 - 6.1. Preparation of Customer Profile
 - 6.2. Utilization of Customer Profile
7. Financing from Financial Institution
8. Pricing of Service Fee
9. Necessary Data for Planning

3 Prospects of Achievement of Project Purpose

Project Purpose:

“To enhance access of machinery and mechanization services to smallholder farmers as and when needed at affordable rates in the identified priority areas.”

A base for the capacity development of the AMSEC unit was built in the AESD. The base means capacity of content of a series of trainings for AMSEC managers and operators, preparation of teaching materials, and capacity of the AMSEC unit to conduct the training. The training consists of the initial capability on understanding the business status of one’s own company through record keeping for managers, and primary technical skills on operation and maintenance for operators. AMSEC managers, then, have to analyze their business and tackled issues. AMSEC managers learned methods to analyze business status and to find issues to be tackled, but only 1 set of trainings is not sufficient to practically conduct work for managers. In this year, only one of twenty AMSEC managers could prepare Profits and Losses statements by themselves at the follow-up training. Even this AMSEC manager could not prepare the Balance Sheet yet. Managers need to be trained for two or three years to obtain the at least the knowledge and skills as a company manager. Operators also need further trainings to improve their capability, repeating trainings and practicing on the field.

In order for smallholder farmers to access machinery service, Agriculture Extension Agent (AEA) who knows the machinery service demands of smallholder farmers, is the key person. Through AEA, AMSEC and smallholder farmers can share information on demand and supply. To expand information sharing between demand side and supply side, a regional engineer who is appointed by AESD facilitates AMSEC and AEA to contact each other at the district level is needed.

The AMSEC management guideline was prepared reflecting two-year project activities, but it has not been distributed to the AMSEC. Feedbacks from the AMSEC will be necessary to improve content.

Expansion of machinery service to smallholder farmers depends on reactivating operation of unserviceable tractors in the AMSEC. Since it is difficult for the AMSEC to receive funds from financial institutions, the AMSEC has to increase earning retention from sales of serviceable tractors.

4 Issues and Lessons Learned on Project Management

4.1 Issues

(1) Budget Allocation for Capacity Building of AMSEC

AESD plans to establish a training course for machinery service providers by rehabilitating part of existing agriculture training centers (farm Institutes) that are run by MOFA. A budget for this rehabilitation project will be covered by the counterpart fund of 2KR, and currently is under proposal selection by Ministry of Finance. Since capacity building of operators is an urgent issue, MOFA has to give high priority to start a training program utilizing any source of funds (the government, donors and NGOs).

(2) Strengthening A Role of Regional Engineer

The following activities in the AMSEC program have to be added to the role of regional engineer who is appointed by AESD at all regional agriculture offices, as well as the necessary budget allocation.

- Monitoring of AMSEC business
- Facilitation of information sharing between AMSEC and AEA/FBO
- Announcement of a series of trainings for machinery service providers and recruit participants

4.2 Recommendation for Project Management

(1) Cost sharing with AMSEC

AMSEC bears transportation and accommodation costs for the manager and operators in the training, because their activity is a private business, and training cost is one important cost to operate their business. It is recommended that direct costs, such as lecturer fees, costs for training materials and snack/lunch will be borne by MOFA whilst, costs for evening meals, transportation and accommodation would be borne by participants (AMSEC), when the training program is countrywide in the future. The quality of the training also is a cost borne by participants as well.

(2) Utilization of Human Resource of Other JICA Project

Since AESD is a technical administrative directorate for agriculture mechanization, they do not have an expert on business management. Private business consultants are available in Ghana, but the cost for recruiting an expert is quite high in Ghana.

Finally, National Board for Small Scale Industry (NBSSI) that is a counterpart agency of JICA “Project for Formulating a Strategic Model for Quality/Productivity Improvement through Strengthening BDS for MSEs,” could provide one expert on business management to the

AMSEC training program.

4.3 Lessons for Project Management

(1) Language in the training

Some operators are not literate enough to understand English. Training materials in local languages should be prepared in the future like Twi. For managers, English training materials can be acceptable.

(2) Flexible Contents of Training

To adapt a level of participants, training content would be changed by information on the participating AMSEC. Most AMSECs have to start with record keeping because they have nothing to show for their business status. Instructors have to select priority issues to be the focus in the limited training period.

5 Recommendation

5.1 Recommendation to AESD

5.1.1 Budget Allocation for Training Program

In the next batch of AMSEC programs, enough of a budget for the training program has to be allocated, even if reducing the budget for equipment procurement. MOFA also should consider decreasing the level of subsidy and increasing the budget for the training program instead. Cost sharing by beneficiaries is also important. There are many AMSECs and 2KR beneficiaries who want their operators to participate in the training to avoid machine problems, and even pay a participation fee. It is necessary to improve the capacity of operators at the national level. There are donors to provide agriculture machinery in their project. MOFA has to announce that they are commencing a training program to stakeholders in the agriculture sector.

5.1.2 Support AMSEC at Regional Level

According to the AMSEC Policy Guideline, AESD has responsibilities to supervise and monitor AMSEC business. Since AESD does not have enough of a budget and clear roles of AESD staff at the regional and central level, supervision and monitoring were not carried out, and the status of AMSEC business had not been reported. Information sharing between FBO and AMSEC was done cooperating with AEA. The status of AMSEC business was also clarified through a series of trainings and monitoring. In order to continue these activities, a demarcation of roles of MOFA staff at the district, regional and central level has to be made, and a necessary budget has to be prepared.

5.2 Recommendation to AMSEC Program

The basic concept of the AMSEC program is acceptable for promoting agriculture mechanization and increasing access to smallholder farmers who cannot afford to buy machinery, utilizing private sector's efficient business management skills. In fact, most AMSECs do not have at least a level of knowledge and management skill to continue their machinery service business, and their business is poorly managed. Low repayment of loans and the number of unserviceable equipment are proof as well. This has been caused by increasing the number of machinery without human resource development. The Government has a plan to expand the AMSEC program in the future, and human resource development is a key issue to sustainable agriculture mechanization. Recommendations for the AMSEC program and AESD, the implementing organization, are stated in order of priority as follows.

5.2.1 Human Resource Development

(1) Owner/ Manager

The Agriculture Machinery Service Provider, especially running a business as an enterprise like AMSEC needs to have a certain level of business skills. Managers have to prepare a company strategy, organize and conduct their staff, have access to the market, and make a profit, analyzing various internal and external business environments.

However, even though demand exists, there are not many AMSECs in sound managing status. Through the project activities, we met about 20 AMSECs. They do not have a business plan, do not know enough about their financial status, and do not know how to forecast their business. Even they acknowledge that their business is not good, but do not know how to analyze and improve their business. The AMSEC manager as a businessperson has to acquire at least a level of business skills, or the submission of planned financial documents and a business plan has to be an obligation when they propose to be an AMSEC, and the review of them in an approval procedure to judge the capability of business management skills.

(2) Operators and Mechanics

Operators younger than early 40s in age did not have opportunities to formally learn about operation, maintenance, and adjustment of agricultural machinery and equipment, and their skill level is low. As a result, their wrong operation causes machine problems and breakdowns sometimes, as well as the shortening of machinery life. It may also affect crop production through insufficient soil turning and unlevelled harrowing. Development of systematic training programs and capacity building of operators is an urgent issue for proper operation and maintenance of machineries.

For farmers who own a tractor, individual machinery service providers and even most AMSECs which have a number of tractors, do not employ a mechanic. They rely on workshops outside for repair work, and operators often take maintenance work. Tractor mechanics, who received basic and practical training have to be appointed

(3) Trainer of Training

Since the government withdrew from machinery service, a formal training program for operators and mechanics has not been done by both the public and private sectors. Instructors in 1980-1990 who were in their late 50s or early 60s in age, have had no instructors that followed them since the late 1990s. The number of these skilled instructors is now very low. It is important to foster new generation instructors transferring knowledge and techniques from skilled instructors.

(4) Farmer

The farmer also would remove stumps and stones from their farmland which cause machine breakdown. Stumps can be marked where an operator can get around. They also try to get information on machinery service providers through Agriculture Extension Agents.

5.2.2 Appropriate Number of Equipment

Most AMSECs bought 5 sets of tractors and implements. Even though demand exists, AMSEC cannot provide machinery service in a sustainable manner without sound financial stability and a well-managed operation. It should be considered that AMSEC starts with two or three tractors then increases the number of tractors depending on their financial and management capacity.

5.2.3 Selection of Equipment for AMSEC Program

A series of implements and equipment, such as the plough, harrow, planter, sprayer, harvester, and postharvest equipment, has to be equipped in order for AMSEC to continuously provide machinery service to farmers. It is also favorable for service providers to increase the working efficiency of machines (decrease idle time), especially tractors, and the stability of sales, for operators to secure steady employment. This also motivates owners to train their operators for capacity building. For a farmer, it also promotes expansion of farmland, eliminates the farm labor shortage issue, and contributes to efficient production. Meanwhile, the skill level of operators to handle these implements is inadequate at the moment. It is obvious that implements do not work as well as farmers require, or are broken down. Especially, the planter and sprayer, which are not well introduced to the AMSEC, are needed to correct the implement adjustment and the proper volume of input application based on the acreage of the farm. Since the structure of the equipment differs, it will break down easily compared to the plough and harrow.

It is therefore recommended to pay attention to the skill level of the operators who AMSEC employs, and hand over equipment, after giving operators the necessary training.

5.2.4 Selection Procedure of AMSEC

MOFA tightened up the payment term, the 70% down payment and the 30% loan with the bank guarantee, from the third year of recruitment of AMSEC, because of the low repayment rate of the first and second batches. The selection procedure should be more strict in business management capability (submission of planned financial documents and the business plan) rather than payment terms. As for loan repayment, a minimum interest at a level of the inflation rate should be charged. Otherwise, only delinquent payments get the benefit of inflation, but AMSEC repays as scheduled and the government loses.

5.2.5 Spare Parts Supply Network

Genuine spare parts cost more than triple its non-genuine spare parts. AMSEC tends to buy non-genuine ones. However, cheaper non-genuine or reused parts may cause machine problems and shorten machine life, eventually incurring high costs.

AESD has to provide the price list (US dollar base) of spare parts at the time of AMSEC recruitment for them to understand how costly maintenance and repair are. Periodic monitoring by AESD, including the status of their business, as well as parts, is recommended so that spare parts are smoothly supplied to users.

5.2.6 Repair of Equipment

Repair of unserviceable tractors is a big challenge for AMSEC. The project supported 2 AMSECs to repair their tractor for 1,000 USD each. As a result, one repaired tractor could provide more than 180 acres of smallholder farmers' fields. If AMSEC cannot receive funds from the outside, they have to increase earning retention by improving their business to repair unserviceable tractors. If the Government promotes AMSEC to repair tractors, the Government provides a bank guarantee, and makes the environment of AMSEC easier to access the funds of financial institutions. Even in this case, AMSEC needs to prepare and submit necessary documents (business plan and financial documents) to financial institutions. It is not recommended that the Government directly give funds to AMSEC.

5.2.7 Strengthening Financial Stability

Most AMSECs participating in the training have not received any funds from financial institutions, because of the high interest rate and low creditability. At the beginning of a season and a time of unexpected equipment problems, they often need cash. AMSEC tries to achieve credibility of financial institutions by repeating borrowing and repaying with a small amount of funds. They need to prepare necessary documents (business plan and financial documents) as well.

5.3 Recommendation to Investors Entering to Ghanaian Market

In the field of agriculture mechanization, investors who intend to enter the Ghanaian market must note the following.

(1) Find A Reliable Partner who has:

- Human resources of sales persons and mechanics,
- Enough funds to purchase machinery and spare parts for sales and stock,
- Adequate facilities for office, a workshop and a warehouse, and
- Sufficient experience and skills of selling agriculture machinery, vehicle, or construction

Project Completion Report

machinery.

(2) Necessary Support to Local Agents

- Technical support for human resource development (sales person, mechanic)
- Technical support for sales management and inventory control
- Technical support for selection of sales priority area

(3) Cost Reduction of Parts and Equipment

- Development of Ghanaian version equipment which is adapted to the environment of crop cultivation and equipment usage
- Cost-reduction by localization of parts and implement production

(4) Flexibility of Payment Terms

Since there are few farmers who can afford to pay, various payment terms must be considered:

- Provide loans by manufacturer or public institutions,
- Provide a bank guarantee for the customers' loans,
- Provide a finance lease, and
- Provide machinery service.

Attachment

- Attachment I: Working schedule
- Attachment II: Manning schedule
- Attachment III: Machinery and Equipment Imported by MOFA since 1990
- Attachment IV: SWOT and Cross SWOT Analysis
- Attachment V: List of AMSEC
- Attachment VI: AMSEC Operational Guideline
- Attachment VII: AMSEC repayment status
- Attachment VIII: Participants list of the training
- Attachment IX: Result of questionnaire after the training
- Attachment X: List of repairs for targeted AMSEC as a pilot project
- Attachment XI: AMSEC financial status
- Attachment XII: Pictures

Work Item	2014 (1st Year)			
	July	August	September	October
(1) Preparation of Pilot Project				
(2)-1 Training in Central region				
(2)-2 Training in Ashanti region				
(3) Intervention to smallholder farmers				
(4) OJT and Monitoring				
(5) Performance data collection for implements				
(6) Reporting				

Working Schedule (Second Year)

Period	2015										
	1	2	3	4	5	6	7	8	9	10	11
Works											
A. Preparation in Japan											
[1] Preparation of second year Inception Report (ICR)			□ △-△								
B. Work in Ghana											
[2] Submission of second year ICR			■ △-△								
[3] Drafting, discussion and submission of Work Plan			■ △-△								
[4] Selection of targeting AMSECs for the training and the pilot project			■								
[5] Data collection of the target AMSECs about business conditions and skills of tractor operators			■								
[6] Implementation of Trainings and Pilot Project											
[6-1] Trainings on improvement of business management of AMSEC and machinery operation.				■				■			
[6-2] Implementation of Pilot Project				■	■	■	■				
[6-3] Monitoring of Pilot Project				■	■	■	■				
[6-4] Drafting, discussion and submission of AMSEC management guideline								■			
C. Work in Japan											
[8] Submission of Final Report								□ △-△			

Legend: — Preparatory ■ Work in Gh: □ Work in Jap: △-△ Explanation of ----- Other works

First year

Manning Schedule

	Responsibilities	Name	Organizaiothn	2014											
				4	5	6	7	8	9	10	11	12			
Work in Ghana	Team Leader/ Management Strategy	KUDO Yasunobu	TASK Co., Ltd.	■				■		■		■			
	Farmer Organization/ Famr Management	YMAGUCHI Koji	TASK Co., Ltd.	■					■						
Work in Japan	Team Leader/ Management Strategy	KUDO Yasunobu	TASK Co., Ltd.	□									□		
	Farmer Organization/ Famr Management	YMAGUCHI Koji	TASK Co., Ltd.	□											
		Report submission		△					△		△		△		
				ICR					Work plan		Agricluture mechanization in Ghana		Interim report		

Second year

Manning Schedule

	Responsibilities	Name	Organizaiothn	2015												
				1	2	3	4	5	6	7	8	9	10	11		
Work in Ghana	Team Leader/ Management Strategy	KUDO Yasunobu	TASK Co., Ltd.				March 28th	May 6th	June 6th	August 12th						
	Farmer Organization/ Training Management	HATANO Mamoru	TASK Co., Ltd.				March 7th	June 22th	July 9th	August 12th						
Work in Japan	Team Leader/ Management Strategy	KUDO Yasunobu	TASK Co., Ltd.				□ 5 days					□ 5 days				
	Farmer Organization/ Training Management	HATANO Mamoru	TASK Co., Ltd.							□ 5 days						
Report submission				△ ICR	△ Work plan					△ Work completion report						

Attachment III
Machinery and Equipment Imported by MOFA since 1990

Machinery and Equipment Imported by MOFA since 1990

Year	Make/ Model	Qty Imported (Units)	Country of origin	Funding source	
1990	Komatsu Bulldozer	3	Japan	Japanese Grant	
	Chain Saw	27	Japan		
	Rice Mills	12	Japan		
	Grain Dryers	12	Japan		
	Hand Sprayers	96	Japan		
	Power Driven Sprayers	20	Japan		
	Yanmar Power Tillers	39	Japan		
	Yanmar Irrigation Pumps	30	Japan		
	Valmet Tractors	7	Brazil		
	Corn Mills	2	Britain		
1991/2	Yanmar Maize Sheller	1	Japan	Japanese Grant	
	Satake Testing Equipment for Rice	1	Japan		
	Bulldozer	1	Japan		
	Stake Corn Mill	1	Britain		
	Kubota Reapers -rice	11	Japan		
	Seed Cleaner	12	Japan		
	Rotary Cultivators	3	Japan		
	Seed Drill	2	Japan		
	Seed Broadcasters	5	Japan		
1993	Yanmar Maize Sheller	9	Japan	Japanese Grant	
	Knapsack Motor Sprayer	13	Japan		
	Boom Sprayer	2	Japan		
	Maize Planter	2	Japan		
	MF 375 Tractor	11	Finland		
	Irrigation Pump	24	Turkey		
	Power Tiller	6	Japan		
1994	Combine Harvester -rice	6	Japan	Japanese Grant	
	Mobile Husker Sheller	22	Britain		
	Ferguson Tractor	2	Finland		
1995	Combine Harvester -rice	6	Japan	Japanese Grant	
	Mobile Husker Sheller	22	Britain		
	Rice reaper	10	Japan		
	John Deere tractor	7	USA		
1997	Power tiller	30	Japan	Japanese Grant	
	water pump	40	Turkey		
	Rice mill	5	Japan		
	Combine harvester	8	Europe		
	Rice reaper	22	Japan		
	Shanghai tractor	200	China		GOG
1998	Shanghai tractor	300	China	GOG	
	Lamborghini tractor	30	italy	Japanese Grant	
1999	Velmet valtra	15	Brazil	Japanese Grant	
	Power tiller-Yanmar	33	Japan		
	Shanghai tractor	40	China		
	Dong feng power tiller	200	China		GOG
	Tricycles	150	China		
2003	Farmtrac-70 tractor	200	India	GOG	
2005	Farmtrac-70 tractor	350	India	GOG	
	Farmtrac-80 (4x4)	50	India		

Attachment III
Machinery and Equipment Imported by MOFA since 1990

2006	Farmtrac-70 tractor	350	India	GOG		
	Farmtrac-80 (2x4)	50	India			
	Rotary slashers	100	India			
	2006	Landini tractors	40	Itali	Japanese Grant (2KR2005)	
		Same tractors	10	Itali		
		Power tillers-Kubota	100	Japan		
		Rice Mills	10	Japan		
		Water pumps	79	Turkey		
2007		Farmtrac-60 tractor	230	India		GOG
		Farmtrac-80 (2x4)	51	India		
	Maize Shellers	220	India			
	Yukon compact tractors	120	Czech			
	Vari mini systems	250	Czech			
	Hurricane slashers	50	Czech			
	Adela slashers	750	Czech			
2008	Shakti power tillers	200	India	GOG		
	Farmtrac-60 tractor	200	India			
	Mahindra-705DI tractor	100	India			
	Mahindra-605DI tractor	132	India			
	John Deere tractor	500	India			
	2008	New Holland-TC5070 / 207hp combine harvester	4	Poland	GOG, GIDA	
		2008	Kubota tractor	78	Japan	Japanese Grant (2KR2007)
			Water pumps	16	Turkey	
Rice Mills	20	Japan				
2009	Kukje DKC685 rice harvester / 70hp	6	Korea	GOG		
	Foton DC200 rice harvester	5	China			
	Foton GE20H rice/ maize harvester	10	China			
	KT09 harvester/ 210hp	2	Thailand			
	Tractor with Rotovator attachment / 210hp	2	Thailand			
2010	Kukje DKC685 rice harvester / 70hp	6	Korea	GOG		
	KT09 rice harvester/ 210hp	2	Thailand			
	Run Yuan jing combine harvester	10	China			
2011	New Holland TD80 tractors	125	Turkey	Japanese Grant (2KR2009)		
	Irrigation Pump	40	Japan			
	Rice mill	10	Japan			
	Rice thresher	35	Indonesia			
	Rice reaper	35	Indonesia			
2012	Cabrio tractors 50hp	50	Czech Republic	GOG		
2013	Cabrio tractors 50hp	95	Czech Republic			
2014	New Holland TD80 tractors	70	Turkey	Japanese Grant (2KR2012)		
	Power tillers - Yanmar	43	Indonesia			
	Rice mill	5	Indonesia			
	Rice thresher	35	Indonesia			
	Rice reaper	20	Indonesia			

Attachment IV
SWOT and Cross SWOT Analysis

SWOT Analysis

		Content	Source
Opportunity (O)	1	Can buy equipment with cheaper price (low initial cost)	Policy/ Program
	2	Can receive operator training free of charge at the establishment	Policy/ Program
	3	High machinery service demand	Interview, survey
	4	Little number of machinery service providers who serve with various implement except plough, harrow and trailer	Reports, survey
Threaten (T)	1	Competitor using second hand tractor	Reports, survey
	2	Escalation of fuel price	Survey
	3	Difficulty of access to S/P	Interview, survey
	4	Low demand of machinery service	Survey
	5	Location of farm is far	Survey
	6	Small plot of farmland	Survey
	7	Farmland is scattered	Survey
	8	Stumps and stones in farmland which cause equipment break down	Reports, survey
	9	Low rainfall	Survey
	10	Low affordability of farmer to pay for service	Interview, survey
	11	Little medium and large scale farmers where machinery can work efficiently	Survey
	12	Fixed seasonal service fee	Interview, survey
	13	Difficulty of planning due to relaying rain fall	Survey
	14	Difficulty of planning due to relaying rain fall	Survey
Strength (S)	1	AMSEC runs agriculture related business, and has a network in agriculture sector in the rural area.	Interview
Weakness (W)	1	Low skill of operators	Survey
	2	Shortage of skilled operators	Reports, survey
	3	Some operators cheat in work	Reports, survey
	4	Frequent machine trouble	Reports, interview, survey
	5	Break down of equipment	Survey
	6	Low operation rate of machinery	Interview, survey
	7	Working efficiency of machines is lowering year by year	Survey
	8	Short life of plough	Interview
	9	Can not buy expensive S/P	Interview, survey
	10	Cash is short (account receivable)	Survey
	11	Can not make business plan	Survey
	12	Low management of record keeping	Survey

Attachment IV
SWOT and Cross SWOT Analysis

Cross SWOT Analysis

<p>Internal environment</p> <p>External environment</p>	<p><Strength></p> <ul style="list-style-type: none"> • AMSEC runs agriculture related business, and has a network in agriculture sector in the rural area. 	<p><Weakness></p> <ul style="list-style-type: none"> • Dispersed nature of small holder farm lands • Low skill of operators • Shortage of skilled operators • Some operators cheat in work • Frequent machine trouble • Break down of equipment • Low operation rate of machinery • Working efficiency of machines is lowering year by year • Short life of plough • Can not buy expensive S/P • Cash is short (account receivable) • Can not make business plan • Low management of record keeping
<p><Opportunity></p> <ul style="list-style-type: none"> • Can buy equipment with cheaper price (low initial cost) because of subsidy. • Can receive operator training free of charge at the establishment • High machinery service demand • Little number of machinery service providers who serve with various implement except plough, harrow and trailer 	<p><u>S/O Approach</u></p> <ul style="list-style-type: none"> • To expand ploughing, harrowing and transporting service by increasing number of tractor • To expand service variety by increasing variety of implements, such as planter, sprayer, and sheller and combine harvesters • To rent out or transfer equipment from AMSEC in low demand area to AMSEC in high demand area. • Increase the number of AMSECs in high demand areas 	<p><u>W/O Approach</u></p> <ul style="list-style-type: none"> • To increase service volume and improve profitability by decrease breakdown and repair through capacity improvement of operator and mechanic and their treatment. • To achieve spare parts stock and quick repair by improvement of cash management through improvement of management skill. • To aggregate small holder farms into block
<p><Threaten></p> <ul style="list-style-type: none"> • Competitor using second hand tractor • Escalation of fuel price • Difficulty of access to S/P • Low demand of machinery service • Location of farm is far • Small plot of farmland • Farmland is scattered • Stumps and stones in farmland which cause equipment break down • Low rainfall • Low affordability of farmer to pay for service • Little medium and large scale farmers where machinery can work efficiently • Fixed seasonal service fee • Difficulty of planning due to relaying rain fall 	<p><u>S/T Approach</u></p> <ul style="list-style-type: none"> • To seek service demands nearby presently servicing small plots. • To advise farmers to improve their farmland condition suitable for mechanization. • To stock expensive spare parts in partnership with neighboring AMSEC • To provide cultivation technique to farmers as well as machinery service for improve crop productivity. 	<p><u>W/T Approach</u></p> <ul style="list-style-type: none"> • To stop machinery service remote farms. • To stop machinery service remote farms. • To stop machinery service farms that are not suitable for mechanization (stumps and stones). • To stop machinery service farmers who are behind on their bills.

Volta Region				
No.	Name of Individual/ organisation	AMSEC Location Town/ District/ Region	Postal Address	Machinery allocated
1	Reddekopp Ministries	Ho-Adaklu, VR	Box HP 1011, Ho. Tel 0248-329718	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
2	Community Relief (Dickson Degbor)	Sogakope- VR	P. Box SK 2, Sogakope Tel 0243-133261, 020-4702597	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
3	Addicent Foods Ltd. (M. Nttorinkansah)	North Tongu District, VR	P.O.Box BT 300, Com. 2 Tema Tel. 0244-378522	(4) John Deere tractors, (4) ploughs, (1) sheller, (1) Farmtrac-60 tractor complete, (1) rotovator
4	ASSOCIATION OF TRACTOR OPERATORS, P. O. BOX 245, HO, V/R.	HO, VR	P.O.BOX 245, HO, VR. TEL: 020-9026012	(5) Farmtrac-70 tractors, (3) Yukon tractors
5	Adidome Mechanisation Centre (Mr. Kudzo Agbo)	Adidome, VR	P. O. Box 16, Adidome. Tel: 0243-216907	(7) John Deere tractors, (7) ploughs
6	Tropical Agricultural Marketing and Consultancy Services (Sunflower Ghana Ltd.) TRAGRIMACS (Issah Sulemana)	Sogakope/Akatsi, VR	P.O. Box AD 464, Adabraka, Accra. Tel. 020-8135861	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
7	Ghana-Cuba Agric Services Ltd (Larry Farms Ltd)	Hohoe, VR	P. O. Box 17463, Accra Central. (P. O. Box CT7021, Accra) Tel: 0244-379378	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
8	Mr. Joe Gidisu	Mafi- Akyemfo, VR	P. O. Box 18, Adidome, V/R tel: 0243216907, 0248511817	
9	S&K Agroservices Providers Ltd	Sagakope, VR	P. O. Box SR 140 Tema, tel: 0244841896, 0276254935	
Central Region				
No.	Name of Individual/ organisation	AMSEC Location Town/ District/ Region	Postal Address	Machinery allocated
1	Mikleb Ent. (Alhaji Amuda Adams)	Swedru, CR	P.O. Box 522, Sakomono Estates. Tel. 0277-604599	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete

2	Vegetable Producers and Exports Association Of Ghana	Buduatta Junction, C/R	P.O. Box SD 239, Stadium–Accra. Tel: 0244–091465, 0244–446882	(5) Mahindra 605Di tractors
3	AKUAFOHEMAA MECHANISATION SERVICES	KASOA, CR	P.O.BOX AN 6159, ACCRA – NORTH. TEL: 0244–626548	(5) Farmtrac–70 tractors, (3) Yukon tractors
4	Emtrade company Ltd. (Emmanuel C. Akuna)	Winneba (Ewutu–Efutu), CR	P.O. Box 233, Winneba. Tel. 020–8123185/ 0244–158588	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac–60 tractor complete
Western Region				
No.	Name of Individual/ organisation	AMSEC Location Town/ District/ Region	Postal Address	Machinery allocated
1	Organic and Biodiversity Farming (Issah Quedraogo)	Ahanta West, Wassa Mpohor West, WR	P.O. Box TD 177, Takoradi Tel. 0244939848	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac–60 tractor complete
Greater Accra Region				
No.	Name of Individual/ organisation	AMSEC Location Town/ District/ Region	Postal Address	Machinery allocated
1	Adeaye Enterprises (W. Agyemang Badu)	Dangbe East & Dangbe West, GAR	P.O. Box DC 623, Dansoman, Accra Tel. 0243162209	(4) John Deere tractors, (4) ploughs, (1) Farmtrac–60 tractor complete
2	Bremoah Ventures	Amasaman, GAR	P. O. Box 285, Amasaman. Tel 020–8179720	(4) John Deere tractors, (4) ploughs, (1) Farmtrac–60 tractor complete
3	THE MANAGING DIRECTOR, AGRIC MECHANISATION & INPUTS LTD,	NSAWAM/ AMASAMAN, GAR	P.O.BOX 106, NSAWAM. TEL: 0244–232287	(5) Farmtrac–70 tractors, (3) Yukon tractors
Brong Ahafo Region				
No.	Name of Individual/ organisation	AMSEC Location Town/ District/ Region	Postal Address	Machinery allocated
1	Sofo–Fatao Enterprise	Nante–Kintampo Centre, BAR	P.O. Box 14, Nante–Kintampo, Brong Ahafo. Tel: 0246–661959, 020–3858130	(3) Mahindra 605Di,
2	THE MANAGING DIRECTOR, FABY (CELVIC) VENTURES LTD,	ATEBUBU, BAR	BOX DS 488, ACCRA. TEL: 020–8133297, 0243–508156	(5) Farmtrac–70 tractors, (3) Yukon tractors
3	Out of Bounds Incorporated (Daniel Opoku)	Tano Obuasi, BAR	Box KA 310522 Accra. Tel: 0244–318342	(4) John Deere tractors, (4) ploughs, (1) trailer (1), Farmtrac–60 tractor complete

4	GUMBIANI FARMS LTD (Mohamed Moro)	Amatin, (Brong-Ahafo), B/A	P.O. Box 5, Amantin, Tel. 0244-076941	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
5	Kodom Farms (Yaw Kodom)	Nkoransa (Brong Ahafo), BAR	P.O.Box 190, Nkoransa, Tel.020-8877301/0244-896837	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
6	Faby Agro Limited. (Francis Amadu Boateng)	Atebubu-Amantin, BAR	Faby Agro Ltd, P.O. Box DS 488, Dansoman Estate, Accra Tel: 0243-508156. P O Box 23 Atebubu-Amantin BA	(2) John Deere tractors, (2) ploughs, (1) Farmtrac-60 tractor complete, (2) FT-70 tractors complete
7	Kobbiman Farm Ltd	Nkoranza, BAR	P.O. Box 16 Nkoranza Tel. 0244-310534	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
8	Amobaff Ent.	Kintampo, BAR	C/o Mr. Amoo Baffoe, P. O. Box M37 Accra Tel 0242-675595	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
9	Tuobodum Unity Cooperation Tomato growers & mkting Society	Tuobodum, BAR	P. O. Box 8, Techiman Tel: 0244-590427	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
10	The Manager, Buah Limited,	Kintampo - North, BAR	C/O Zajab Ventures DTD, P26 Community 22, Tema. Tel: 0246-526676/0244-370230	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
11	The Principal, Methodist University College	Wenchi, BAR	Wenchi	(4) Mahindra, (1) Farmtrac
12	CONSORTIUM	WENCHI, BAR	C/O METHODIST UNIVERSITY, WENCHI Tel: 021-314542, 020-4426114	(3) Farmtrac-70 tractors, (2) John Deere tractors
13	The Managing Director, Ghana Nuts Ltd	Techiman, BA/R	Techiman, B/A. Tel:0244-010711	(5) Mahindra 605Di tractors
Ashanti Region				
No.	Name of Individual/ organisation	AMSEC Location Town/ District/ Region	Postal Address	Machinery allocated
1	Woodland Mechanical Company (Gibson Ankromah)	Sekyere East, Kumawu, ASR	P. O. Box AM 176, Amasaman, Accra. Tel. 020-7860227/ 020-8494736	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
2	P.N. Industries Ltd (K. N. Poku)	Ejura, ASR	P.O. Box 567 KNUST, Kumasi Tel: 0277-454547	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete, (1) trailer, (1) Yukon tractor, (1) power tiller, (1) sheller, (1) FT-80 (4x4) tractor

3	CEO, Baribon Ltd	Offinso, ASR	Box AN 11267, Accra. tel 0242-563557	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
4	Clear Farms Ltd	Agogo-Ashanti, ASR	P. O. Box 550, Accra. Tel; 0249-959643, 0272-922359	(3) John Deere tractors, (3) ploughs, (2) Farmtrac-60 tractor complete, sheller
5	Nso Nyame Ye Women's Gp ,	Ejura, ASR	C/o Ejura District Assembly, Box 9, Ejura	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
Eastern Region				
No.	Name of Individual/ organisation	AMSEC Location Town/ District/ Region	Postal Address	Machinery allocated
1	AA Farms (Alex Adeti)	Mame Krobo Afram Plains, ER	Box AC156, Accra 0244-959132	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
2	Unkar Limited (Alex Anane-Darko)	Manya-Krobo, E/R	P.O. Box GP4927, Accra, Tel.0246-584081	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
3	Community Planning and Development (Justice M. Darko)	Kwahu North District, Donkorkrom, E/R	C/o P.O. Box 1, Donkorkrom, Kwahu-North District Tel. 020-8774038	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
4	Kwasamay Ltd. (Nana Ackah-Yensu)	Afram Plains Donkorkrom, ER	P.O Box CT 419 Cantoments, Accra Tel. 0244-291878	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
5	Mr. Theophilus Asante-Darko	Manya-Krobo, E/R	P. O. Box 521, Accra 050-733-7799	(4) John Deere tractors, (4) ploughs, (2) trailer, (1) Farmtrac-60 tractor complete
6	ADEMEC LTD,	DONKORKROM, ER	P.O.BOX AN 10576. ACCRA- NORTH. TEL: 020-8155224, 0244-635221	(5) Farmtrac-70 tractors, (3) Yukon tractors
7	NOMAFO FARMS & SERVICES,	ASUTSUARE,ER	BOX 522, TEMA. TEL: 0244-622105	(5) Farmtrac-70 tractors, (10) shakti power tillers, (5) rotovators
8	The Chairman, Afram Plains Tractors Owners And Farmers Association	Afram Plains-Forifori, E/R	% Box 20, Afram Plains, E/R. Tel: 0278-628772, 0546-421832, Mallam Issifu	(5) Mahindra 605Di tractors
9	The Managing Director, Royal River Agro Estate Ltd	Asuogyaman Centre. E/R	P.O. Box 15649, Accra- North. Tel: 0277-424612, 0274-853303	(5) Mahindra 605Di tractors
10	ELFA Enterprise (Victor Aglieko)	Fanteakwa (Begoro), E/R	P.O.Box KB 170, Korle-Bu, Accra, Tel. 0242-167603	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete

Northern Region				
No.	Name of Individual/ organisation	AMSECC Location Town/ District/ Region	Postal Address	Machinery allocated
1	Green Planet Ltd. (A. Ayariga)	Tamale, NR	P.O. Box 100, Tamale. Tel. 0248-140000	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
2	Sakpe Agricultural Ent. (Ibrahim Adam Fawzy Momoa).	Central Gonja, NR	P.O. Box CT 5577, Cantoments Accra	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
3	Kukurdama Enterprise (Alhaji Yusuf Salifu Abdella).	Bimbilla, NR	P.O. Box 1104, Tamale	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
4	Bosbbel Kofi Ansah	Tamale, NR	P. O. Box 279, Tamale 071-23342, 0244-864799	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
5	Laangu Farmers Ass. Janga Walewale West Mamprusi	Janga, Walewale, NR	C/o MOFA P.O.Box 4 Walewale, Tel: 054 113 1976	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
6	Tijo Farms (Alhaji Ibrahim Adam), Tamale	Tamale, NR	P.O Box 2943 Tamale Tel. 0246-847774	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
7	Kurbani Farms	Tamale, NR	P.O. Box 65 Tamale Tel. 0244-686604	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
8	Dagbon Traditional Council (Attn Alhaji Ibrahim Adam), Yendi	Yendi, NR	Dagbon Traditional Council, Yendi	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
9	Sofo Awudu Azoka Group	Tamale, NR	P. O. Box 586, Tamale 0244-218296	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
10	Tas Kalia Ent Ltd. (Hon. Ibrahim Tanko)	Yagaba-Kubori West-Mamprusi District, NR	P.O. Box 41, Navrongo Tel. 0742-22284, 020-8543000, 0244-995111	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete, (2) power tillers, (1) FT-80(2x4)
11	MD, Zijaha Gh. Ltd	Tolon/Kumbugu, NR	Box 1519, Tamale Tel; 0243-253331, 020-8139652	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
12	The Chairman, Tunteya Farming Gp	Zabzugu, NR	Zubzugu District Assembly Tel: 0242-608374/0246-58819	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
13	Logistics Support Services (Adam Manama)	Bole, NR	Bole District, N/R	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete

14	THE MANAGING DIRECTOR, FATHI AGRO-FORESTRY CO-OPERATIVE FOOD FARMING AND MARKETING SOCIETY	TAMALE, NR	P.O.BOX 841, TAMALE. TEL: 0244-679689, 071-23154	(5) Farmtrac-70 tractors, (3) Yukon tractors
15	THE MANAGING DIRECTOR, GLOBAL AL-MAS LTD,	BIMBILLA, NR	P. O. BOX 57,BIMBILLA. TEL: 0244-177050, 021-517815, 071-25984	(5) Farmtrac-80 tractors, (2) Farmtrac-70 tractors
16	Sakfos Farms (Sakara Asumah Rennie)	West Gonja (Damango), NR	P.O. Box DM 111, Navrongo Tel. 0243-523848	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
17	AKK Risk Management Consulting Ltd	Yapei -NR	P. O. Box DC579, Dansoman, Accra.	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
18	Nasara Best Farmers Association	Gushegu - NR	C/o Box GU27, Gushegu 0246-733004	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
19	The Manager Agro Concepts Limited	Gambaga, N/R	P.O. Box 1, Gambaga-East Mamprusi. Tel: 0244-942442	(5) Mahindra 605Di tractors, maize sheller
20	Hon. Alhaji Abdulkarim iddrisu, MP Nanton Constituency	Nanton, Savelugu	Parliament of Ghana, Parliament House, Accra. Tel: 0243-665642, 0244-350409	(5) Mahindra 605Di tractors
21	Savanna Agric. & Trading Co. Ltd	Chereponi Centre, N/R	P.O. Box DS 689, Dansoman, Accra. Tel:	(3) Mahindra 605Di, (2) farmtrac 60
22	Hon. Dr. Alhassan Ahmed Yakubu, Office Of the Member of Parliament	Mion Centre N/R	Accra. Tel: 0244-838977	(3) Mahindra 605Di, (2) farmtrac 60
23	Kpangmanga Co-operative Food Farming and Marketing Society Ltd	Nayugu-Gushegu Centre	House No. G 103, Gushegu. Tel: 0243-453492	(2) Mahindra 605Di, (3) Farmtrac 60
24	Gbewaa Farmers association, % Abubakari Immururana	Tamale Centre, N/R	P.O. Box 1967, Tamale. Tel: 0268-587103,0243-253331,0244-704291	(5) Mahindra 605Di tractors
25	Nanduwa Valley Farms & Mechanization Services	AMSEC Nalerigu	P.O. Box 12, Nalerigu, East -Mamprusi. Tel: 020-8527331, 0277-890418	(5) Mahindra 605Di tractors
26	Hon. Fuseini Alhassan, % Gushegu District Assembly	Tamale, N/R	P.O. Box GU. 1 Gushegu. Tel: 0244-714070	(5) Mahindra 605Di tractors
27	The Municipal Chief Executive, East Gonja Assembly	Salaga, N/R	P. O. Box 1 Salaga, tel: 0246753565, 0244868533, 0246904173, 0246633414	
28	SIMTEX enterprise	Tamale, N/R	P. O. Box TML 1354, Tamale tel; 0208154959	

Upper West Region				
No.	Name of Individual/ organisation	AMSEC Location Town/ District/ Region	Postal Address	Machinery allocated
1	Cashew Farmers Association Wigbert Y. Dogoli	Nadowli District, UWR	C/O CWSA Box 810 Tamale	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
2	MCE, Wa Municipal Assembly	Wa, UWR	Wa Municipal Assembly, Wa	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
3	DCE, Wa West District Assembly	Wa, UWR	Wa West District Assesmbly Naa Bawah Seidu, Tel:020-841-3541	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
4	DCE, Wa East District Assembly	Wa, UWR	Wa East District Assembly	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
5	DCE, Jirapa District Assembly	Jirapa, UWR	Jirapa District Assembly, Mr. Festus, Tel: 020 947 8757, 039 202 2503	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
6	DCE, Sisala West District Assembly	Sisala,UWR	Sisala District Assembly	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
7	THE MANAGING DIRECTOR, NYIVORI-TONA CO LTD,	WA, UWR	P.O.BOX SR 326, ACCRA. Tel:027-4523443 (old) 024	(5) Farmtrac-70 tractors, (3) Yukon tractors
8	DCE, Nadowli District Assembly	Nadowli, UWR	Nadowli District Assembly	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
9	DCE, Lambussie District Assembly	Lambussie, UWR	Lambussie District Assembly	(4) John Deere tractors, (4) ploughs, (1) Farmtrac-60 tractor complete
Upper East Region				
No.	Name of Individual/ organisation	AMSEC Location Town/ District/ Region	Postal Address	Machinery allocated
1	THE PRESIDENT, NATIONAL FARMERS & FISHERMEN AWARD WINNERS ASSOC.,	FUMBISI VALLEY, UER	BOX KD 537, KANDA ACCRA. TEL: 021-222455, 0244-364440	(5) Farmtrac-70 tractors, (3) Yukon tractors
2	GOODMAN & SONS LTD,	NAVRONGO, UER	P. O. Box 287, TAMALE	(5) Farmtrac-70 tractors, (3) Yukon tractors

3	Yelsumde Farms Ltd. Zongoyire	Bawku West Centre	P.O. Box ZE 27, Bawku. Tel: 0244-409331, 0244-216591	(3) Mahindra 605Di,
4	Irrigation Farmers Association (Ahmed Bogobiri),	Tono, Kasena Nanakani , UER	Tono cooperative Union, C/o Icour Limited, Box 70, Navrongo	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
5	The Manager, Dolidona Ent	Bolgatanga, UER	P.O. Box 1 Bolgatanga Tel. 020-8336643	(4) John Deere tractors, (4) ploughs, (1) trailer, (1) Farmtrac-60 tractor complete
6	Hon. Mahama Ayariga,	Bawku, UER	Office of the President, Accra. Tel (020-6662337)	(5) John Deere tractors, (5) ploughs, (4) trailers, (3) harrows
7	Alhaji Mumuni Bolnaba, Bonaba Const. Ltd,	Pusaga, UER	P.O. Box 115, Bawku Tel: 026749019, 0244022425	

Agricultural Machinery Service Centre (AMSEC)

Operational Guideline

Aug 2015

Japan International Cooperation Agency
(JICA)

Contents

- 1. Before Applying AMSEC..... 19
 - 1.1. Customer and Demand 19
 - 1.2. Skilled Operator and Mechanic 20
 - 1.3. Facility and Equipment 20
 - 1.4. Workshop for Repair 20
 - 1.5. Investment Analysis 20
 - 1.6. Funds for Establishment of AMSEC 21
- 2. After the Proposal is Accepted 22
 - 2.1. Preparation of Mid and Long-Term Business Plan 22
 - 2.2. Preparation of Annual Business Plan 22
 - 2.3. Capacity Development of Staff (Manager, Operator and Mechanic)..... 22
 - 2.4. Preparation of a Series of Records Form..... 22
 - 2.5. Announcement to Customer 23
- 3. Implementation Stage 24
 - 3.1. Order..... 24
 - 3.2. Preparation of Monthly Work Plan 24
 - 3.3. Weekly Planning 24
 - 3.4. Monitoring and Adjustment of the Weekly Plan..... 24
 - 3.5. Monitoring of Records 24
- 4. Periodic Work 26
 - 4.1. Daily Management 26
 - 4.2. Weekly Management..... 26
 - 4.3. Monthly Management 27
 - 4.4. Works After the Season..... 27
 - 4.5. Works at the End of the Year 28
- 5. Human Resource Development 29
 - 5.1. Strengthening of Human Resource Development 29
 - 5.2. Labor Management..... 29
- 6. Customer Management 31
 - 6.1. Preparation of Customer Profile..... 31
 - 6.2. Utilization of Customer Profile 31
- 7. Financing from Financial Institution 32
- 8. Pricing of Service Fee..... 33
- 9. Necessary Data for Planning 34

1. Before Applying AMSEC

1.1. Customer and Demand

To collect the following information by cooperating with Agriculture Extension Agent and Farmer Based Organization in target district and adjacent area.

(1) Demand of Machinery Service

Applicants roughly confirm expected demand of machinery service in target district and adjacent area (timing, types of service, and acreage) from availability of farmland, number of farmers, cultivated crops, crop calendar.

(2) Service Type

Applicants confirm that what types of service could be expected by farmers from crops cultivated in target area.

(3) Competition

If there are other machinery service providers already working in the target area, there are two options: one is to avoid competition and find another target area, another is to compete with them. Applicants confirm information regarding service area, types of service, and service fee in order to consider the competitive price of the service fee. If there is no competition, a similar level of service fee in an adjacent area could be acceptable at the time of start-up.

(4) Target Area

Based on the collected information, the applicant identifies the target area and service type (ploughing, harrowing, planting, spraying, harvesting, shelling, milling, carting, etc.). Distance between a station and the target area has to be considered. A farther distance results in a higher transportation cost and longer time. This is related to the pricing of service fee as well.

(5) Identifying Customer Segment

It is expected that the customer segment are farmers who do not have agriculture machinery, and farmers who cannot cover their farm with their own machinery. The farms are small, medium and large scale. Servicing to larger-scale farms is more efficient considering transportation from farm to farm, but it can be solved by gathering adjacent small farms.

1.2. Skilled Operator and Mechanic

- (1) The applicant availability of operators and mechanics around the target area.
- (2) The applicant judges their skill level, such as experience and technical knowledge. If the applicant cannot judge their skill level, it consults with AESD regional engineer.
- (3) If there are no skilled operators and mechanics available, the applicant provides the appropriate training to a possible candidate. The cost for the training has to be estimated in the initial cost estimation.

1.3. Facility and Equipment

(1) Office

A certain space for daily work or meeting with staff is necessary.

(2) Parking Yard and Storage Facility

In order to keep equipment in better condition, a parking yard with a roof and storage facility is necessary as well to prevent theft.

(3) Tools

A series of tools has to be prepared for easy maintenance and repair of equipment. It is recommended to use a personal computer for the efficient management of information like record keeping and analysis, but it is not indispensable.

1.4. Workshop for Repair

(1) Availability of Workshops for Repair of Equipment

The applicant checks the availability of workshops or mechanics nearby. In case there are no workshops or mechanics, it checks the availability of field mechanics traveling from region to region.

(2) Availability of Spare Parts

The applicant checks the availability of spare parts nearby, or in the regional capital and Accra, place, types, price, and delivery time.

1.5. Investment Analysis

In a sense, AMSEC business is an investment for applicants who plan to be machinery service providers. They invest funds, utilize equipment, and secure sales. Then, can they make profits against

Attachment VI
AMSEC Operational Guideline

invested funds? Various factors have to be considered. For example:

- How much sales, costs, and profits do they expect from each service?
- How much do they charge for services?
- What kinds of costs are expected?
- In case they borrow funds from financial institutions, how much do they repay every year? When do they redeem a loan?

Both internal environment (amount of funds, skill of business management) and external environment (service demands, competition, availability of skilled managers and operators, fluctuation of fuel and spare parts costs) are comprehensively examined for decision making regarding investment.

The applicant examines profitability of AMSEC business using the following information. If the applicant borrows funds, repayment also has to be considered in the analysis.

- Pricing by service type
(ploughing, harrowing, planting, spraying, harvesting, shelling, carting etc.)
- Cost items, unit cost
- Estimation of sales, costs, and profits based on annual work plan

Even though AMSEC uses equipment on their own farm, a service fee has to be collected for investment analysis. Costs for imported items like spare parts and fuel have to be estimated, referring to past price fluctuation. Risks due to weather conditions have to also be considered in the investment analysis, but there are no data available to measure the risk on machinery service. In the future, it would be clarified by analyzing records kept by AMSEC. An unserviceable risk by equipment malfunction is likely higher than a weather risk, but proper management can avoid it.

1.6. Funds for Establishment of AMSEC

Applicant has to estimate necessary funds for the establishment of AMSEC, and to secure funds.

(1) Initial Investment Cost

An applicant estimates costs for equipment, the workshop, tools, an office, and fixtures and furniture.

(2) Operating Cost

An applicant estimates costs for labor, fuel, maintenance, repair, and spare parts for the first year.

2. After the Proposal is Accepted

2.1. Preparation of Mid and Long-Term Business Plan

AMSEC prepares a mid and long-term business plan. It is considered that AMSEC add a tractor for their operation or add a variety of services in the future. In the first 3 years, they should concentrate on strengthening their business foundation by fully utilizing current equipment. If they borrow funds from the government or financial institutions, they should repay them as scheduled. Based on the investment plan, figures should be adjusted and utilized as the mid and long-term business plan.

2.2. Preparation of Annual Business Plan

An annual business plan has to be prepared. When, what type, and how many acres does AMSEC provide for machinery service? How much does AMSEC earn from their business? How much does AMSEC spend? It should also consider whether cash is enough.

In the investment analysis, AMSEC already roughly estimated the above figures. AMSEC adjusts figures at the field level, and then allocates them each month in the business plan.

2.3. Capacity Development of Staff (Manager, Operator and Mechanic)

Whether or not operators have experience, AMSEC should make them participate in technical training before operation starts. There are not many operators participating in formal training on agriculture machinery. Even though they have received training before, they may misunderstand or may forget things they have learned.

Low skilled operators easily let equipment break down. Repair costs will be a big burden for AMSEC business, and AMSEC has to carefully handle their equipment. Therefore, AMSEC should give the opportunity to operators to participate in training periodically.

The malfunction of equipment results not just in the increase of repair costs, but also in the lost opportunity to provide service during the unused period.

A manager also should have business management skills and have knowledge of agriculture machinery, in the very least.

AESD periodically organizes a series of training for managers, operators and mechanics of machinery service providers. AMSEC should contact AESD to participate in the trainings.

2.4. Preparation of a Series of Records Form

AMSEC has to prepare the necessary records which will be completed by the manager and operators when they start the operation. The manager would explain how to complete information in the record. The information maintained in the records is very important for analyzing operation status and for

Attachment VI
AMSEC Operational Guideline

preparing financial statements afterwards.

2.5. Announcement to Customer

Before the season starts, AMSEC announces their service type, service area, service fee by type to the customer through AEA/FBO and any publication medias.

3. Implementation Stage

3.1. Order

When AMSEC receives an order from customers, a manager visits the site and checks basic information on the site. Then a Customer Profile is completed. Service area has to be measured for operation planning. Recently, GPS function of a smartphone is utilized for measuring acreage of the farm by some farmers and AMSEC.

3.2. Preparation of Monthly Work Plan

Based on the annual work plan, the monthly work plan is prepared identifying service type and acreage by tractor. Expected revenue, cost and profits are calculated. Especially at the beginning of the season, AMSEC checks whether they have enough cash for maintenance and repair.

3.3. Weekly Planning

Based on the information of Customer Profile, a manager makes a weekly tractor allocation plan. Fuel consumption of a tractor is varied from 4 to 6km/liter depending on road condition. Therefore, for effective tractor allocation, it is necessary to consider minimization of movement and time, from the station to the site gathering service sites, by tractor, and by day. More movement distance results in higher fuel cost. More movement time results in less workable time on site.

3.4. Monitoring and Adjustment of the Weekly Plan

Monitoring actual service results, a manager adjusts the service plan as ahead of schedule or postpones it. Schedule changes, especially due to rainfall conditions, require the confirmation of customers. Even if a service plan is changed, gathering service area by a tractor and by date has to be considered for cost effective service.

3.5. Monitoring of Records

A manager monitors necessary records mentioned in Chapter 2.2 for all machines and equipment.

(1) Service Records

Information to be recorded: date-time, site, acreage, service type, working time, and filled fuel.

(2) Inspection and Maintenance Record

Information to be recorded: regular inspection and maintenance, and their date-time and content.

(3) Repair Record

Information to be recorded: place of repair, price, name of workshop/mechanic, and operator in charge.

If a particular tractor has been repaired very often, the operator's technical level of inspection, adjustment and operation should be suspected. When interviewing the operator, if he seems not to have enough technical skills, a manager decides to replace the operator, and has him participate in a training course.

(4) Income and Expenditure Record

A manager checks whether there are missing records by referring to the Service Record, maintenance record and repair record.

4. Periodic Work

4.1. Daily Management

(1) Operation Management

The manager checks operators carrying out inspection before and after servicing. If there is trouble or signs of trouble with the equipment, it calls a mechanic to inspect it.

At the end of the day, the manager checks the results of service and the service plan. Then, if the service plan has to be changed (postponed or front loaded), the manager notices any change of service schedule to customers immediately, as well as he/she informs the operators of the new schedule.

(2) Financial Management

The manager enters the financial record into the Income and Expenditure record referring to the Service Record, Maintenance Record and Repair Record. At the end of day, the manager checks the balance stated in the Income and Expenditure Record and savings/ money on hand.

4.2. Weekly Management

(1) Operation Management

At the end of the week, the manager reviews the week of work of each piece of equipment through related records. It determines whether higher fuel consumption and longer working time is correct, compared to the distance between the station and the sites and serviced area, checking with the operator information.

The manager also prepares the weekly service plan for the next week depending on the progress of the current service week.

(2) Financial Management

At the end of the week, the manager checks the balance stated in the Income and Expenditure Record and savings/ money on hand.

The manager tabulates weekly sales and costs by item (labor cost, fuel cost, maintenance cost, repair cost). Then the manager calculates the amount of weekly sales, costs, and profits.

(3) Inspection, Maintenance and Repair

At the end of the week, the manager checks the condition of all the tractors referring to Inspection Records, the Maintenance Record and Repair Record. If inspections and maintenance were not properly conducted, the manager instructs operators to carry out the proper work.

Once repair works are done during the week, the status of the repaired point has to be checked.

4.3. Monthly Management

(1) Operation Management

At the end of the month, the manager prepares the monthly service plan, sales plan and budget plan for the next month depending on the progress of service in the current month.

(2) Financial Management

At the end of the month, the manager checks the balance stated in the Income and Expenditure Record and savings/ money on hand.

The manager tabulates monthly sales and cost by item (labor cost, fuel cost, maintenance cost, repair cost). Then the manager calculates the amount of monthly sales, costs, and profits.

(3) Inspection, Maintenance and Repair

At the end of the month, the manager checks the condition of all tractors, referring to Inspection Records, the Maintenance Record and Repair Record. If inspections and maintenance were not properly conducted, the manager instructs operators to carry out the proper work.

Once repair works are completed during the month, the status of the repaired point has to be checked.

4.4. Works After the Season

(1) Operation Management

Reviewing the Work Plan and the results, the manager identifies improvement in terms of management issues. Any improvement would be utilized for the next season's operation.

(2) Financial Management

At the end of the season, the manager checks the balance stated in the Income and Expenditure Record and savings/ money on hand.

The manager tabulates seasonal sales and cost by item (labor cost, fuel cost, maintenance cost, repair cost). Then the manager calculates the amount of seasonal sales, costs, and profits.

(3) Inspection, Maintenance and Repair

Ideally, all the equipment should be taken to a workshop where there are professional mechanics for inspection and maintenance and repair.

4.5. Works at the End of the Year

(1) Inspection, Maintenance and Repair

All the equipment should be taken to a workshop where there are professional mechanics for inspection and maintenance and repair.

(2) Financial Management

The Annual Financial Statement, which consists of the Profits and Loss Statement, Balance Sheet, and Cash flow Statement) is prepared.

(3) Analysis

Comparing current Financial Statements and past ones, or one's Financial Statement and other AMSEC's Financial Statements, the business status is analyzed from viewpoints of profitability, soundness, and productivity. Issues to be improved would be reflected in the next year's Annual Plan. (Textbook includes how to analyze Financial Statement)

(4) Preparation of Annual Plan

The following plans for the next year are prepared referring to the results of the current year.

- Work Plan
- Sales Plan
- Budget Plan

5. Human Resource Development

5.1. Strengthening of Human Resource Development

For sound business management, the key is the performance of human resources as well as the performance of equipment. Performance of equipment is defined at the time of procurement, and it might decrease, but never increase. Performance of human resources, however, is controlled by the intention of both the owner and employees. Low management capability of AMSEC staff can cause work planning to be inefficient, equipment to break down due to improper operation, and broken down equipment to be left due to cash shortage. In AMSEC, each employee has to have the following knowledge, skill and experience. It is advisable that AMSEC employ well-trained and experienced human resources personnel. Even if it is difficult, AMSEC should try to improve the capacity development of their employees by on-the-job and off-the-job trainings.

(1) Manager

The following administrative and technical skills are necessary to carry out the work.

- Daily management skills (preparation of service plans, supervision of operations, communication skills with customers and laborers)
- Knowledge of accounting
- Basic knowledge of agriculture machinery

(2) Operator

- Operation of tractors, adjustment of implements, maintenance of equipment
- Record keeping

(3) Mechanic

- Inspection, maintenance, procurement of spare parts, repair of equipment
- Record keeping

AESD periodically organizes a series of trainings for managers, operators and mechanics of machinery service providers. AMSEC should contact AESD to participate in the trainings.

5.2. Labor Management

(1) Proper Evaluation and Treatment

It is important to evaluate employees' performance and treat them properly for maintaining or increasing their morale. This will enhance the competitiveness of AMSEC business.

Different salary rates based on their work experience and operation skills, by monitoring the records maintained (service record, maintenance record, and repair record) could be adopted. Currently, most farmers do not care much about the quality of ploughing and harrowing service, but once introduction

Attachment VI
AMSEC Operational Guideline

of planters starts or farmers improve cultivation techniques, service quality will be a key for differentiation strategy. It will then be necessary to decide the level of salary by technical skills of the operator. Proper treatment by performance is also to limit employees changing to other machinery service providers.

Evaluation methods vary, and have to be well understood by both the owner and employees. For example, as mentioned, necessary records are well maintained, work is done within the expected time, equipment is well maintained, and equipment does not need repair work except due to accident, can be indicators of evaluation. These indicators are evaluated by 3 or 5 levels, then salary level is decided based on total points.

(2) Employment Status

Most operators are seasonal employees. Their loyalty to AMSEC is very low, and they often change the machinery service providers they work for. They use different equipment, and handle it carelessly. AMSEC tries to increase the types of service, not only ploughing and harrowing, but also carting and shelling, for employing operators as permanent staff. This results both in increasing morale and raising the degree of tractor utilization.

6. Customer Management

6.1. Preparation of Customer Profile

AMSEC prepares Customer Profile collecting following information. Customer Profile is maintained at the office.

- Farmer Profile (name, address, and telephone number)
- Site Profile (location, distance from AMSEC station, acreage, presence of stones and stumps and soil condition)
- Cultivation Profile (crops cultivated)
- Payment Status (cash/in kind, delay of payment, accumulated outstanding)

6.2. Utilization of Customer Profile

(1) Efficient Operation Planning

An efficient work plan can be prepared utilizing the location of a site (aggregation of servicing site) and the distance from the AMSEC station (minimization of movement). The increase of movement between a site and a station directly affects the increase in fuel cost as well as workable time at sites.

(2) Avoiding Equipment Malfunction

A tractor hitting to stones and stumps at a servicing site causes the malfunction of equipment. The presence of stones and stumps has to be checked and recorded. The manager briefs operators before they start servicing.

7. Financing from Financial Institution

At the beginning of a cultivation season and at the time of machine malfunction, AMSEC often needs cash. When AMSEC does not have enough cash in hand, they should take out a loan from financial institutions. Creditworthiness is an obstacle for AMSEC. Preparing for possibilities of this kind, AMSEC starts borrowing a small amount, and then, increases the amount of borrowing, even though they have funds, so that creditworthiness can be achieved. Even in that case, AMSEC prepares financial statements and a series of plans (work plan, sales plan and budget plan).

Example of borrowing and repayment

< Borrowing amount: 3,000GHS with 30% annual interest rate (2.5% monthly interest rate) >

Machinery service fee is 60GHS/ac, Gross profit ate is 40%

Date		Sales	Repayment	Balance
1/May	Borrows 3,000GHS for repair of a tractor, and fixing the tractor			-3,000
31/May	The tractor worked on 50ac during the month. Gross profit=60GHS/ac x 50ac x 0.4 =1,200GHC	1,200		
1/June	Interest =3,000GHS x 0.025=75GHC			-3,075
1/June	Repayment 1,000GHS		1,000	-2,075
31/June	The tractor worked on 90ac during the month. Gross profit=60GHS/ac x 90ac x 0.4 =2,160GHS	2,160		
1/July	Interest =2,075GHS x 0.025=52GHS			-2,127
1/July	Repayment 1,000GHS		1,000	-1,127
31/July	The tractor worked on 40ac during the month. Gross profit=60GHS/ac x 40ac x 0.4 =960GHS	960		
1/August	Interest =1,127GHS x 0.025=29GHS			-1,156
	Repayment 1.156GHS		1,156	0
	Total	4,320	3,156	-

8. Pricing of Service Fee

In general, service fee is decided by demand and supply. Service fee of AMSEC is decided by consulting with farmer representatives. Therefore, the decided service fee is not always enough to make profits for AMSEC. Especially, fuel and parts that share a large component of the service cost are imported goods, and price is often changed by a probable increase. At least, these increased costs have to be added to the previous service fee. Otherwise, a low service fee presses AMSEC business, and finally farmers cannot receive the machinery service from AMSEC.

Of course, efforts by AMSEC into decrease their costs, such as the repair cost for the malfunction of equipment and fuel cost by inefficient operation, is a prior condition for increasing the service fee.

9. Necessary Data for Planning

Tractor

Work Efficiency and Fuel Consumption

Transportation: 4~8km/litter depending on the road condition

Work:

Work/ Implement	Winneba, Central region		Atebubu, Brong Ahafo region	
	Work Efficiency (ha/hr)	Fuel Consumption (liter/ha)	Work Efficiency (ha/hr)	Fuel Consumption (liter/ha)
Plough/ Disk plough	0.40	9.87	0.80	9.10
Leveling/ Disk harrow	0.59	8.21	0.72	7.79
Work/ Implement	Damongo, Northern region		Wa West, Upper West region	
	Work Efficiency (ha/hr)	Fuel Consumption (liter/ha)	Work Efficiency (ha/hr)	Fuel Consumption (liter/ha)
Plough/ Disk plough	0.52	6.04	0.42	3.93
Leveling/ Disk harrow	1.06	6.00	0.54	8.58
Drilling/ Planter	1.20	2.21	-	-

Annual depreciation (period is 10 years) : Price of equipment / 10 year

Costs for operation and maintenance : About 10% of Sales

Costs for repairs (parts, labor) : About 2,000GHS/year

Operator costs : About 10% of service fee

Above costs are just for reference, and changed depending on the level of maintenance and the skill level of operators.

Service Fee

Ploughing : 40-80GHS/acre depending on area and farm condition

Harrowing : About a half of ploughing service fee

Maize shelling : 1 bag for shelling 10-11bags

AMSEC

AMSEC/IND. FARMER	MACHINERY ALLOCATED	DATE OF APPLICATION	TOTAL COST OF MACHINERY AND IMPLEMENT ALLOCATED (GH¢)	2008 INITIAL PAYMENT MADE (GH¢)	2009 1 ST YEAR PAYMENT	2010 2 ND YEAR PAYMENT	2011 3 RD YEAR PAYMENT	2012 4 TH YEAR PAYMENT	2013 5 TH YEAR PAYMENT	2014 6 TH YEAR PAYMENT	TOTAL PAYMENT	BALANCE
THE MANAGING DIRECTOR ADEMAC LTD.	(5) FT 70	28/03/08	116,000.00	11,000.00	-	-	-	-	-	-	11,600.00	104,400.00
THE MANAGING DIRECTOR AKUAFOHENMAA	(5) FT 70	25/03/08	116,000.00	2,000.00 9,000.00	-	4,000.00	-	-	-	-	15,000.00	101,000.00
THE MANAGING DIRECTOR, AGRIC MECH. AND INPUT	(5) FT 70	25/03/08	116,000.00	2,000.00	-	-	-	-	902 14000	-	6902 <u>16,902</u>	99098
THE MANAGING DIRECTOR, FATHI AGRO FORESTRY	(5) FT 70	25/03/08	116,000.00	2,000.00	-	-	-	-	-	-	2,000.00	114,000.00
THE MANAGING DIRECTOR, GLOBAL AL-MAS	(5) FT 70 (2) FT 70	12/05/08	152,000.00	15,200.00	20,000	-	-	-	-	-	35,200.00	116,800.00
THE MANAGING DIRECTOR GUMBIANI FARMS LTD.	4 JD 4 PLOUGHS (1) TRAILER 2 FT 60	22/05/09	63,000.00	-	11,000.00 6,000.00	-	-	-	30000	-	47000	16000
THE MANAGING DIRECTOR NAMAFO FARM SERVICES	(5) FT 70 SHAK TI-PO TILLER 10 ROTO (5)	09/04/08	116,000.00	16,000.00	-	-	-	-	-	-	11,600.00	104,400.00
THE MANAGING DIRECTOR NYVORITONA	(5) FT 70 (3) YUKON	16/05/08	116,000.00	16,000.00	-	-	12,000.00	-	-	-	23,600.00	92,400.00
THE MANAGING DIRECTOR FABY VENTURES	(5) FT 70		182,700.00	116,000.00	11,000.00 6,000.00 2,000.00 24,400.00	-	-	-	-	-	55,000.00	127,700.00
THE MANAGING DIRECTOR CONSORTIUM	JD (4) PLOUGH	2008	63,000.00	16,000.00	-	-	-	-	-	-	11,000.00	52,000.00

THE MANAGING DIRECTOR NATIONAL FARMERS & FISHERMEN	FT-70	06/05/08	116,000.00	16,000.00	-	-	-	-	-	-	11600	104,400.00
VEGETABLE PRODUCERS & EXP.	JD 5404	2009	58,500.00	-	11,000.00	7,000.00	-	-	-	-	18,000.00	40,500.00
METHODIST UNIVERSITY	JD (7) PLOUGH (7)	01/09/09	84,000.00	20,000.00	-	20,000.00	16,000.00	-	12000 4000	12000	84000	NIL
TROPIC AGRIC. MKT.	JD (4) PLOUGH (4) TRI TEAR (1) FT 60	08/07/09	63,000.00	-	11,000.00	18,000.00 8,000.00	-	-	-	-	37,000.00	26,000.00
YELSUMDE FARMS LTD	JD 5404	MAR 2010	90,000.00	-	-	28,000.00	-	-	-	-	28,000.00	62,000.00
WOODLAND MECH. CO.	JD (4) PLOUGH (4) FARMTRAC	2009	63,000.00	-	5,000.00 11,000.00	-	-	-	-	-	16,000.00	47,000.00
TUOBODOM UNITY	JD (4) PLOUGH (4) FARMTRAC	19/08/09	58,500.00	-	11,000.00 7,000.00	-	-	-	-	-	18,000.00	40,500.00
UNKAR	JD (4) PLOUGH (4)	2009	63,000.00	-	11,000.00	-	-	-	-	-	11,000.00	52,000.00
THE MANAGING DIR. ASS. OF TRACTOR OPERATION	FT 70 (5)	2008	116,000.00	5,000.00	-	2,000.00	-	-	-	-	7,000.00	109,000.00
ADDICENT FOOD LTD.	JD (4)	2008	67,000.00	-	11,000.00	2,000.00	-	-	-	-	13,000.00	54,000.00
AA FARMS (ALEX ADET)	JD (4)	2009	63,000.00	-	11,000.00	5,000.00	-	-	-	-	16,000.00	47,000.00
AFRAM PLAINS	JD 5404	2009	90,000.00	-	3,500.00	7,000.00 15,317.00 16,000.00 3,500.00	-	-	-	-	45,317.00	44,683.00
ADEAYE ENT.	4 JD & OTHERS	2009	63,000.00	-	11,000.00	-	-	10,000.00 6,000.00	-	-	27,000.00	36,000.00

EMTRADE CO. LTD. E.C. AKUNA	TRACTORS	MAY 2009	63,000.00	-	11,000.00	4,000.00	30,000.00 14,000.00 4,000.00	-			63,000.00	NIL
ADIDOME	7 JD FT 60 (7)	02/07/09	84,000.00	28,000.00	-	-	15,500.00	20,050.00	14000	-	77550	6450
REDDEKOP	4 JD 4 PLOUGH FT 60	2008	58,500.00	-	11,000.00	17,000.00	-	-	7500.00	3000	38500.00	20000.00
AKK RISK MANAGEMENT	(4) JD & OTHERS	01/08/09	63,000.00	-	9,000.00 11,000.00	-	-	-	-	-	20000	43,000.00
GOODMAN & SON LTD.	5 FT-70 3 YUKON	2008	80,000.00	11,600.00	-	-	-	-			11,600.00	68,400.00
ALHAJI MUMUNI BOLNABA, BOLNABA												
AMOBFAFF ENTERPRISE	4 JD 4 PLOUGH FT (1)	01/09/09	58,500.00	-	2,000.00 11,000.00		8,000.00	-			21,000.00	37,500.00
BOSBEL KOFI ANSAH ENT.	4 JD TRACTORS & OTHERS	2009	63,000.00	-	11,000.00	2,000.00	-	-			13,000.00	50,000.00
COMMUNITY PLANNING DEPT.	4 JD (1) TRAILER 1-FT 60 4 PLOUGH	12/06/09	63,000.00	-	16,000.00	10,000.00					26,000.00	37,000.00
BREMOAH VENTURES	4 JD & OTHERS	01/09/09	59,900.00	-	10,000.00 7,000.00	1,500.00	-	-			18,500.00	41,400.00
CASHEW FARMEERS ASS.	4 JD 4 PLOUGH 1 -TRAILER 1-FARMTRAC	28/05/09	63,000.00	-	21,000.00 12,000.00	-	-	-			33,000.00	30,000.00
DCE, WA EAST DIST	4 JD 4 PLOUGH	AUG 2009	58,500.00	-	10,000.00	-	-	-			10,000.00	48,500.00
DCE JIRAPA	4 JD 4 PLOUGH 1 FT-60	AUG 2009	58,500.00	-	-	-	25,000.00	-	13500.00		38500.00	20000.00
DCE NANDOM	4 JD 4 PLOUGH	AUG 2009	58,500.00	-	10,000.00	-		-			10000	48500
DCE LAMBUSSIE	4 JD 4 PLOUGH 1 FT-60	AUG 2009	58,500.00	-	10,000.00	-	12,000.00	-			22,000.00	36500

DCE SISALA DIST.	4 JD 4 PLOUGH 1 FT-60	AUG 2009	58,500.00	-	10,000.00	40,000.00	-	-			50,000.00	8,500.00
DCE WA WEST DIST.	4 JD 4 PLOUGH 1 FT-60	AUG 2009	58,500.00	-	10,000.00	4,700.00	200.00 1,200.00 2,000.00	-			18,100.00	40,400.00
KPANGMANGA	2 MHD 3 FT 60	MAY 2010	72,000.00	-	-	30,600.00	3,000.00 400.00	-	3300	-	37300.00	34700.00
KODOM	4 JD 4 PLOUGH 1 FT-60	05/06/09	63,000.00	-	11,000.00 6,000.00	-	800.00 9,000.00 9,000.00	-			35,800.00	27,200.00
KWASAMAY	4 JD 4 PLOUGH 1-TRAILER 1-FARMTRAC 1 FT 60 TRACTOR COMPLETE	01/07/09	63,000.00	-	4,500.00 11,000.00	1,400.00	-	-	-	6200 24600 8300 7000	63000	NIL
KOBBIMAN FARMS	4 JD 4 PLOUGH 1 FT-60	26/05/08	63,000.00	6,000.00	6,000.00 11,000.00 8,000.00 4,000.00	-	-	-			35,000.00	28,000.00
GHANA NUT	1 FT-60 5 MHD	03/05/10	90,000.00	-	24,000.00	24,000.00	-	-			48,000.00	42,000.00
GHANA CUBA	4 JD 4 PLOUGH 1 FT-60	15/07/09	58,500.00	-	11,000.00	-	16,000.00	-	12000	12,500.00	51500	7000.00
GUMBIANI FARMS	JD (4) PLOUGH (4)	MAY 2009	63,000.00	-	6,000.00 11,000.00	-	-	-	30000	-	47000	16000
HON. MAHAMA AYARIGA	5 JD 5 PLOUGHS 4 TRAILERS 3 HARROWS	16/04/09	83,000.00	-	9,000.00	5,000.00 5,000.00	-	-	-	-	20,000.00	63,000.00
HON FUSEINI ALHASSAN	5 MHD	03/05/10	90,000.00	-	8,000.00	27,000.00	-	-	-	-	35,000.00	55,000.00
KUKURDAMA	(4) JD (4) PLOUGHS FT 60	MARCH 2009	63,000.00	-	11,000.00	-	-	-			11,000.00	52,000.00

KURBANI FARMS	4 JD 4 PLOUGH 1 FT-60 1 TRAILER	11/06/09	63,000.00	-	11,000.00 9,000.00	-	-	-			20,000.00	43,000.00
ORGANIC & BIODIVERSITY	4 JD 4 FT 60	June 2009	63,000.00	-	4,000.00 11,000.00	-	-	-	2000 2000	-	19,000.00	44,000.00
SAKFOS	4 JD 4 PLOUGH 1 FT-60 1 TRAILER	11/06/09	63,000.00	-	11,000.00 9,000.00 21,000.00		5,000.00 5,000.00	-	4000		55,000.00	8,000.00
SAKPE AGRIC	4 JD 4 PLOUGH 1 FT-60 1 TRAILER	05/08/09	63,000.00	-	11,000.00	-	24,800.0	10,000.00			45,800.00	17,200.00
SAVANA AGRIC & TRADING	3 MD FT 60(2)		78,000.00	-	6,000.00	24,800.00	3,000.00 3,000.00- 10,000.00				46,800.00	31,200.00
THEOPHILUS ASANTE DARKO	4 JD 4 PLOUGH 1 FT-60 2 TRAILER	AUG 2009	63,000.00	-	11,000.00						11,000.00	52,000.00
OUT OF BOUNDS	4 JD 4 PLOUGH 1 FT-60	25/05/09	63,000.00	-	11,000.00	12,000.00 7,000.00	-	-			30,000.00	33,000.00
HON. ALHAJI ABDUL KARIM	(5) MDR 605 TRACTORS	09/09/10	90,000.00			18,000.00					18,000.00	72,000.00
HON. DR. ALHASSAN AHMED YAKUBU	3 MHD 2 FT	APRIL 2010	90,000.00			18,000.00	1,000.00				19,000.00	71,000.00
LAANGU FARMERS ASS.	4 JD 4 PLOUGH 1 FT-60 1 TRAILER	26/05/09	63,000.00		11,000.00						11,000.00	52,000.00
MANAGER CLEAR	3 JD 3 PLOUGH 2 FARM TRAC	27/07/09	59,900.00		11,000.00						11,000.00	48,900.00
MD. ZIAH GH. LTD.	4 JD 4 PLOUGH 1 FARM TRAC	26/08/09	58,500.00		20,000.00	11,000.00					31,000.00	27,500.00

MR JOE GIDISU												
NANDUWA VELLE		APRIL 2010	90,000.00			18,000.00					18,000.00	72,000.00
SOFO AWUDU AZOKA	4 JD 4 PLOUGHS 1 FT	19/06/09	58,500.00	-	11,000.00	-	-	-			11,000.00	47,500.00
PN INDUSTRIES	4 JD 4 PLOUGHS 1 FT & OTHERS	21/05/09	106,100.00	-		6,000.00 18,000.00	-	-			24,000.00	82,100.00
SOFO-FATAO ENT	3 MHD	05/07/10	54,000.00	-	-	27,000.00	4,000.00	-			31,000.00	23,000.00
MIKLEB ENT		22/05/09	63,000.00	-	6,300.00 2,000.00	8,700.00 4,500.00	-	-			21,500.00	41,500.00
ELFA ENT	4 JD 4 PLOUGH 1 FT-60 (1)	2009	63,000.00	-	11,000.00	10,000.00	-	-			21,000.00	42,000.00
DAGBON TRADITIONAL COUNCIL	4 JD 4 PLOUGH 1 FT-60	2009	63,000.00	-	11,000.00	-	-	-			11,000.00	52,000.00
LOGISTIC SUPPORT SERVICE	4 JD 4 PLOUGH 1 FT-60 (1)	22/09/09	58,500.00		20,000.00	-	-	-			20,000.00	38,500.00
TUNTEYA FARMING GROUP	4 JD 4 PLOUGH 1 FT-60 (1)	02/09/09	58,500.00	-	11,000.00	-	-	-			11,000.00	47,500.00
IRRIGATION FARMERS ASSOC. (AHMED BOGOBIRI)	4 JD 4 PLOUGH 1 FT-60 (1)	2009	63,000.00	-	9,000.00 11,000.00	10,500.00	-	-	2000	451.00 451.00	33402	29598
DOLIDONA	4 JD 4 PLOUGH 1 FT-60 (1)	15/05/09	200,000.00		20,000.00 11,000.00	10,000.00 23,000.00	40,000.00 10,000.00	-			114,000.00	86,000.00
GLOWOOD		2009			-		2,000.00 1,000.00 4,500.00	6,000.00			13,500.00	
BARIBON CEO	3 JD 4 PLOUGH 1 FT 60	20/5/09	63,000.00	-	11,000.00	-	-	-			11,000.00	52,000.00

GREEN PLANE LTD	4 JD 4 PLOUGH 1 FT-60	JUNE 2009	63,000.00	-	11,000.00	-	-	-	-	-	11,000.00	52,000.00
GBEWAA FARMERS	JD 5404	April 2010	90,000.00		-	27,000.00	-	-			27,000.00	63,000.00
Total			5778100								2101171 2,087,671	3680429 3,690,429

Year	Cost of goods	Repayment	Balance
2008	1,531,200	263,602	1,267,598
2009	3,502,900	1,573,969	1,928,931
2010	744,000	260,100	483,900

【1st year】

Participants list of the training

Venue	Date	Target AMSECs
Ejura, Ashanti region	4th Aug ~ 6th Aug: 3 days	NSO NYAME YE, PN Industries, Woodland Mechanical Company, My Clear
Winneba, Central region	11th Aug ~ 13th Aug: 3 days	Emtrade, Mikleb, VEPEAS, Akufo Hema

【Ejura】

	OP	MG	Others
1st day: Training for managers	3	—	Regional Engineer: 1, AEA: 2

	NSO NYAME YE		PN Industries		Woodland Mechanical Company		My Clear		小計		Others	
	OP	MG	OP	MG	OP	MG	OP	MG	OP	MG		
2nd day: Training for operators	7	1	1	2	0	1	2	0	10	4	3	Regional Engineer: 1, AEA: 2
3rd day: Training for operators	6	1	1	2	0	1	0	0	7	4	3	Regional Engineer: 1, AEA: 2

【Winneba】

	OP	MG	Others
1st day: Training for managers	5	—	Regional Engineer: 1, AEA: 2, JICAexpert (Agribusiness)

	Emtrade		Mikleb		VEPEAS		Akufo Hema		Sub total		Others	
	OP	MG	OP	MG	OP	MG	OP	MG	OP	MG		
2nd day: Training for operators	5	3	3	2	2	0	1	1	11	6	3	Regional Engineer: 1, AEA: 2
3rd day: Training for operators	4	2	3	2	2	0	1	1	10	5	3	Regional Engineer: 1, AEA: 2

【2nd year】

Participants list of the training

Venue	Date	Target AMSECs
Upper West Region, Wa	7th Apr ~10th Apr: 4 days	Wa West, Wa East, Nadowli, Jirapa, Nyvoli Tona
Northern Region, Tamale	13th Apr~16th Apr: 4days	Sakfos, Tijo Farms, Fathi Agro, Kurbandi Farms, Laangu Farms

【Wa】

	MG	OP	Others
1st day: Training for managers	5	—	Regional Engineer: 1, AEA: 2, Senior Technical Engineer: 1, Engineer: 1

	Wa West		Wa East		Nadowli		Jirapa		Nyvoli		Sub total		Others	
	OP	MG	OP	MG	OP	MG	OP	MG	OP	MG	OP	MG		
2nd day: Training for operators	6	0	4	0	2	1	2	1	2	1	16	3	6	Regional Engineer: 1, AEA: 2, MOFA Engineer: 1, MOFA senior technical engineer: 1, MOFA service personal: 1
3rd day: Training for operators	5	0	4	0	1	0	2	1	2	0	14	1	7	Regional Engineer: 1, AEA: 2, MOFA Engineer: 1, MOFA senior technical engineer: 1, MOFA service personal: 2
4th day: Training for operators	6	0	4	0	1	1	2	0	2	0	15	1	9	Regional Engineer: 1, AEA: 2, MOFA Engineer: 1, MOFA senior technical engineer: 2, MOFA service personal: 3
											45	5		

【Tamale】

	MG	OP	Others
1st day: Training for managers	5	—	Regional Engineer: 1, AEA: 2, JICA Ghana office: 2

	Sakfos		Tijo		Fathi		Kurbandi		Laangu		Sub total		Others	
	OP	MG	OP	MG	OP	MG	OP	MG	OP	MG	OP	MG		
2nd day: Training for operators	6	1	3	1	3	1	3	1	2	1	17	5	7	Regional Engineer: 1, AEA: 2, JICA Ghana office: 2, Kokobila Nasia farms: 2 (tractor operator)
3rd day: Training for operators	6	1	3	1	2	0	4	1	2	0	17	3	10	Regional Engineer: 1, AEA: 2, JICA Ghana office: 2, Kokobila Nasia farms: 2 (tractor operator), Regional crop officer and his operators: 1+2, MOFA mechanic: 1
4th day: Training for operators	6	1	3	1	2	0	4	1	2	1	17	4	9	Regional Engineer: 1, AEA: 2, JICA Ghana office: 2, Kokobila Nasia farms: 2 (tractor operator), Regional crop officer and his operators: 1+2, MOFA mechanic: 1
											51	12		

Attachment IX
Result of questionnaire after the training

[1st year: Ejura, Ashanti region]

Analysis of the Questionnaire for the Training Participants

	Operator	Manager	AES	Reg. eng.	Total
Number of valid response	5	3	2	1	11

Q1 How was the timing of training? :

	Operator	Manager	AES	Reg. eng.	Total	Reason
Appropriate	5	3	2	1	11	
Not appropriate	0	0	0	0	0	

Q2 How was the time allocation?

	Operator	Manager	AES	Reg. eng.	Total	Reason
Appropriate	4	3	1	0	8	
Need to be longer	0	0	1	1	2	4 days (Reg.), 5 days (AES)
Need to be shorter	1	0	0	0	1	2 days but from 9am to 2pm
					11	

Q3 How was the level of understanding on the content of the training?

		Operator	Manager	AES	Reg. eng.	Total	Reason
Tractor	Easy	3	2	1	1	7	
	Understandable	2	1	1	0	4	
	Difficult		0	0	0	0	
Disk plough	Easy	4	2	1	1	8	
	Understandable	1	1	1	0	3	
	Difficult		0	0	0	0	
Harrow	Easy	3	3	1	1	8	
	Understandable	2	0	1	0	3	
	Difficult		0	0	0	0	
Planter	Easy	0	1	1	0	2	
	Understandable	4	2	0	1	7	
	Difficult	1	0	1	0	2	
Sprayer	Easy	1	1	0	0	2	
	Understandable	4	2	2	1	9	
	Difficult	0	0	0	0	0	
Sheller	Easy	4	3	0	1	8	
	Understandable	1	0	2	0	3	
	Difficult	0	0	0	0	0	
Repair	Easy	2	1	0	1	4	
	Understandable	2	1	1	0	4	
	Difficult	1	1	1	0	3	
					77		

Q4 How was the contents of handouts distributed?

	Operator	Manager	AES	Reg. eng.	Total	Reason
Sufficient	5	3	2	1	11	
Not Sufficient	0	0	0	0	0	
					11	

Q5 Do you think contents of the training would be useful for you work?

		Operator	Manager	AES	Reg. eng.	Total	Reason
Tractor	Useful	5	3	2	1	11	
	Not very much	0	0	0	0	0	
	Not useful	0	0	0	0	0	
Disk plough	Useful	5	3	2	1	11	
	Not very much	0	0	0	0	0	
	Not useful	0	0	0	0	0	
Harrow	Useful	4	3	2	1	10	
	Not very much	1	0	0	0	1	
	Not useful	0	0	0	0	0	
Planter	Useful	4	3	2	1	10	
	Not very much	1	0	0	0	1	
	Not useful	0	0	0	0	0	
Sprayer	Useful	4	2	2	1	9	
	Not very much	1	1	0	0	2	
	Not useful	0	0	0	0	0	

Attachment IX

Result of questionnaire after the training

Sheller	Useful	5	3	2	1	11
	Not very much	0	0	0	0	0
	Not useful	0	0	0	0	0
Repair	Useful	5	2	2	1	10
	Not very much	0	1	0	0	1
	Not useful	0	0	0	0	0
						77

Q6 Do you think you can avoid the machine trouble by skills you learnt in this training?

	Operator	Manager	AES	Reg. eng.	Total	Reason
Yes, a lot	4	3	2	1	10	
Not at all	1	0	0	0	1	
I don't know	0	0	0	0	0	
						11

Q7 What subjects or contents of the training would you like to receive?

AEA	Business management (machinery management)
AEA	Planter, Repair
Reg. Eng.	Power point presentation, Operator safety on the tractor and implements
Manager	Additional training on repair
Manager	Impressed about the training and wish that it continues.
Sec	The operators need more training on the setting and handling of the plough and the harrow.
Operator	Operation of the tractor.
Operator	Operation and maintenance of the planter.
Operator	I didn't get much understanding on the use of the planter.
Operator	Got impressed about the training because this time I can stand on my own as an operator.

Q8 Any comments or request on this training?

AEA	The quality and quantity of snacks and meals were not sufficient for a day-long intensive training. Could do better.
AEA	The training should be contains in at least every three months.
Reg. Eng.	The snacks and lunch should be improved in both quality and quantity. Good / proper machines / implements should be used for the training. Fuel should be provided for the MOFA officer's from the regional office.
Manager	The food supply was not enough. It should be of good quality.
Manager	Trainers should be mindful of their work.
Sec	Operators need further training still on the operation of the tractor and its implements
Operator	The training was well organized and we are very grateful.
Operator	Quality and quantity of food must be improved. Machines used for the training were not good.
Operator	I have really enjoyed the training and look forward to a similer one in the future.
Operator	After training one can be helped in anyway.

Attachment IX

Result of questionnaire after the training

【1st year: Winneba, Central region】

Analysis of the Questionnaire for the Training Participants

	Operator	Manager	Engineer	Total
Number of valid response	10	1	1	12
Emtrade	4	0	0	4
Mikleb	3	0	1	4
VEPEAS	2	0	0	2
Akuafu Hema	1	1	0	2

Q1 How was the timing of training? :	Operator	Manager	AES	Reg. eng.	Total	Reason
Appropriate	10	0	0	0	10	
Not appropriate	0	2	0	0	2	

Q2 How was the time allocation?	Operator	Manager	AES	Reg. eng.	Total	Reason
Appropriate	6	0	0	0	6	
Need to be longer	4	2	0	0	6	5 days (4) 8am to 4pm
Need to be shorter	0	0	0	0	0	
					12	

Q3 How was the level of understanding on the content of the training?		Operator	Manager	AES	Reg. eng.	Total	Reason
Tractor	Easy	5	0	0	0	5	12
	Understandable	5	2	0	0	7	
	Difficult	0	0	0	0	0	
Disk plough	Easy	5	0	0	0	5	12
	Understandable	5	2	0	0	7	
	Difficult	0	0	0	0	0	
Harrow	Easy	5	1	0	0	6	12
	Understandable	5	1	0	0	6	
	Difficult	0	0	0	0	0	
Planter	Easy	2	1	0	0	3	12
	Understandable	7	1	0	0	8	
	Difficult	1	0	0	0	1	
Sprayer	Easy	3	1	0	0	4	12
	Understandable	6	1	0	0	7	
	Difficult	1	0	0	0	1	
Sheller	Easy	1	1	0	0	2	6
	Understandable	4	0	0	0	4	
	Difficult	0	0	0	0	0	
Repair	Easy	4	0	0	0	4	12
	Understandable	6	2	0	0	8	
	Difficult	0	0	0	0	0	
					78		

Q4 How was the contents of handouts distributed?	Operator	Manager	AES	Reg. eng.	Total	Reason
Sufficient	10	0	0	0	10	
Not Sufficient	1	0	0	0	1	cannot read all, but some
					11	

Q5 Do you think contents of the training would be useful for you work?		Operator	Manager	AES	Reg. eng.	Total	Reason
Tractor	Useful	8	2	0	0	10	12
	Not very much	2	0	0	0	2	
	Not useful	0	0	0	0	0	
Disk plough	Useful	9	2	0	0	11	12
	Not very much	1	0	0	0	1	
	Not useful	0	0	0	0	0	
Harrow	Useful	9	2	0	0	11	12
	Not very much	1	0	0	0	1	
	Not useful	0	0	0	0	0	
Planter	Useful	9	2	0	0	11	12
	Not very much	1	0	0	0	1	
	Not useful	0	0	0	0	0	
Sprayer	Useful	9	2	0	0	11	12
	Not very much	1	0	0	0	1	
	Not useful	0	0	0	0	0	
Sheller	Useful	6	2	0	0	8	8
	Not very much	0	0	0	0	0	
	Not useful	0	0	0	0	0	
Repair	Useful	8	2	0	0	10	12
	Not very much	2	0	0	0	2	
	Not useful	0	0	0	0	0	
					80		

Attachment IX

Result of questionnaire after the training

Q6 Do you think you can avoid the machine trouble by skills you learnt in this training?

	Operator	Manager	AES	Reg. eng.	Total	Reason
Yes, a lot	12	0	0	0	12	I knew some of them but not all, so it is a good dexperience.
Not at all	0	0	0	0	0	
I don't know	0	0	0	0	0	
					12	

Q7 Do you have a driving license? If yes, please circle your type of license.

	Total	A	B	C	D	E	F
Yes	7	2	0	2	3	0	0
No	4						

Q8 How many years are you working as a tractor operator?

	Number
Less than 5 years	3
5 to 10 years	1
More than 10 years	6

Q9 Do you have any experience of formal machinery operation training? If yes, please describe a length and contents of the training.

Yes 4
No 6

If yes...	Organized by	Length	Contents
		1 week	1: How to plough with the hand gas (hand accelerator), 2: Boom sprayer, 3: harvester
		1 week	
	ICOUR (Irrigation Company of Upper Region)	3 years	Special tractor training programme
		7 days	

Q10 What subjects or contents of the training would you like to receive?

Emtrade operator	How to communicate and have patient for for the work that we are doing.
Emtrade operator	Tractor and its implements, how to handle the tractor with care
Emtrade operator	These should have been more practical work on the sheller and the combine harvester.
Emtrade operator	Include training on combine harvester and groundnut lifter too.
Mikleb operator	I think you have taught us all we need to know.
Mikleb operator	All the materials are useful and needed.
Mikleb operator	All the materials are needed.
VEPEAS operator	How to handle the machine on the field to make it last long
VEPEAS operator	I was taught how to handle the machine very well like every morning I have to check the engine systems before moving to the field.
Akuafo Hema operator	The planter and the boom sprayer operation.
Akuafo Hema manager	I think what you have taught us is okay but you can add more if there is need.
Mikleb engineer	All the materials.

Q11 Any comments or request on this training?

Emtrade operator	I also need further training in the near future, since it will really improve and I will get all the benefit.
Emtrade operator	I would that the implements would work better next time. I also like how we were taught to handle the machine with care.
Emtrade operator	There should be more of such training in every 6 months or a year.
Emtrade operator	I thank the organisers for the training. Help us to form a vibrant association to help solve our problems.
Mikleb operator	The training has been good but next time provide us with token in the form of money at the end of the training.
Mikleb operator	The training should twice in a year.
Mikleb operator	The training should be done twice every year.
VEPEAS operator	Misundersdanding of ideas. (There are some gaps of understanding between the participants depending on their knowledges and experiences.)
Akuafo Hema operator	I am very happy with all what I have been taught and wish it will done 1/2 a year so that I will be more perfect and matured.
Akuafo Hema manager	The training has been really good and I think such training should be organized frequently.
Mikleb engineer	The training should be done twice every year.

Attachment IX
Result of questionnaire after the training

[2nd year: Wa, Upper West region]

Training for AMSEC managers

Analysis of the Questionnaire for the Training Participants

Date	7th April 2015
Venue	In Service Training Centre in Wa, Upper West Region
Target AMSECs	Wa West (host), Wa East, Nadowli, Jirapa, Nyivori Tona

	Manager	Reg. eng.	AEA	Others	Total
Number of valid response	5	1	1	2	9
AMSECs Name					
Wa West	1				
Wa East	1				
Nadowli	1				
Jirapa	1				
Nyvori Tona	1				

Q1 How was the timing of training? :

	Manager	Reg. eng.	AEA	Others	Total	Reason
Appropriate	5	1	1	2	9	
Not appropriate	0	0	0	0	0	

Q2 How was the time allocation?

	Manager	Reg. eng.	AEA	Others	Total	Reason
Appropriate	3	0	1	2	6	
Need to be longer	2	1	0	0	3	5 working days (2days for managers training)
Need to be shorter	0	0	0	0	0	1 week (2days for managers training)
					9	

Q3 How was the level of understanding on the content of the training?

		Manager	Reg. eng.	AEA	Others	Total	Reason
Business Planning	Easy	2	0	1	0	3	9
	Understandable	3	1	0	2	6	
	Difficult	0	0	0	0	0	
Financial Management	Easy	0	0	1	0	1	9
	Understandable	3	1	0	2	6	
	Difficult	2	0	0	0	2	
Service Operation	Easy	2	0	1	1	4	9
	Understandable	3	1	0	1	5	
	Difficult	0	0	0	0	0	
						27	

Q4 How were the contents of handouts distributed?

	Manager	Reg. eng.	AEA	Others	Total	Reason
Sufficient	5	1	1	2	9	
Not Sufficient	0	0	0	0	0	
					9	

Q5 Do you think contents of the training would be useful for you work?

		Manager	Reg. eng.	AEA	Others	Total	Reason
Business Planning	Useful	5	1	1	2	9	9
	Not very much	0	0	0	0	0	
	Not useful	0	0	0	0	0	
Financial Management	Useful	5	1	1	2	9	9
	Not very much	0	0	0	0	0	
	Not useful	0	0	0	0	0	
Service Operation	Useful	5	1	1	2	9	9
	Not very much	0	0	0	0	0	
	Not useful	0	0	0	0	0	
						27	

Q6 Do you think you can avoid the machine trouble by skills you learnt in this training?

	Manager	Reg. eng.	AEA	Others	Total	Reason
Yes, a lot	5	1	1	2	9	
Not at all	0	0	0	0	0	
I don't know	0	0	0	0	0	
					9	

Q7 How much do you know about operation and maintenance of agriculture machinery?

Machine and implements	O/M	Manager	Reg. eng.	AEA	Others	Total
Tractor	Operation	Know very well	3	1	1	1
		Not so much	1	0	0	1
		Not know at all	1	0	0	0
Tractor	Maintenance	Know very well	2	1	1	1
		Not so much	2	0	0	1
		Not know at all	1	0	0	0
Disk plough	Operation	Know very well	3	1	1	1
		Not so much	2	0	0	1
		Not know at all	0	0	0	0
Disk plough	Maintenance	Know very well	3	1	1	1
		Not so much	2	0	0	1
		Not know at all	0	0	0	0
Harrow	Operation	Know very well	2	1	1	1
		Not so much	1	0	0	1
		Not know at all	2	0	0	0
Harrow	Maintenance	Know very well	2	1	1	1
		Not so much	1	0	0	1
		Not know at all	2	0	0	0

Attachment IX
Result of questionnaire after the training

Planter	Operation	Know very well	2	1	1	1	8
		Not so much	0	0	0	1	
		Not know at all	2	0	0	0	
Maintenance	Maintenance	Know very well	1	1	1	1	9
		Not so much	1	0	0	1	
		Not know at all	3	0	0	0	
Sprayer	Operation	Know very well	2	1	1	1	9
		Not so much	0	0	0	1	
		Not know at all	3	0	0	0	
Maintenance	Maintenance	Know very well	1	1	1	1	8
		Not so much	1	0	0	0	
		Not know at all	2	0	0	1	
Sheller	Operation	Know very well	3	1	1	1	9
		Not so much	0	0	0	1	
		Not know at all	2	0	0	0	
Maintenance	Maintenance	Know very well	2	1	1	1	9
		Not so much	1	0	0	1	
		Not know at all	2	0	0	0	
							106

Q8 How many years are you working with agriculture machinery service? (Years of machinery operation experience)

	Manager	Reg. eng.	AEA	Others	Total
Less than 1 years	0	0	1	0	1
1 to 3 years	1	0	0	0	1
3 to 5 years	0	0	0	0	0
5 to 10 years	2	1	0	2	5
More than 10 years	2	0	0	0	2

Q9 Have you ever attended to business management training?

	Total	Manager	Reg. eng.	AEA	Others
Yes	6	4	1	0	1
No	3	1	0	1	1

If yes...

Designation	Organized by	Length	Contents
Manager	Vocational institution	3 years	
Manager	NGO	2 days	
Manager	Donor agency	several days	operation, maintenance and service operation
	University	3 days	Business and Financial planning
Senior tech eng	University		Business management was taught as part of enterprenourship taken as a course in the university.

Q10 What subjects or contents of the training would you like to receive?

Manager	Daily maintenance of tractor and it accessories Monthly maintenance schedule for tractors Tractor maintenance Business planning On accounting
Regional Engineer	Machine maintenance and implement maintenance, Business planning
AEA	Tractor operation and maintenance
Dist chief tech eng	Assembly of farm machinery
Senior tech eng	Financial planning

Q11 Any comments or request on this training?

Manager	We need to have more days for the training. Training serves as eye-opener to learn about business management and more especially the value and importance of record keeping. This will enable you know if you are making progress or not. Do follow ups The training is timely and very useful for the participants. Organized one next year
Regional Engineer	I wish training are frequent or quarterly. Regional engineer should be given major role in the training process
AEA	This training will assist us to managed our business in terms planning, organizing, financial management and record keeping to help us to attend our goals.
Dist chief tech eng	Hope it will be repeated.

Attachment IX
Result of questionnaire after the training

Training for AMSEC operators

Analysis of the Questionnaire for the Training Participants

Date	8th~10th April 2015
Venue	In Service Training Centre in Wa, Upper West Region
Target AMSECs	Wa West (host), Wa East, Nadowli, Jirapa, Nyivori Tona

	Operator	Manager	Reg.Eng.	AEA	Other from MOFA	Total
Number of valid response	15	—	1	1	4	21

Participants of the operators		Total	Age				
			~20	21~30	31~40	41~50	51~
AMSECs Name	Wa West	6	0	2	2	2	0
	Wa East	3	0	3	0	1	0
	Nadowli	1	0	1	0	0	0
	Jirapa	2	0	1	1	0	0
	Nyivori Tona	2	1	0	1	0	0

Q1 How was the timing of training? :	Operator	Manager	Reg. eng.	AEA	Others	Total	Reason
Appropriate	15	0	1	1	4	21	
Not appropriate	0	0	0	0	0	0	

Q2 How was the time allocation?	Operator	Manager	Reg. eng.	AEA	Others	Total	Reason
Appropriate	14	0	1	1	4	20	
Need to be longer	0	0	0	0	0	0	
Need to be shorter	1	0	0	0	0	1	
						21	

Q3 How was the level of understanding on the content of the training?		Operator	Manager	Reg. eng.	AEA	Others	Total	Reason
Tractor	Easy	12	0	1	0	2	15	
	Understandable	3	0	0	1	2	6	
	Difficult	0	0	0	0	0	0	
Disk plough	Easy	11	0	1	0	4	16	
	Understandable	4	0	0	1	0	5	
	Difficult	0	0	0	0	0	0	
Harrow	Easy	12	0	1	0	4	17	
	Understandable	2	0	0	1	0	3	
	Difficult	1	0	0	0	0	1	
Planter	Easy	7	0	1	0	3	11	
	Understandable	6	0	0	1	1	8	
	Difficult	2	0	0	0	0	2	
Sprayer	Easy	7	0	0	0	3	10	
	Understandable	8	0	1	1	1	11	
	Difficult	0	0	0	0	0	0	
Sheller	Easy	8	0	0	0	2	10	
	Understandable	5	0	1	1	2	9	
	Difficult	0	0	0	0	0	0	
Repair	Easy	9	0	0	0	2	11	
	Understandable	5	0	1	1	2	9	
	Difficult	1	0	0	0	0	1	
						145		

Q4 How was the contents of handouts distributed?	Operator	Manager	Reg. eng.	AEA	Others	Total	Reason
Sufficient	14	0	1	1	4	20	
Not Sufficient	1	0	0	0	0	1	
						21	

Attachment IX
Result of questionnaire after the training

Q5 Do you think contents of the training would be useful for you work?

		Operator	Manager	Reg. eng.	AEA	Others	Total	Reason
Tractor	Useful	15	0	1	1	4	21	
	Not very much	0	0	0	0	0	0	
	Not useful	0	0	0	0	0	0	
Disk plough	Useful	14	0	1	1	3	19	
	Not very much	1	0	0	0	1	2	
	Not useful	0	0	0	0	0	0	
Harrow	Useful	15	0	1	1	4	21	
	Not very much	0	0	0	0	0	0	
	Not useful	0	0	0	0	0	0	
Planter	Useful	15	0	1	1	4	21	
	Not very much	0	0	0	0	0	0	
	Not useful	0	0	0	0	0	0	
Sprayer	Useful	15	0	1	1	4	21	
	Not very much	0	0	0	0	0	0	
	Not useful	0	0	0	0	0	0	
Sheller	Useful	11	0	1	1	3	16	
	Not very much	0	0	0	0	1	1	
	Not useful	0	0	0	0	0	0	
Repair	Useful	13	0	1	1	4	19	
	Not very much	1	0	0	0	0	1	
	Not useful	1	0	0	0	0	1	
							143	

Q6 Do you think you can avoid the machine trouble by skills you learnt in this training?

		Operator	Manager	AES	Reg. eng.	Others	Total	Reason
Yes, a lot		15	0	1	1	4	21	
Not at all		0	0	0	0	0	0	
I don't know		0	0	0	0	0	0	
							21	

Q7 Do you have a driving license? If yes, please circle your type of license.

	Total	A	B	C	D	E	F
Yes	7	1	3	1	1	3	0
No	14						

Q8 How many years are you working as a tractor operator?

	Operators	Others
Less than 1 years	2	4
1 to 3 years	3	1
3 to 5 years	5	0
5 to 10 years	3	1
More than 10 years	2	0
		19 years

Q9 Do you have any experience of formal machinery operation training?

If yes, please describe a length and contents of the training.

	Operators	Others
Yes	9	5
No	6	1

Designation	Organized by	Length	Contents
Operator	Agric	2 days	Tractor operation and maintenance
Operator	the Government		Training of the tractor, harrowing, ploughing, use of sprayer.
Operator	MOFA	several days	
Operator	the Government	7 days	Appropriate land preparation
Operator	the Government		Safety precautions and tractor maintenance
Operator	the Government	3 days	Servicing, Appropriate tillage practice, Field measurement
Operator	MOFA		
Operator	the Government		Effective use of plough and other equipments
Reg. Eng.	University	2 months	Tractor operation and implement attachment
Senior Tech. Eng.	University	2 years	A course in Agric mechanization
Service personel	Polytechnic	3 years	Everything about tractor
Service personel	Polytechnic	3 years	It was very useful in soo many ways
Service personel	NGO, Polytechnic	several days	

Attachment IX

Result of questionnaire after the training

Q10 What subjects or contents of the training would you like to receive?

Designation	Comment
Operator	I'd like to receive more training on: planter, sprayer and sheller.
Operator	Maintenance of the tractor.
Operator	I would like to receive more materials on routine maintenance.
Operator	I would like to receive more training on the use of the harrow.
Operator	Training on planters, sprayers.
Operator	Tractor maintenance and plough adjustment.
Operator	I'd like to receive more training on the different maters of furrow opening.
Operator	Farm machinery.
Operator	The disc plough and repair.
Operator	Methods of ploughing and plough adjustment.
Operator	I would like to recover more training.
Reg. Eng.	Need more training in tractor operation and attachment of implement.
AEA	Tractor operation
Senior Tech. Eng.	The use of planter and its calibration.
Service personel	Repair and maintenance
Service personel	I will like to receive the repair content, because if you can repair then 90% of your problems in terms of tractor operation is solved.
Service personel	I would like to be trained on the combine harvester and the use and calibration of the planter.

Q11 Any comments or request on this training?

Designation	Comment
Operator	I will suggest that such training should be regular.
Operator	Organize annual training for us.
Operator	I am very happy to be a participant of this training because now I know how to properly set the plough / harrow for quality work.
Operator	Annual training required.
Operator	I'd like to have spare parts available all time.
Operator	Well organize training
Operator	As an operator, I have learned a lot which will assist me in my operational works to avoid damages to my tractor and other equipments while operating.
Operator	Would be much glad if the training will be organize again.
Operator	I will like you to have discussions with the tractor owners so that they will always pay attention to the operators. They should always meet our needs to anable us deliver quality work.
Reg. Eng.	More training should be organized frequently so as to avoid frequent accidents.
AEA	The training is useful and further training is required on tractor operation.
Senior Tech. Eng.	Further training, we will like to see the tractor mounted planter and sprayer.
Service personel	Is OK
Service personel	It was useful and it helped a lot. I will prepare that the organization should try to help those without driving licence to get one for themselves.
Service personel	It was very useful to me and would like to participate in such programme in the future.

Attachment IX
Result of questionnaire after the training

【2nd year: Tamale, Northern region】

Training for AMSEC managers

Analysis of the Questionnaire for the Training Participants

Date	13th April 2015
Venue	GILLBT Training Centre in Tamale, Northern Region
Target AMSECS	Sakfos, Tijo Farms, Fathi Agro, Kurbandi Farms, Laangu Farms

		Manager	Reg. eng.	AEA	Others	Total
Number of valid response		5	1	2	0	8
AMSECS Name	Sakfos	1				
	Tijo Farms	1				
	Fathi Agro	1				
	Kurbandi Farms	1				
	Laangu Farms	1				

Q1 How was the timing of training? :

	Manager	Reg. eng.	AEA	Others	Total	Reason
Appropriate	5	1	2	0	8	
Not appropriate	0	0	0	0	0	

Q2 How was the time allocation?

	Manager	Reg. eng.	AEA	Others	Total	Reason
Appropriate	2	1	2	0	5	
Need to be longer	3	0	0	0	3	2 days, about 7 days
Need to be shorter	0	0	0	0	0	
					8	

Q3 How was the level of understanding on the content of the training?

		Manager	Reg. eng.	AEA	Others	Total		Reason
Business Planning	Easy	0	1	0	0	1	8	
	Understandable	5	0	2	0	7		
	Difficult	0	0	0	0	0		
Financial Management	Easy	0	1	0	0	1	8	
	Understandable	4	0	2	0	6		
	Difficult	1	0	0	0	1		
Service Operation	Easy	2	1	0	0	3	8	
	Understandable	3	0	2	0	5		
	Difficult	0	0	0	0	0		
						24		

Q4 How were the contents of handouts distributed?

	Manager	Reg. eng.	AEA	Others	Total	Reason
Sufficient	4	1	2	0	7	No Answer: 1
Not Sufficient	0	0	0	0	0	
					7	

Q5 Do you think contents of the training would be useful for you work?

		Manager	Reg. eng.	AEA	Others	Total		Reason
Business Planning	Useful	5	1	1	0	7	8	
	Not very much	0	0	1	0	1		
	Not useful	0	0	0	0	0		
Financial Management	Useful	3	1	1	0	5	7	No Answer: 1
	Not very much	1	0	1	0	2		
	Not useful	0	0	0	0	0		
Service Operation	Useful	4	0	1	0	5	7	No Answer: 1
	Not very much	0	1	1	0	2		
	Not useful	0	0	0	0	0		
						22		

Q6 Do you think you can avoid the machine trouble by skills you learnt in this training?

	Manager	Reg. eng.	AEA	Others	Total	Reason
Yes, a lot	4	1	2	0	7	
Not at all	1	0	0	0	1	
I don't know	0	0	0	0	0	
					8	

Attachment IX

Result of questionnaire after the training

Q7 How much do you know about operation and maintenance of agriculture machinery?

Machine and implements	O/M		Manager	Reg. eng.	AEA	Others	Total
Tractor	Operation	Know very well	5	1	0	0	8
		Not so much	0	0	2	0	
		Not know at all	0	0	0	0	
Tractor	Maintenance	Know very well	5	1	0	0	8
		Not so much	0	0	2	0	
		Not know at all	0	0	0	0	
Disk plough	Operation	Know very well	4	1	0	0	7
		Not so much	1	0	1	0	
		Not know at all	0	0	0	0	
Disk plough	Maintenance	Know very well	4	1	0	0	8
		Not so much	1	0	2	0	
		Not know at all	0	0	0	0	
Harrow	Operation	Know very well	4	1	0	0	8
		Not so much	1	0	2	0	
		Not know at all	0	0	0	0	
Harrow	Maintenance	Know very well	2	1	0	0	7
		Not so much	2	0	2	0	
		Not know at all	0	0	0	0	
Planter	Operation	Know very well	1	1	0	0	8
		Not so much	2	0	2	0	
		Not know at all	2	0	0	0	
Planter	Maintenance	Know very well	0	1	0	0	7
		Not so much	2	0	2	0	
		Not know at all	2	0	0	0	
Sprayer	Operation	Know very well	1	1	0	0	7
		Not so much	2	0	1	0	
		Not know at all	1	0	1	0	
Sprayer	Maintenance	Know very well	0	1	0	0	7
		Not so much	3	0	2	0	
		Not know at all	1	0	0	0	
Sheller	Operation	Know very well	3	1	0	0	8
		Not so much	1	0	2	0	
		Not know at all	1	0	0	0	
Sheller	Maintenance	Know very well	4	1	0	0	8
		Not so much	0	0	2	0	
		Not know at all	1	0	0	0	
							91

Q8 How many years are you working with agriculture machinery service? (Years of machinery operation experience)

	Manager	Reg. eng.	AEA	Others	Total
Less than 1 years	0	0	0	0	0
1 to 3 years	0	0	0	0	0
3 to 5 years	1	0	0	0	1
5 to 10 years	2	1	0	0	3
More than 10 years	2	0	1	0	3

Q9 Have you ever attended to business management training?

	Total	Manager	Reg. eng.	AEA	Others
Yes	4	3	1	0	0
No	4	2	0	2	0

If yes...	Organized by	Length	Contents
Manager	Donor Agency	1 day	Similar
Manager	NGO	2 days	Helpful
Manager	Private		
Reginal Engineer	University		Agri-business management

Q10 What subjects or contents of the training would you like to receive?

Manager	All contents
Manager	Business Planning, Financial Management
AEA	Is a good training. It will help our operations and management to work efficiently and maximize profit.

Q11 Any comments or request on this training?

Manager	Help us to get spare parts at affordable prices. To have more of this training each year or as much as possible.
Manager	It has been a day well spent, have refreshed once again ones ability to work perfectly. Will wish that such workshops will last for at least two days.
Manager	Very educative. We need more of such training programme.
Regional Engineer	Time span if possible should be shortened because participants are adults and have very tight schedules.

Attachment IX
Result of questionnaire after the training

Training for AMSEC operators

Analysis of the Questionnaire for the Training Participants

Date	13th~16th April 2015
Venue	GILLBT Training Centre in Tamale, Northern Region
Target AMSECs	Sakfos (host), Kurbandi, Laangu, Tijo, Fathi

	Operator	Manager	Reg.Eng.	AEA	Other from MOFA	Total
Number of valid response	20	2		2		24

Participants of the operators		Total	Age				
AMSECs Name			~20	21~30	31~40	41~50	51~
	Sakfos	6	0	3	2	0	1
	Kurbandi	4	0	1	1	1	1
	Laangu	2	0	2	0	0	0
	Tijo	2	1	0	1	0	0
	Fathi	2	0	1	1	0	0
	Reg. Crop Office	2		0	2	0	0
	Kokobila	2	1	0	1	0	0

Q1 How was the timing of training? :

	Operator	Manager	Reg. eng.	AEA	Others	Total	Reason
Appropriate	14	2	0	2	0	18	
Not appropriate	0	0	0	0	0	0	

Q2 How was the time allocation?

	Operator	Manager	Reg. eng.	AEA	Others	Total	Reason
Appropriate	13	1	0	2	1	17	
Need to be longer	1	1	0	0	0	2	5 days
Need to be shorter	0	0	0	0	0	0	
						19	

Q3 How was the level of understanding on the content of the training?

		Operator	Manager	Reg. eng.	AEA	Others	Total	Reason
Tractor	Easy	11	2	0	0	0	13	
	Understandable	2	0	0	2	1	5	
	Difficult	1	0	0	0	0	1	
Disk plough	Easy	11	0	0	0	0	11	
	Understandable	3	2	0	2	1	8	
	Difficult	0	0	0	0	0	0	
Harrow	Easy	11	0	0	0	0	11	
	Understandable	3	2	0	2	1	8	
	Difficult	0	0	0	0	0	0	
Planter	Easy	9	1	0	0	0	10	
	Understandable	5	1	0	2	1	9	
	Difficult	0	0	0	0	0	0	
Sprayer	Easy	9	0	0	0	0	9	
	Understandable	5	2	0	2	1	10	
	Difficult	0	0	0	0	0	0	
Sheller	Easy	10	1	0	0	0	11	
	Understandable	3	1	0	2	1	7	
	Difficult	0	0	0	0	0	0	
Repair	Easy	9	0	0	0	0	9	
	Understandable	4	2	0	2	1	9	
	Difficult	0	0	0	0	0	0	
						131		

Q4 How was the contents of handouts distributed?

	Operator	Manager	Reg. eng.	AEA	Others	Total	Reason
Sufficient	13	2	0	2	0	17	
Not Sufficient	1	0	0	0	1	2	
						19	

Attachment IX
Result of questionnaire after the training

Q5 Do you think contents of the training would be useful for you work?

		Operator	Manager	Reg. eng.	AEA	Others	Total	Reason
Tractor	Useful	14	2	0	2	1	19	
	Not very much	0	0	0	0	0	0	
	Not useful	0	0	0	0	0	0	
Disk plough	Useful	14	2	0	2	1	19	
	Not very much	0	0	0	0	0	0	
	Not useful	0	0	0	0	0	0	
Harrow	Useful	14	2	0	2	1	19	
	Not very much	0	0	0	0	0	0	
	Not useful	0	0	0	0	0	0	
Planter	Useful	14	2	0	2	1	19	
	Not very much	0	0	0	0	0	0	
	Not useful	0	0	0	0	0	0	
Sprayer	Useful	14	2	0	2	1	19	
	Not very much	0	0	0	0	0	0	
	Not useful	0	0	0	0	0	0	
Sheller	Useful	13	2	0	2	1	18	
	Not very much	0	0	0	0	0	0	
	Not useful	0	0	0	0	0	0	
Repair	Useful	13	2	0	2	1	18	
	Not very much	0	0	0	0	0	0	
	Not useful	0	0	0	0	0	0	
							131	

Q6 Do you think you can avoid the machine trouble by skills you learnt in this training?

	Operator	Manager	Reg. eng.	AEA	Others	Total	Reason	
Yes, a lot	14	2	0	2	1	19		
Not at all	0	0	0	0	0	0		
I don't know	0	0	0	0	0	0		
							19	

Q7 Do you have a driving license? If yes, please circle your type of license.

	Total	A	B	C	D	E	F
Yes	7	0	0	0	2	3	2
No	12						

Q8 How many years are you working as a tractor operator?

	Operators	Others
Less than 1 years	0	3
1 to 3 years	1	0
3 to 5 years	2	0
5 to 10 years	4	0
More than 10 years	7	2
↳ 15, 15, 18, 40, 39, years		

Q9 Do you have any experience of formal machinery operation training? If yes, please describe a length and contents of the training.

	Operators	Others
Yes	3	2
No	11	3

Designation	Organized by	Length	Contents
Operator	Government		
Operator	Government		
Operator	Government	7 days	
Reg. Crop Officer	Government, Machine Dealer, University	Several years	
Manager	Government, University, College		Agric college to university level

Attachment IX

Result of questionnaire after the training

Q10 What subjects or contents of the training would you like to receive?

Designation	Comment
Operator	Opening a combine harvester and its maintenances.
Operator	More of what has been taught.
Operator	More about tractor maintenance.
Operator	Tractor servicing and records keeping.
Operator	I would like to receive materials on all the subjects treated
Operator	More of what was learnt to have more next time.
Operator	Tractor maintenance and records keeping.
Operator	Repairs.
Operator	Implementing coupling.
Operator	I would like to receive contents on all because it has been helpful.
Operator	More training on the tractor and equipment servicing and repairs.
Operator	Tractor repairs / Maintenance
Operator	How to use the tractor well
Operator	Repairs.
Reg. Crop Officer	Repairs.
Manager	On more maintenance
Manager	Boom sprayer operation and seed drill operation.

Q11 Any comments or request on this training?

Designation	Comment
Operator	Very helpful and will need more training.
Operator	Very helpful and need more training.
Operator	I have enjoyed the training and would like to attend more of such trainings frequently in future.
Operator	Very happy and I pray that you will help us to have licence
Operator	Very good.
Operator	Very helpful.
Operator	Very happy with the training offered me and would like to state my appreciation.
Operator	Very appreciative.
Operator	The training has helped me to learn more on tractor operation and this added to the already existing knowledge will be enough for my daily activities so for as the tractor is concerned.
Operator	Everything is OK
Operator	Very useful
Operator	I'm grateful for the training
Operator	I want to thank you for the training given to us and also appeal to you to always come to our aid on trainings such as this and related ones. Thank you.
Reg. Crop Officer	More emphasis on the land preparation and repairs and maintenance of tractors.
Manager	If I was setting time like this I think my machines shelf life would prolong. I am grateful.
Manager	Very useful

Attachment X

List of repairs for targeted AMSEC as a pilot project

【 Sakfos 】 (Damongo, Northern Region,)

Qty.	Description	Unit Price	Amount GHS
3	Pistons	280	840
3	Set of Rings	150	150
3	Linning	160	480
	Bearings	130	130
	Head Gasket	40	40
	Valve Seals	70	70
	Thrust Washers		180
3	Injector Nozzles	140	420
	Head Valves		120
2	Engine Oil	42	84
1	Diesel Filter	25	25
1	Engine Oil Filter	18	18
	Servicing of Pump	500	500
	Workmanship (Mechanic)	300	300
		Total	3,357

【 Wa West 】 (Wa West, Upper West Region)

Qty.	Description	Unit Price	Amount GHS
1	Battery	400	400
1	Starter Motor	1000	1000
2	Front (750x16)	300	600
1	Hydraulic Filter	150	150
1	Oil Filter	40	40
1	Fuel Filter	80	80
3	Plough Disc	250	750
10	Hydraulic Oil	30	300
2	Engine Oil	50	100
	Workmanship	80	80
		Total	3,500

Result of the current season of the tractor service

Sakfos

Holding number	Workable number	Rate/Acre (GHS)	Operator's Wage (GHS/ac)
4	3	75	10%

Repayment (of 5 tractors)

Total cost	Total payment	Balance (Rest of the payment)
63,000	55,000	8,000

(GHS)

	Registered No.	Manufacture e.g.) Farntrac	Model (HP e.g.) JD5303	Price of the tractor	Total date of the service	Total no. of service beneficiaries	Total acreage of the service	Gross revenue of the service	Total Expenditure	Net Profit
1	GE6573-09	John Deere	JD5303	14,400	24th Jun~16th July 15 days	14	46	3,585	6,752	-6,047
2		John Deere	JD5303	14,400	5th May~27th July 53 days	25	246	16,565	17,035	-3,350
1'		John Deere	JD5303	14,400	24th Jun~16th July 15 days	14	46	7,545	8,942	-4,277
2'		John Deere	JD5303	14,400	5th May~27th July 53 days	25	246	20,840	17,785	175
1'+2'					68 days	39	292	28,385	26,727	-4,102

[Expenditure]

(GHS)

(GHS)

Tractor No.1 (include JICA's repair cost, exclude expectation)				Tractor No.2 (exclude expectation)			
Fuel	595	Sales	3,585	Fuel	3,410	Sales	16,565
Operator's Wages	143	Fuel	595	Operator's Wages	1,708	Fuel	3,410
Maintenance	237	Operator	142.5	Maintenance	1,857	Operator	1,708
Repair	5,702	Maintenance	237	Repair	1,995	Maintenance	1,857
Others	75	Depriciation	2,880	Others	2,065	Depriciation	2,880
Manager's wage		Sub total	3,855	Manager's wage	6,000	Sub total	9,855
Monitoring&Supervision		Gross Profit	-7.5% -269.5	Monitoring&Supervision		Gross Profit	40.5% 6,710
Total Expenditure	6,752	Repair	5,702	Total Expenditur	17,035	Repair	1,995
		Monitoring	0			Monitoring	0
		Payroll	0			Payroll	6,000
		Others	75			Others	2,065
		Sub total	5,777			Sub total	10,060
		Net profit	-168.7% -6,047			Net profit	-20.2% -3,350

(GHS)

(GHS)

Tractor No.1 (include JICA's repair cost and expectation)				Tractor No.2 (include expectation)			
Fuel	1,285	Sales	7,545	Fuel	4,160	Sales	20,840
Operator's Wages	143	Fuel	1,285	Operator's Wages	1,708	Fuel	4,160
Maintenance	237	Operator	143	Maintenance	1,857	Operator	1,708
Repair	7,202	Maintenance	237	Repair	1,995	Maintenance	1,857
Others	75	Depriciation	2,880	Others	2,065	Depriciation	2,880
Manager's wage		Sub total	4,545	Manager's wage	6,000	Sub total	10,605
Monitoring&Supervision		Gross Profit	39.8% 3,001	Monitoring&Supervision		Gross Profit	49.1% 10,235
Total Expenditure	8,942	Repair	7,202	Total Expenditur	17,785	Repair	1,995
		Monitoring	0			Monitoring	0
		Payroll	0			Payroll	6,000
		Others	75			Others	2,065
		Sub total	7,277			Sub total	10,060
		Net profit	-56.7% -4,277			Net profit	0.8% 175

(GHS)

Tractor No.1'+No.2' (include JICA's repair cost and expectation)			
Fuel	5,445	Sales	28,385
Operator's Wages	1,851	Fuel	5,445
Maintenance	2,094	Operator	1,851
Repair	9,197	Maintenance	2,094
Others	2,518	Depriciation	5,760
Manager's wage	6,000	Sub total	15,150
Monitoring&Supervision	720	Gross Profit	46.6% 13,236
Total Expenditure	27824.5	Repair	9,197
		Monitoring	720
		Payroll	6,000
		Others	2,518
		Sub total	18,435
		Net profit	-18.3% -5,200

Result of the current season of the tractor service

Laangu

Holding number	Workable number	Rate/Acre (GHS)	Operator's Wage (GHS/ac)
5	2	Plough:50 Harrow: 25	10% of Service

Repayment (of 5 tractors)		
Total cost	Total payment	Balance (Rest of the payment)
63,000	20,000	43,000

(GHS)

	Registered No.	Manufacture e.g.) Farmtrac	Model (HP e.g.) JD5303	Price of the tractor	Total date of the service	Total no. of service beneficiaries	Total acreage of the service	Gross revenue of the service	Total Expenditure	Net Profit
1	GE6978	John Deere	JD5303	16,000	5th Jun~17th July 24 days		238	10,725	10,759	-1,634
2		John Deere	JD5303							
3		John Deere	JD5303							
4		John Deere	JD5303							
5		Farmtrac	FT70							

[Expenditure]

(GHS)

Tractor No. 1			
Fuel	4,104	Sales	10725
Operator's Wages	900	Fuel	4,104
Maintenance	355	Operator	900
Repair	5,400	Maintenance	355
Others		Depriciation	1,600
Manager's wage		Sub total	6,959
Monitoring&Supervision		Gross Profit	35.1% 3,766
Total Expenditure	10,759	Repair	5,400
		Monitoring	0
		Payroll	0
		Others	0
		Sub total	5,400
		Net profit	-15.2% -1,634

Result of the current season of the tractor service

Fathi

Holding number	Workable number	Rate/Acre (GHS)	Operator's Wage (GHS/ac)
6	3	40~50GHS	

Repayment (of 5 tractors)		
Total cost	Total payment	Balance (Rest of the payment)
116,000	20,000	96,000

(GHS)

	Registered No.	Manufacture e.g.) Farmtrac	Model (HP e.g.) JD5303	Price of the tractor	Total date of the service	Total no. of service beneficiaries	Total acreage of the service	Gross revenue of the service	Total Expenditure	Net Profit
1		MF	385	12,600	18 days 22th May~20th July	32	102	4,870	4,797	73
2		Farmtrac	FT70							
3		JD								
4		JD								
5		JD								
		JD								

[Expenditure]

(GHS)

Tractor No. 1			
Fuel	1,765	Sales	4,870
Operator's Wages	500	Fuel	1,765
Maintenance	332	Operator	500
Repair	1,713	Maintenance	332
Others		Depriciation	0
Manager's wage		Sub total	2,597
Monitoring&Supervision	487	Gross Profit	46.7% 2,273
Total Expenditure	4,797	Repair	1,713
		Monitoring	487
		Payroll	
		Others	0
		Sub total	2,200
		Net profit	1.5% 73

Result of the current season of the tractor service

Wa West

Holding number	Workable number	Rate/Acre (GHS)	Operator's Wage (GHS/ac)
1	1	60GHS~70GHS/ac (30GHS: Harrow)	5GHS/ac

Repayment

Total cost	Total payment	Balance (Rest of the payment)
58,500	48,100	10,400

(GHS)

	Registered No.	Manufacture e.g.) Farmtrac	Model (HP e.g.) JD5303	Total date of the service	Total no. of service beneficiaries	Total acreage of the service	Gross revenue of the service	Operator's wages	Gross Expenditure	Benefit
1	GE6615	John Deere	JD5303	9thMay~26thJul 37 days	83	182.0	11815	910	10482.5	1332.5
2										
3										
4										
5										

[Expenditure]	(GHS)
Fuel	1899
Operator's Wages	910
Maintenance	660
Repair	4671
Others	202.5
Manager's wage	1800
Monitoring&Supervision	340
Total Expenditure	10482.5

Sales		11815
Fuel	1899	
Operator	910	
Maintenance	660	
Depriciation		
Sub total		3469
Gross Profit	70.64%	8346
Repair	4671	
Monitoring	340	
Payroll	1800	
Others	202.5	
Sub total		7013.5
Net profit	11.28%	1332.5

Result of the current season of the tractor service

Wa East

Holding number	Workable number	Rate/Acre (GHS)	Operator's Wage (GHS/ac)
2	1	70GHS/ac	7GHS/ac

Repayment		
Total cost	Total payment	Balance (Rest of the payment)
58,500	20,000	38,500

(GHS)

	Registered No.	Manufacture e.g.) Famtrac	Model (HP e.g.) JD5303	Total date of the service	Total no. of service beneficiaries	Total acreage of the service	Gross revenue of the service	Operator's wages	Total Expenditure	Benefit
1		John Deere	JD5303	9thMay~8thJul 26 days	41	122	8540	854	8,560	-20
2		MF	MF435extra	12thApr~17thJul 52 days	56	370	25900	2590	15,600	10,300
3										
4										
5										

[Expenditure]

(GHS)

JD				MF			
Fuel	3,270	Sales	8,540	Fuel	6,840	Sales	25,900
Operator's Wages	854	Fuel	3,270	Operator's Wages	2,590	Fuel	6,840
Maintenance	877	Operator	854	Maintenance	1,696	Operator	2,590
Repair	3,559	Maintenance	877	Repair	1,900	Maintenance	1,696
Others		Depriciation				Depriciation	
Manager's wage	0	Sub total	5,001	Manager's wage	2,574	Sub total	11,126
Monitoring&Supervision	20% of profit	Gross Profit	41.44% 3,539	Monitoring&Supervision		Gross Profit	57.04% 14,774
Total Expenditure	8,560	Repair	3,559	Total Expenditur	15,600	Repair	1,900
		Monitoring	20% of profit			Monitoring	0
		Payroll	0			Payroll	2,574
		Others	0			Others	0
		Sub total	3,559			Sub total	4,474
		Net profit	-0.23% -20			Net profit	39.77% 10,300

Result of the current season of the tractor service

Nyori Tona

Holding number	Workable number	Rate/Acre (GHS)	Operator's Wage (GHS/ac)
8	2	75GHS/ac	10GHS/ac

Repayment		
Total cost	Total payment	Balance (Rest of the payment)
116,000	23,600	92,400

(GHS)

	Registered No.	Manufacture e.g.) Farmtrac	Model (HP e.g.) JD5303	Total date of the service	Total no. of service beneficiaries	Total acreage of the service	Gross revenue of the service	Operator's wages	Total Expenditure	Benefit
1		Farmtrac	FT70	14thMay~20thJul 10 days	26 Farmers	103ac	6475	880	8435	-1963
2										
3										
4										
5										

[Expenditure]	(GHS)
Fuel	2475
Operator's Wages	880
Maintenance	1071
Repair	3602
Monitoring & Super vision	410
Total Expenditure	8438

Sales		6475
Fuel	2475	
Operator	880	
Maintenance	1071	
Depriciation		
Sub total		4426
Gross Profit	31.64%	2049
Repair	3602	
Monitoring	410	
Payroll		
Sub total		4012
Net profit	-30.32%	-1963

Attachment XII
Pictures



Breakdown of electrical system (AMSEC tractor)



Broken down tractor



Training for managers: Lecture on business management



Training for managers: Group work



Training for managers: Lecture on record keeping



Training for operators: Structure of tractor



Training for operators: Maintenance of tractor



Training for operators: Field measurement (farmland size)

Attachment XII
Pictures



Training for operators: Ploughing method



Training for operators: Plough adjustment



Training for operators: Structure of maize sheller



Pilot project: Selection of target FBO



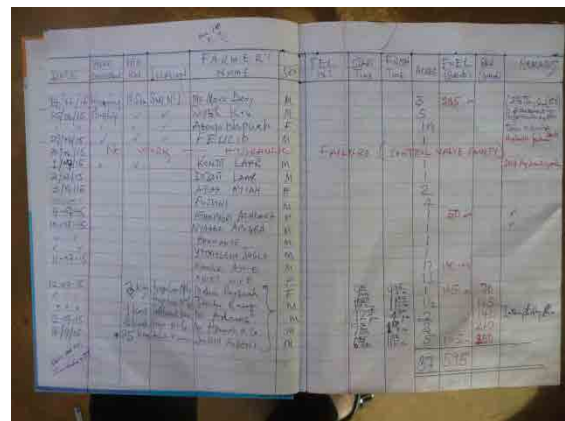
Interview with farmers



Pilot project: Stakeholder meeting



Monitoring: Measurement of fuel consumption



Monitoring: Record keeping