# Summary Results of the Terminal Evaluation

<table>
<tr><td colspan="2">I. Outline of the Project</td></tr>
<tr><td>Country: The Republic of the Union of Myanmar</td><td>Project Title: Project for Development of Water Saving Agriculture Technology in the Central Dry Zone</td></tr>
<tr><td>Issues/Sector: Agriculture</td><td>Cooperation Scheme: Technical Cooperation Project</td></tr>
<tr><td>Division in Charge:<br>Rural Development Department</td><td>Estimated Total Cost: Ｉ460 million JPY</td></tr>
<tr><td rowspan="2">Period of Cooperation:<br>Five (5) years from November 2013</td><td>(Implementation Organizations in the Partner Country):<br>Ministry of Agriculture, Livestock and Irrigation (MoALI)<br>Department of Agricultural Research (DAR)<br>Department of Agriculture (DOR)<br>(Related Organization in the Partner Country):<br>Irrigation and Water Utilization Management Department (IWUMD)</td></tr>
<tr><td>Implementation Organizations in Japan:<br>Ministry of Agriculture, Forestry and Fisheries<br>University of Tsukuba</td></tr>
<tr><td colspan="2">1-1. Background of the Project<br>The mainstay of the primary industries of the Republic of the Union of Myanmar (hereafter referred to as “Myanmar”) represented by agriculture sector where 61% of the total labor population is engaged and 27.9% of GDP as well as 16% of the export earnings are produced (2014-15). The Government of Myanmar has given higher priority to the issues such as food self-sufficiency, export promotion, and rural development through agriculture development in order to achieve food security and poverty alleviation.<br>In Central Dry Zone (CDZ) which is located in the geographical center of Myanmar, the annual rainfall is only 700 ~ 1,000 mm (3,000 mm in Delta area) with erratic duration of rainy season and with wide annual deviation (Figure 2.1). It causes crop failure which makes farmers’ livelihood unstable and insecure. In CDZ, the ratio of lowland farm and upland farm is 28 to 72, implying that as much as about 30% of the whole farmlands could be cultivated with rice if sufficient rain or irrigation water is available.<br>While vast paddy areas in Shwebo (Sagaing Region) and Meikthila (Mandalay Region) are well equipped with irrigation facilities, leguminous crops and oil crops are grown in upland with rain-fed condition which has been exposed to unpredictable severe drought and degradation of soil. It is due to weakness of agriculture technologies which are adaptable to agro-environmental conditions of CDZ. To increase and stabilize agricultural production in CDZ, MoALI is engaged in development of water saving technologies from the aspects of: 1) introducing adaptable crops and its varieties, 2) conserving soil by prevention of soil erosion and improvement of cultivation practices, and 3) developing water saving irrigation on farm level in CDZ.<br>Therefore, this project, the Project for Development of Water Saving Agriculture Technology in the</td></tr>
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Central Dry Zone (hereafter referred to as “the Project”), was proposed by MoALI to improve local livelihood through increasing and stabilizing agricultural production by combination and improvement of water saving technologies. The Project has been implemented since November 2013 and will complete in October 2018.

From February to March 2018, Joint Terminal Evaluation was conducted by Japan and Myanmar in order to provide recommendations on the actions to be taken during the remaining cooperation period to secure the sustainability of the Project, as well as to draw lessons useful for technical cooperation schemes in general.

**1-2. Project Overview**

The Project is aimed to disseminate the water-saving agriculture technologies for stabilization of agricultural income in CDZ through identification of suitable crops and varieties, improvement of cultivation technologies, improvement of farm maintenance technologies and development of Water-saving irrigation technologies.

**(1) Overall Goal**

In CDZ (especially the non-irrigated areas where upland farming is a main form of agriculture), an agricultural income is stabilized as a result of the spread of water-saving agricultural technologies which are suitable to CDZ.

**(2) Project Purpose**

Water-saving agriculture technologies that are adapted to CDZ are established.

**(3) Outputs**

1. New and/or conventional crops and promising varieties that are adaptable to CDZ are identified and prepared.
2. Cultivation technologies are improved so that these can match the environments of CDZ.
3. Technologies for farm maintenance including control of soil environment (nutrients, water retention, etc.) are improved so that these can match the environments of CDZ.
4. Water-saving irrigation technologies that are adaptable to project sites in CDZ are developed.

**(4) Inputs (as of Mid-Term Review)**

Japanese Side:

-Long-term Experts: 10 persons in total

- 2 Chief Advisor/ Dry Land Crop Cultivation
- 1 Chief Advisor
- 2 Water Saving Irrigation
- 2 Integrated Pest Management
- 3 Project Coordinator

-Short-term Expert: Seed-multiplication of field crop

-Equipment Provision: (i) JICA Owned Equipment (USD 102,946 and Kyat 28,853,000)
(ii) Handover Equipment (USD 80,000 and Kyat 127,694,050)
- Renovation/ Rehabilitation of Infrastructure: USD 80,000 and Kyat 54,952,500
-Training in Abroad: None
-Budget Execution*: 2013 (Kyat 243,562,996 = JPY 25,623,112= USD 252,586 in total)
2014 (Kyat 385,893,388 = JPY 42,950,158= USD 392,988 in total)
2015 (Kyat 236,630,000 = JPY 24,658,215= USD 186,486 in total)
2016 (Kyat 317,936,538 = JPY 27,892,016= USD 248,790 in total)
2017 (Kyat 333,556,100 = JPY 2,996,210= USD 247,629 in total)

*The figures include JICA owned equipment, handover equipment and renovation / rehabilitation of infrastructure. The value (Kyat, JPY and USD) is converted by JICA exchange rate (2013: USD 1.00= JPY 101.4、2014: USD 1.00= JPY 109.3、2015: USD 1.00= JPY 132.2、2016：USD 1.00＝ JPY 112.1、2017: USD 1.00= JPY 121.0)

Myanmar Side:
- Project Director : 3 persons in total
- Project Manager: DAR (2 persons in total), DOA (5 persons in total)
- Counterparts: 13 persons (DAR 10 persons, DOA 3 persons) (as of February 2018)
- JCC: Chairperson (3 persons in total), Members (6 in total)
- Land, Building, Office and Facilities: Office Building, Office space, Warehouse, Experimental and seed production field, Drying yard, Meeting venue, Seed production field (sesame)
- Budget Execution: 2013 (Kyat 166,467,000)
2014 (Kyat 196,739,000)
2015 (Kyat 260,365,600)
2016 (Kyat 236,660,000)
2017 (Kyat 250,479,000)

In-kind Contribution : water and electricity bills, baseline and end line surveys and other utility costs

**II. Evaluation**

| | Evaluator | | |
|---|---|---|---|
| | Name | Position | Affiliation |
| Myanmar Team | Dr. Pau Sian Kam | Leader | Research officer, Department of Agricultural Research (DAR), MoALI |
| | Daw Aye Aye Khaing | Member | Staff officer, Department of Agriculture (DOA), MoALI |
| Japanese Team | Dr. Akira KAMIDOHZONO | Leader | Senior Advisor (Agricultural and Rural Development), JICA |
| | Mr. Kota SAKAGUCHI | Cooperation Planning | Deputy Director, Team1, Agricultural and Rural Development Group1, Rural Development Department, JICA |
| | Mr. Shunji SEGAWA | Evaluation Analysis | Staff, Team1, Agricultural and Rural Development Group1, Rural Development Department, JICA |

| **Period of Evaluation:** 21 Feb – 9 Mar 2018 | **Type of Evaluation:** Terminal Evaluation |
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**III. Results of Evaluation**

**3-1. Achievements**

**(1) Outputs:**

**Output 1:** New and/or conventional crops and promising varieties that are adaptable to CDZ are identified and prepared.

| Indicators | Status | Achievement |
|---|---|---|
| 1-1 Within a half year from beginning of the project, the baseline study is conducted and consumer needs for the local agriculture products are identified. | Achieved | The baseline survey and market price survey were completed in January and September 2014, respectively. These were compiled in Baseline Survey Report and Market Price Survey Data, respectively. |
| 1-2 10% or more of the farmers in the target area adopt the new and/or existing crops and their superior varieties that are recommended by the project based on the consumer needs. | Achieved | The number of seed recipients (CFs, NFs, and OFs) of the quality seeds of the target varieties.<br>2014: 26<br>2015: 818<br>2016: 798<br>2017: 882<br>Total: 2,524<br>CFs and NFs have disseminated the WSAT technologies to 18.4 farmers on average.<br>According to the Evaluation Team's survey, 21 out of 72 GFs were using the technologies that were taught by CFs or NFs. Therefore, an estimated number of farmers who use the recommended varieties is<br>2,524 + (1,638 ×18.4× 21/72) =11,315<br>11,315 / 78,492 (14.4 %) |
| 1-3 By selling the new and/or existing crops and their superior varieties that are recommended by the project based on the consumer needs, an average sales amount of the contact farmers for such crops/varieties increases by 10% or more. | Mostly Achieved | The data of the average gross agricultural income (Kyat/ acre) from the target variety of the CFs show that the average income during the project period is larger by 10% or more for most of the crops. |

**Output 2:** Cultivation technologies are improved so that these can match the environments of CDZ.

| Indicators | Status | Achievement |
|---|---|---|
| 2-1. Cultivation technologies adapted to local conditions are established for the selected new and/or existing crops and their superior varieties, and these technologies are implemented 2 times in total (2 times per year) | Achieved | The trials ware conducted 4 times at the DAR farms. |

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| at DAR Experiment Farm. | | |
| 2-2. Appropriate technical manual for cultivation technologies are prepared. | Mostly Achieved | The manuals for each target crop were prepared. In addition to those manuals, a manual of rhizobium for extension agents is being prepared. |
| 2-3. 30 or more persons of the extension agents who can apply the above manual and implement cultivation technologies are built up. | Achieved | 29 extension agents have been trained and 15 are under training. In addition, Training on Trainers (TOT) will be conducted in 2018. |
| 2-4. Verification test by applying the above manual is conducted 100 times or more (1 time or more per year) by the project at the contact farmer's field. | Achieved | Verification tests (CFs) have been conducted 137 times. |
| 2-5. The cultivation that is applied with the above manual is implemented by 10% or more of the farmers in the target area. | Achieved | An estimated number of farmers who use the cultivation techniques taught with the manuals is 13,726.<br>13,726 / 78,492 (17.5%) |

| **Output 3:** Technologies for farm maintenance including control of soil environment (nutrients, water retention, etc.) are improved so that these can match the environments of CDZ. | | |
|---|---|---|
| **Indicators** | **Status** | **Achievement** |
| 3-1. Within a half year from beginning of the project, the baseline study is conducted and soil conditions in the target area are identified. | Achieved | Data Collection Survey Reports were compiled in August 2013. In addition, the following reports were prepared.<br>1. Climate in the Target Area<br>2. A Soil Condition in the Project Site |
| 3-2. The soil improvement technologies that are adapted to the local conditions are established | Mostly Achieved | The approach based on application of *gliricidia sepium* has been identified. Rhizobium inoculation and green manure techniques are also being established. |
| 3-3. Technical manual for the soil improvement technologies is prepared. | Mostly Achieved | Extension material (FFS) for gliricidia was prepared and is being used. A manual for green manure and rhizobium inoculation is being prepared. |
| 3-4. 30 or more persons of the extension agents who can apply the above manual and implement the soil improvement technologies are built up. | Mostly Achieved | 24 extension staff have been trained. Implementation of TOT regarding the soil improvement technologies is planned in 2018. |
| 3-5. Verification test by applying the above manual is conducted 100 times or more (1 time or more per year) by the project at the contact farmers' field. | Achieved | 107 verification tests (CFs) have been conducted. |
| 3-6. The soil improvement that is applied with the above manual is implemented by 2% or more of the farmers in the target area. | Decision making is required for achievement | Estimated number of farmers who applied the technology is 1,402.<br>1,402 / 78,492 (1.8%) |

| | | |
|---|---|---|
| | of the indicator | |

| **Output 4:** Water-saving irrigation technologies that are adaptable to project sites in CDZ are developed. | | |
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| **Indicators** | **Status** | **Achievement** |
| 4-1. The study report on water resources and water use by farmers at project sites is drafted. | Achieved | 3 study reports were prepared. |
| 4-2. Technical guideline and/or manual for the water-harvesting and water-saving irrigation technologies are prepared. | Achieved | Guideline and extension materials were drafted. |
| 4-3. The recommendation for combined methods for water-saving cultivation and water-saving irrigation technologies is prepared. | Achived at DAR Research Stations<br><br>Not Compatible for Farmers | At DAR research stations, water-irrigation technology is used for production of Foundation seeds and Certified seeds of the recommended variety of groundnut and pigeon pea. On the other hand, the water-saving irrigation technologies that have been introduced to farmers are used for cultivation of horticultural crops, and not for the four target crops of water-saving cultivation. |

**(2) Project Purpose:**

| **Project Purpose:** Water-saving agriculture technologies that are adapted to CDZ are established. | | |
|---|---|---|
| **Indicators** | **Status** | **Level of Achievement** |
| 1. The water-saving agricultural technology developed in this project are introduced by the 15% farmer in Project Site and carried out more than 1 cropping seasons. | Achieved | 4,936 farmers participated in FFS and field day during the Project. Out of those participants, CFs and NFs have disseminated the WSAT technologies to 18.4 farmers on average. According to the Evaluation Team's survey, 21 out of 72 GFs were using the technologies that were taught by CFs NFs. Therefore, an estimated number of farmers who use the cultivation techniques taught with the manuals is 4,936+ (3,204×18.4×21/72 ) =22,130 22,130 / 78,492 (28.2%) |
| 2. 2. In Project Site, crop yields increased 10% at the farmers who used the water-saving agricultural technology developed in this project. | Mostly Achieved on average between 2014-17 | The average yield of each target crop in Project sites from 2014 till 2017 has mostly increased from the yield before the project. The overall average of the yield increase is 16%. It has to be noted that weather conditions and other external factors may affect the yield in 2018, changing the status of this indicator. |

| | | |
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| 3. 3. In Project Site, 60% of farmers, who used the water-saving agricultural technology developed in this project, evaluate that this technology is effective. | Mostly completed | The endline survey conducted in 2017 towards 88 farmers (CF and NF) showed that 99% of them affirmed that one or more WSAT technologies were effective. |

**3-2. Review by the Five Evaluation Criteria**

**Relevance: High**

The Project meets needs of the beneficiaries (farming households) and the target group (staff of three DOA offices and DAR research farms in the target area). The Project coincides with development policy of Myanmar and aid policy of Japan. The methodology as a means to achieve Overall Goal (stabilization of agricultural income in CDZ) is considered appropriate. There are no factors to lower relevance of the Project.

**Effectiveness: Relatively High**

Logical sequence between Outputs and Project Purpose is secured and logically connected. The Project Purpose has been mostly achieved. Some external factors such as erratic rainfall and fluctuation of market price of target crops, especially chick pea, have affected the achievement of the Project Purpose.

**Efficiency: Relatively High**

The Outputs are mostly achieved at the time of the Terminal Evaluation. Implementation process is generally efficient and satisfactory except for delay at the beginning of the Project. Inputs from both sides are generally appropriate, and equipment and infrastructure are well utilized and managed.

**Impact: High**

The tangible impact is observed on CFs, NFs, OFs, and GFs through FFS and demonstration of WH/WS technologies. Overall Goal may be difficult to achieve unless the extension mechanism is strengthened in the remaining period of the Project. No negative impacts as well as no unexpected negative effects have been found.

**Sustainability: Relatively High**

Policy and administrative sustainability as well as technological sustainability are “relatively high”. Organizational and institutional sustainability and financial sustainability are “moderate”.

**3-3. Major supporting factors to achieve the Project Purpose**

- Leadership and active attitude of senior officials in the implementing agencies
- Awareness of importance of upland crops, necessity of seed-multiplication and distribution system
- Enthusiasm and disciplined (time conscious) C/Ps and TG
- Transfer of technical C/P from Biotechnology, Plant Genetic Resources and Plant Protection,

headquarters of DAR to Dryland Crop Research Centre in Nyaung Oo for production of Output 4

- Good collaboration and cooperation between DAR, DOA, and farmers through field day and FFS
- Highly motivated CFs and NFs
- Flexible arrangement of administrative and coordination structure and procedures.

**3-4. Major hampering factors to achieve the Project Purpose**

- Frequent transfer of trained C/Ps and TGs
- Insufficient means of transport and travel allowances for extension agents
- Drop of the price of pigeon pea due to restriction of import of pulses from Myanmar by Indian Government in 2017
- Fluctuation of the rainfall pattern at the target sites
- Increase of the labour fee at the target sites
- Drastic decrease in the yield of groundnut and pigeon pea due to rodent and squirrels.
- The Project started with a framework of technology development but it was modified at in the first few years with more focus on extension of technologies. The framework such as PDM and implementation structure of the Project should have been revised at the same time, but was not changed.

**3-5. Conclusion**

The Evaluation Team confirmed that the Project has mostly achieved the Project Purpose and four Outputs. Capacity development for C/Ps and TGs of DAR and DOA, CF, NF and OF has been strengthened through research and extension activities especially in DAR farms and FFS on the CF's fields. The Evaluation team also confirmed that the Project has contributed to increase and stabilization of yield as well as increase of income by introducing suitable crops and varieties under the circumstances of unstable weather and fluctuation of market price in CDZ. It was also found that the Project has positively impacted dissemination of Sinpadaethar-11 for groundnut and rhizobium to GFs who received no intervention by the Project. The Evaluation Team also highly appreciates that DOA utilized the knowledge and extension manuals of the Project in FFS under the FAO's Climate Smart Agriculture project.

It was highly appreciated that the Draft version of the PPS has been properly prepared under the recommendation by the Joint Mid-term Review in June 2016. Furthermore, in order to achieve the Overall Goal, the Project has established mutual cooperation with Regional Government of Mandalay, Magway and Sagaing as well as seed supply system based on cooperation between DAR and DOA and Master Trainers training (TOT) for extension agents and farmers. The Project has put much effort into establishing a mechanism that enables achievement of the Overall Goal after the end of the Project.

**3-6. Recommendations**

Based on results of the Terminal Evaluation, the Evaluation Team makes following recommendations.

**(1) Official Approval of the PPS and Budget Allocation**

Sustainability of the Project needs to be ensured by finalizing and approving the PPS and the plan of

necessary budget until 2023. It has to be noted that the responsibilities for inputs necessary for activities of the Project need to be gradually handed over to the Myanmar side towards the end of the Project. The budget plan for PPS needs to cover not only the activities within each Township but also the cost of production of seeds, gliricidia, and rhizobium as well as other extension activities for other TSs.

**(2) Official Recognition of Master Trainers**

The TOT to train Master Trainers is a crucial activity in order to ensure sustainability. However, this is a new activity for the Myanmar side, and therefore the following aspects need to be discussed and confirmed among stakeholders:

- How to certify the Master Trainers
- How to allocate the Master Trainers for the future extension activities
- How to incentivize the Master Trainers to conduct extension activities in multiple Townships

**(3) Strengthening of Seed Production and Supply System**

As for the seed production and distribution system, some achievements have been made from the activities that started in the fourth year of the Project. On the other hand, it is hard to say that the system is fully functioning, and therefore continuous efforts are required. It is crucial to reorganize the flow of the system among the concerned departments and stakeholders. The Evaluation Team recommends the Project to continue its efforts in establishing seed production and system development necessary for application of WSAT technologies and to work towards development of the system in cooperation with other projects.

**(4) Optimization of Application of Water-Harvesting and Water-Saving Irrigation Technologies**

The water-harvesting and water-saving irrigation technologies have contributed to the production of horticultural crops such as tomatoes, onions, chilli etc. and to the production of seeds of recommended crops at DAR research stations. These horticultural crops are suitable for consumption at local restaurants and hotels, especially in Bagan which has significant tourism resources and is applying for registration as the World Heritage Site. Considering these circumstances, the Evaluation Team recommends the Project to optimize the application of water-harvesting and water-saving irrigation technologies and to conduct activities that will lead to the establishment of FVC in the area.

**(5) Continuous Work on Climate-Related Issues**

Throughout the Evaluation Team's interviews, C/Ps, Target Groups, and farmers have pointed out the difficulty caused by the climate, especially erratic amount and timing of rainfall. This is an external factor of the Project, but it will continue to be a critical issue in the future. Continuous collection of data and its analysis and discussions among the Project members, and cooperation with Myanmar's metrological agencies is recommended.

**(6) Continuous Effort on Academic Works**

The Project has been utilizing Myanmar's existing extension systems, but also started innovative

activities and revitalized some of the past activities of the C/Ps. The Evaluation Team recommends writing academic papers and making presentations regarding the achievements of the research conducted within the Project.

**(7) Strengthening Dissemination of Achievements by the Project**

The Evaluation Team has observed tangible Outputs being achieved by the Project. These activities should be shared among Myanmar officials of the Central and Regional Government, private companies, other donors, NGOs and international NGOs, as well as farmers outside the CDZ. The Evaluation Team recommends the Project to consider using the media and conducting the following events open to the public:

- Seminar on the achievements of the Project
- Expanded FFS at farmers' fields
- Tours of WSAT activities for the media and the press

**(8) Utilization of ICT**

At one of the interviews conducted by the Evaluation Team, usage of ICT for dissemination of technologies was proposed by DAR and DOA. This is a very important aspect, and the Evaluation Team recommends utilization of smartphone applications to distribute technical manuals and of social media for advertisement of activities such as FFS. Activities which require smaller budget should be implemented as a starting point.

**(9) Revision of the PDM**

The Evaluation Team recommends modification of PDM version 1 and proposes PDM version 2.

**(10) Extension of the Project Period Until March 2019**

In order to ensure sustainability of the Project, TOT activities are planned for seed quality control and implementation of FFS. The Evaluation Team recommends that the Japanese experts monitor and support the implementation of TOT. If the Project is terminated as planned, both TOT activities will be conducted without any support from the Japanese experts, and the quality of TOT will not be ensured. Therefore, the Evaluation Team recommends extension of the implementation period of the Project until March, 2019.

**3-7. Lessons Learned**

**(1) Effect of JICA's Intervention on Strengthening of the Collaboration Among DAR, DOA and Farmers**

Due to the Project's activities such as production of seeds of new varieties of crops, rhizobium, and gliricidia by DAR and extension activities by DOA, the collaboration between these two departments has been established. This collaboration was achieved due to the constant meetings and communication supported by the Japanese experts, leading to the recognition of the importance of working as a team among the stakeholders. Once the flow of activities was established, the number of meetings was

reduced and more time was spent in the field. This flexible change of project management for maximum productivity and outcome can be applied to other projects.

**(2) Considering Stability of Production**

The Project has been implemented in CDZ which is a harsh agro-ecological environment easily affected by climate change. Considering these circumstances, the Project chose the recommended varieties considering not only high yield but also yield stability. Based on the results from experiments and discussions with DAR and DOA, this approach has greatly contributed to the achievement of the second indicator of the Project Purpose.

**(3) Multilayered Extension Approach**

This Project has used a multilayered approach for dissemination of the technology, consisting of the following;

Development and demonstration of new technologies at the DAR research stations

FFS and extension activities toward farmers using the manuals by DOA

Dissemination of technologies to OFs and GDs from CFs and NFs in their own community

This approach has led to dissemination of technologies towards a large number of farmers.

-End-