

Republic of the Union of Myanmar

FY2018 Ex-post Evaluation of Japanese Grant Aid Project

“The Project for Strengthening Human Development Institutions in Agriculture”

External Evaluator: Masato Onozawa, IC Net Limited

## **0. Summary**

This project was implemented to meet increasingly diverse and sophisticated needs by improving the facilities and experimental/training equipment at Yezin Agricultural University (YAU) and other agricultural human development institutions in order to improve the institutions for providing efficient education and training, thereby contributing to the development of human resources engaged in the development and dissemination of technology that meet the needs of markets and producers.

The project has been consistent with the development policies of Myanmar from the planning stage to the ex-post evaluation. It has been consistent with the development needs of Myanmar such as improving deteriorating equipment and educational environment required for human resource development as well as creation of improving varieties. The approaches of the project, such as facility improvement and equipment provision, have been appropriate for solving the needs of the implementing agencies to promote human resource development and research. The project was also consistent with Japan’s ODA policy at the planning stage, particularly with “assistance for improving the lives of people (including support for the poor and minorities, agriculture development and regional development)” and “assistance for developing capacity building of human resources and system that support the economy and society (including assistance for promotion of democratization)” of Economic Cooperation Policy for Myanmar formulated in April 2012. Thus, the relevance of the project is high.

This project was implemented within the planned cost. Its duration was 8 months longer than planned (136%) because of unpredictable reasons, such as the delay in the preparatory work caused by buried objects found in the planned construction site on YAU’s premises and the delay in the procurement of construction materials and customs clearance. Therefore, the efficiency of the project is fair.

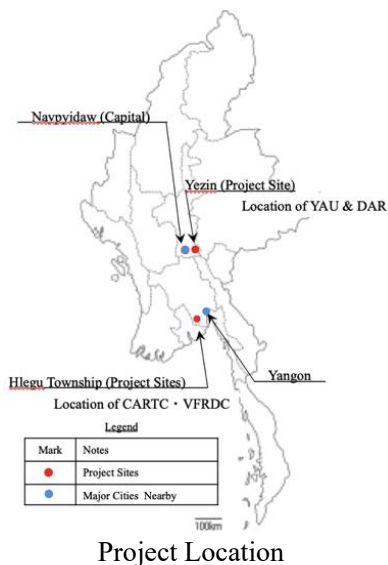
Of the quantitative indicators that show the effectiveness of the project, the increase in the number of students and staff members, and the implementation status of experiments and practices respectively exceeded the set of targets at the time of the planning. The indicator for the number of the participants of the training from institutions concerned to the project exceeded the plan. On the other hand, the increase in the number of curriculums fell below the plan because of the delay in promoting some of the university’s departments to major courses. The number of papers published by YAU and the Department of Agricultural Research (DAR), which were regarded as quantitative indicators of the impact of this project, confirmed the achievement of the target value. It was discovered that the institutions set new research themes to address the

“development of research and human resources meeting the needs of farmers, markets and consumers,” which was positioned as one of the qualitative effects of the impact. According to the questionnaire survey conducted to students and participants who completed the training, improvements of learning environment starting with facilities were highly evaluated. In addition, through improvements in the educational and research environment at YAU, positive impacts of the project emerged such as YAU conducting joint research in cooperation with agricultural research institutions and similar institutions in various countries. Thus, it can be evaluated that both the effectiveness and the impact of the project are high.

With regard to the sustainability of this project, the facility and the equipment installed at the implementing agencies are used by undergraduate and graduate students as well as by researchers. Organizational arrangement for maintenance is established, and barring some equipment, daily maintenance is carried out. In YAU, where technical cooperation project (TCP) is directly assisting, acquiring knowledge and passing on the use and maintenance methods of equipment requiring sophisticated technology are done properly. In other institutions, there are some rooms for improvement for inheriting the maintenance method systematically by developing a manual at laboratory to maintain or promote OJT to replace necessary parts and consumables for some equipment at appropriate timing, even if personnel changes or retire. From a financial point of view, there are some issues in regards to regular inspection of some of the equipment, securing consumables and response to breakdown, such as unable to allocate budget in timely and sufficient manner when repair and maintenance are required. Therefore, the sustainability of the project is fair because its long-term financial sustainability on operation and maintenance (O&M) is questionable.

In light of the above, this project is evaluated to be satisfactory.

## 1. Project Description



Laboratory equipped by the project (at YAU)

## 1.1 Background

In Myanmar, the importance of agriculture within its economy is very high because approximately 60% of its population is engaged in agriculture and the GDP share of the agricultural sector occupies more than 30%. The government of Myanmar has recognized the importance of promotion and development of the agricultural sector. Experiencing a transition to market economy, Myanmar has been urgently in need of developing cultivation technology for meeting its diverse agricultural zones and environments, and producing high quality agro-products matching market demand. YAU, the only agricultural university in Myanmar has played a role to provide training opportunities to officials of the Ministry of Agriculture and Irrigation (MOAI) and agricultural engineers of the private sector. The Department of Agricultural Research (DAR), the Central Agriculture Research and Training Center (CATRC), and the Vegetable and Fruit Research and Development Center (VFRDC) established under the ministry have been tasked with accumulating the latest knowledge and technology, and providing education and training to such trainees as agricultural extension workers. Because their educational and training facilities and the equipment, however, have been deteriorated due to aging and obsolescence, the above four institutions were facing challenges in achieving their missions of human resources development and training.

## 1.2 Project Outline

The objective of the project is to ensure preparation of a system to effectively implement education and training that meet the diversified and advanced needs by improving experimental laboratory and preparing experimental and training equipment of human resources institutions in agricultural sector including Yezin Agricultural University, thereby contributing to strengthening of human resources engaging technology development and dissemination to correspond to the needs of markets and producers.

Grant Limit / Actual Grant Amount	1,008 million yen / 912 million yen
Exchange of Notes Date / Grant Agreement Date	March 2013 / May 2013
Implementing Agencies	Yezin Agricultural University Department of Agricultural Research, Ministry of Agriculture and Irrigation <sup>1</sup>
Project Completion	October 2015
Target Area	· Yezin Agricultural University (YAU) in

<sup>1</sup> The name at the planning stage. After the launch of the new administration in March 2016, the Ministry of Agriculture and Irrigation, the Ministry of Livestock, Fisheries and Rural Development, and the Ministry of Cooperatives were merged into the Ministry of Agriculture, Livestock and Irrigation. In this report, the name at the time of planning, Ministry of Agriculture and Irrigation, is used.

		Naypyidaw <ul style="list-style-type: none"> <li>· Research Center of Department of Agricultural Research (DAR) in Naypyidaw</li> <li>· Central Agriculture Research and Training Center (CARTC) in Hlegu Township, Yangon</li> <li>· Vegetable and Fruit Research and Development Center (VFRDC) in Hlegu Township, Yangon</li> </ul>
Main Contractors	(Construction)	Wakachiku Construction Co., Ltd.
	(Equipment)	Ogawa Seiki Co., Ltd.
Main Consultant		System Science Consultants Inc.
Preparatory Survey		From June 2012 to March 2013
Related Projects		[Technical Cooperation Project] Agricultural Training and Extension Improvement Project (2008–2011) Development of Participatory Multiplication and Distribution System for Quality Rice Seed (2010 – 2015) Project for Capacity Development of Yezin Agricultural University (2015–2020)

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Masato Onozawa, IC Net Limited

### 2.2 Duration of Evaluation Study

The ex-post evaluation study was conducted with the following schedule.

Duration of the Study: August 2018–September 2019

Duration of the Field Survey: November 13, 2018–December 2, 2018

## 3. Results of the Evaluation (Overall Rating: B<sup>2</sup>)

### 3.1 Relevance (Rating: ③<sup>3</sup>)

#### 3.1.1 Consistency with the Development Plan of Myanmar

The government of Myanmar has emphasized human resource development in the agricultural

<sup>2</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>3</sup> ③: High, ②: Fair, ①: Low

sector for promoting investment by setting improvement of agricultural productivity as one of the important policy objectives<sup>4</sup> in the Myanmar *National Comprehensive Development Plan* (NCDP<sup>5</sup>), the highest national plan at the time of the project planning. In *Myanmar 20 Year Agriculture Strategic Development Plan* (ASDP<sup>6</sup>), a long-term development plan at the time of the planning set by the MOAI based on NCDP, expanding sales channels for domestic and overseas markets for priority products and high value-added agricultural products and developing agricultural products while in harmony with the natural environment and markets have been intended. NCDP continues to be the highest national plan even at the time of the ex-post evaluation, and in the “*Economic Policy of the Union of Myanmar*”<sup>7</sup> was prepared under the new administration established in March 2016. In these plans and policies, development of industries minimizing disparity and improvement in productivity is considered as the important policy item<sup>8</sup>. The four recipient institutions by the project have carried out activities for human resources development and research aiming at improvement of agricultural productivity. Thus, the project has been confirmed consistent with the development policies of the agricultural sector in Myanmar both at the time of the project planning and the ex-post evaluation.

### 3.1.2 Consistency with the Development Needs of Myanmar

According to the interviews to the implementing agencies during the ex-post evaluation, the development needs of agricultural markets acknowledged by the government of Myanmar at the planning stage were to identify weatherproof agricultural varieties resistant to climate change. Based on the preparatory survey and interviews conducted during the ex-post evaluation to YAU and DAR, in addition to improvement of conventional variety and cultivation methods and enhancement of extension technique, introduction of new research and development such as agricultural biotechnology, food science, and microbiology were recognized as necessary. For instance, the need of developing weatherproof agricultural products utilizing genetic resources<sup>9</sup> collected by DAR and VFRDC for dissemination to farmers are recognized by researchers of the

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<sup>4</sup> Japan International Cooperation Agency. Final Report, Myanmar Agriculture Sector Data Collection and Confirmation Study (December 2013) in Japanese p.2-1. The planning documents effective at the time of project planning were “National Comprehensive Development Plan: NCDP” (Target Planning Period: 2011 – 2030) and “Second Five-Year Development Plan (2011 -2015). These two documents were not available during the evaluation study.

<sup>5</sup> Target year of planning: 2011 - 2030.

<sup>6</sup> Target year of planning: 2011 – 2030.

<sup>7</sup> Economic Policy of the Union of Myanmar is the economic policy consisting of 12 policy priorities prepared by NLD in July, 2016. The policy does not indicate the target year.

<sup>8</sup> President U Thein Sein mentioned “The Government of Myanmar has been paying attention to the importance of investment in the agricultural sector seriously “ at his inaugural speech on March 30, 2011. ( [http://www.burmalibrary.org/docs12/2011-03-30-TS\\_inaugural\\_speech\\_to\\_Pyidaungsu\\_Hluttaw.pdf](http://www.burmalibrary.org/docs12/2011-03-30-TS_inaugural_speech_to_Pyidaungsu_Hluttaw.pdf) . Retrieved on April 10, 2019

<sup>9</sup> Genetic resources refer to materials of biological origin with genetic functions. It is used for research and industry in a wide range of fields such as pharmaceuticals, food, materials, energy and environment. It includes those that may be used in the future, and those that are currently unused but have a potential value to human, and almost all animals and plants on the earth have microorganisms as genetic resources and plants and microorganisms on the earth have genetic resources.

institutions<sup>10</sup>. To expand new research areas in Myanmar, however, the institutional arrangement and upgrading of system and facilities for human resources development were delayed at the time of the planning. In addition, due to aging facilities and equipment, delay in renewing and upgrading them made it difficult for education and research institutions to improve level of research, education and training. Thus the institutions were not fully responding to these development needs. According to the interviews conducted at the time of the ex-post evaluation, it was confirmed that development needs in the new research area have been high and needs for research and human resources development also has been high.

The annual GDP growth rate of Myanmar has been around 7% in recent years. On the other hand, its annual agricultural growth rate has been 1.8% despite the workforce engaging in the agricultural sector occupies 60% (Table 1). Agricultural productivity has remained one of the most important development needs for reducing poverty and income disparity at the time of the ex-post evaluation.

Based on the above, the implementation of the project has been consistent with the development needs of the agricultural sector in Myanmar since the planning stage up to the ex-post evaluation.

Table 1: GDP and Agricultural Output in Myanmar

Fiscal year	GDP growth rate (%)	Agricultural sector GDP		
		Proportion to GDP (%)	Agricultural output (Million MMK <sup>11</sup> )	Increase in agricultural output from the previous year (%/year)
2011–12	5.6	32.5	11,166,211	0.1
2012–13	7.3	30.6	11,374,527	1.9
2013–14	8.4	29.5	11,633,534	2.3
2014–15	8.0	27.8	11,904,788	2.3
2015–16	7.3	26.8	12,212,132	2.6
Average annual rate	7.3	-	-	1.8

Source: MOAI; Data Bank of World Bank<sup>12</sup>

### 3.1.3 Consistency with Japan’s ODA Policy

At the time of the planning, Japan’s ODA policy on Myanmar stated “The economic assistance to Myanmar is significant from the perspective of providing support to establish Myanmar as a country contributing to prosperity, stability and integration of ASEAN, by boosting its reform

<sup>10</sup> Japan International Cooperation Agency. Preparatory Survey Report on the Project for Strengthening Human Development Institutions in Agriculture in the Republic of the Union of Myanmar. 2013 p.36

<sup>11</sup> MMK= Myanmar Kyat is an unit of the local currency in Myanmar.

<sup>12</sup> World Bank Data Base: URL= <https://data.worldbank.org/topic/economy-and-growth?locations=MM&view=ch> Retrieved on January 10, 2019.

efforts towards democratization, national reconciliation and sustainable development.”<sup>13</sup> In April 2012, Japan changed its economic cooperation policy to support Myanmar’s reform for democratization and national reconciliation, for the country. The scope of assistance, which was mainly provided in the sector related to the basic human needs where citizens of Myanmar directly received the benefits, was expanded to: (1) Improvement of people’s livelihoods, (2) Capacity building and development of systems to sustain economy and society, and (3) Development of infrastructure and related systems necessary for the sustainable economic development. Among three areas, the project is closely related to items (1) and (2) and contributes to each, and it was highly consistent with Japan’s ODA policy.

As stated above, this project has been highly relevant to Myanmar’s development plan and the development needs, as well as Japan’s ODA policy. Therefore, its relevance is high.

### 3.2 Efficiency (Rating: ②)

#### 3.2.1 Project Outputs

##### 3.2.1.1 Improvement of Facility

This project constructed two buildings of Experiments and Lectures Buildings (two-story (partially one-story) with a reinforced concrete, total floor area of 4,345.04 m<sup>2</sup>) on the premises of YAU. The buildings were constructed and developed mainly according to the plan. Major changes from the plan are shown in Table 2. These changes were given to improve the comfortability, ease of use and maintainability and were appropriate respectively.

Table 2: Comparison between Plan and Result of Building Development

Item/Specification	Plan	Result
Common items		
Preparatory work (temporary facilities/ site preparation, etc.)	<ul style="list-style-type: none"> <li>• Clearing of building site (former tennis court, former field), removal of obstacles</li> <li>• Land leveling</li> <li>• Temporary fence</li> </ul>	<ul style="list-style-type: none"> <li>• Changed the site location to protect the vegetation around the premises.</li> <li>• Secured the construction area, carry-in passage and pedestrian corridor.</li> <li>• Other works were implemented according to the plan.</li> </ul>
Structure and purpose of use	<ul style="list-style-type: none"> <li>• Two-story building with reinforced concrete structure</li> <li>• Laboratory, lecture room</li> <li>• Common spaces (corridor, stairs, machine rooms)</li> </ul>	<ul style="list-style-type: none"> <li>• Both the structure and the purpose of use were consistent to the plan.</li> <li>• Built a separate unit for the machine rooms to avoid the sound/vibration.</li> </ul>

<sup>13</sup> Ministry of Foreign Affairs. “2013 Official Development Assistance (ODA) Country Data Book – Myanmar.” URL= [https://www.mofa.go.jp/mofaj/gaiko/oda/shiryo/kuni/13\\_databook/pdfs/01-09.pdf](https://www.mofa.go.jp/mofaj/gaiko/oda/shiryo/kuni/13_databook/pdfs/01-09.pdf), viewed on February 15, 2019

Item/Specification	Plan	Result
Size and descriptions Experiment and Lecture Building-1 Machine Room Building	(m <sup>2</sup> ) 2,157.7 0.0	(m <sup>2</sup> ) 2,131.08 41.44
Experiment and Lecture Building-2 Machine Room Building	2,157.7 0.0	2,131.08 41.44
Total floor area	4,315.4	4,345.04
Room floor finish	<ul style="list-style-type: none"> <li>• Trowel finish after placing concrete</li> </ul>	<ul style="list-style-type: none"> <li>• Changed the capacity of the transformers and generators.</li> </ul>
Room ceiling finish	<ul style="list-style-type: none"> <li>• Paint finish after mortar repair</li> </ul>	<ul style="list-style-type: none"> <li>• Application of an acrylic resin coating</li> <li>• Placement of a gypsum board</li> </ul>
Landscape work	<ul style="list-style-type: none"> <li>• Landscape work to secure access to the surrounding ground, planting, changes in the shape of surrounding ground</li> <li>• Installation of walk paths</li> </ul>	<ul style="list-style-type: none"> <li>• Because of the change in the building position, the landscape and corridors were developed to secure access to the ground around the premises.</li> </ul>
<b>Experiment and Lecture Building-1</b>		
1st floor Laboratory, preparation room, staff room, etc.	<ul style="list-style-type: none"> <li>• Department of Agricultural Chemistry, Department of Agricultural Economics, Common Laboratory</li> </ul>	<ul style="list-style-type: none"> <li>• Departments' laboratories were developed according to the plan.</li> </ul>
Common spaces	<ul style="list-style-type: none"> <li>• Stairs-1, Stairs-2, Lavatory-1, Lavatory-2, Corridor, Passage, Service Balcony, Machine Room</li> </ul>	<ul style="list-style-type: none"> <li>• Minor changes in department rooms (changes in the position of partitions/doors, added small rooms, etc.)</li> </ul>
2nd floor Laboratory, preparation room, staff room, etc.	<ul style="list-style-type: none"> <li>• Department of Plant Pathology, Department of Entomology</li> </ul>	<ul style="list-style-type: none"> <li>• Constructed a separate building for the machine room. Changed the capacity of the transformer and power generator.</li> </ul>
Common spaces	<ul style="list-style-type: none"> <li>• Stairs-1, Stairs-2, Lavatory-1, Lavatory-2, Corridor, Passage, Service balcony</li> </ul>	
<b>Experiment and Lecture Building-2</b>		
1st floor Laboratory, preparation room, staff room, etc.	<ul style="list-style-type: none"> <li>• Department of Botany, Department of Animal Science, Department of Agricultural Engineering, multipurpose room</li> </ul>	<ul style="list-style-type: none"> <li>• Departments' laboratories were developed according to the plan.</li> </ul>
Common spaces	<ul style="list-style-type: none"> <li>• Stairs-1, Stairs-2, Lavatory-1, Lavatory-2, Corridor, Passage, Service balcony, Machine room</li> </ul>	<ul style="list-style-type: none"> <li>• Installed a sink in the laboratory of the Department of Agricultural Engineering.</li> <li>• Minor changes in department rooms (changes in the position of partitions/doors,</li> </ul>



Item/Specification	Plan	Result
2 <sup>nd</sup> floor Laboratory, preparation room, staff room, etc. Common spaces	<ul style="list-style-type: none"> <li>• Department of Agronomy, Department of Horticulture</li> <li>• Stairs-1, Stairs-2, Lavatory-1, Lavatory-2, Corridor, Passage, Service balcony</li> </ul>	<ul style="list-style-type: none"> <li>etc.)</li> <li>• Constructed a separate building for the machine room.</li> </ul>

Source: Information provided by JICA

### 3.2.1.2 Provision of Equipment

The methodology for equipment selection includes the following: 1) a list of equipment based on the requests by the implementing agencies was prepared; 2) priorities were given to the items listed based on the consistency with the education and research purpose, the mission of each implementing agency and difficulty of procurement other than the project; and 3) selection was made based on the project purpose of each organization, multiplicity and frequency of utilization. Equipment was provided to YAU, DAR, CARTC, and VFRDC as shown in the Appended Table 1. A total of 228 different types<sup>14</sup> of equipment were provided to the four institutions.

While YAU received the highest number of items, the nine departments in the main campus selected equipment necessary for improvement of experiments and training based on the curriculum as a higher educational institution. The relevancy of procuring research equipment was reviewed and selected by such criteria as usage at class-room activities, high level of their added value, contribution to new area of academic activities, and experience of usage and the research of faculty members. In addition, YAU has established a common experiment laboratory to share and allocate equipment among different departments to avoid duplication. According to interviews to implementing agencies in the evaluation study, the selection process based on the above policy and the provided equipment was satisfactory, and no negative opinions for the equipment were given. Although the number of equipment types changed from the plan, detailed examination for the selection were made at each institution, and therefore, the provided equipment is appropriate.

### 3.2.1.3 Consulting Services

The project carried out the detailed design and cost estimation, preparation of tender documents, tender assistance, construction and procurement supervision, and technical instructions on the use of the equipment immediately after equipment delivery. The training on teaching how to use the equipment when advanced techniques are required during research (so-called “soft component”), however, was not provided. Training for utilization of equipment requiring advanced technology has not been carried out except the TCP carried out at YAU. According to an interview to

<sup>14</sup> Equipment was counted by types because more than one unit of the same types of equipment was provided to an organization and the same equipment was provided to different organizations.

implementing agencies, there was an opinion that some of the equipment are complicated to use, and initial technical instructions given were not necessarily sufficient. In particular, technical instructions other than the initial training were not planned at the planning stage despite many equipment items requiring advanced techniques were provided to YAU and DAR. Therefore, short-term experts have been dispatched by the TCP, “Project for Capacity Development of Yezin Agricultural University” and utilization of machinery and equipment were instructed. There are still some rooms for providing additional assistance as some institutions did not seem to make full use of the equipment.

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The total project cost was planned to be 1,010 million yen while actual expenditure was 914 million yen, which was 91% of the plan. Table 3 shows the costs borne by Japan and Myanmar respectively and the ratio of the actual expenditure against the planned cost. The cost borne by Japan was 91% of the plan, and the cost borne by Myanmar was 100% as planned on a local currency basis.

Table 3: Project Cost

	Plan	Actual	Actual/Plan
A. Cost borne by Japan (million yen)	1,008 <sup>*1</sup>	912	91%
B. Cost borne by Myanmar (million MMK)	22.123	22.123	100.0%
B'. Cost borne by Myanmar calculated in Japanese Yen (in million Yen)	(2.150) <sup>*2</sup>	(2.331) <sup>*3</sup>	(108%)
C. Total project cost (A+B') (million yen)	1,010	914	91%

Source: Documents provided by JICA for the cost borne by Japan, and documents provided by the implementing agencies for the cost borne by Myanmar

\*1: GA grant amount

\*2: Exchange rate MMK 1.0 =0.09718 yen (based on the preparatory study report in August 2012)

\*3: Exchange rate MMK 1.0 =0.10536 yen (IMF's average exchange rate between May 2013 and October 2015)

#### 3.2.2.2 Project Period

The project period planned was from May 2013 to February 2015 (22 months) however the actual period was from May 2013 to October 2015 (30 months), which exceeded the plan by 136%. The reasons for the eight-month extension of the period are as follows: it took considerable time to remove unexpected objects buried underground and found during the earthwork of the site undertaken by the Myanmar side; to avoid starting civil engineering work during the rainy season, the time of starting construction had to be postponed; and procedures for the exemption of import taxes were delayed because of changes in the specifications of the iron bars used for reinforced concrete. These unexpected delays were caused by unforeseeable factors. Because of the eight-

month delay, third-year and above students had fewer opportunities to use the new facilities and equipment. As a result, learning opportunity using the facilities and equipment upgraded by the project was provided to the students at that time much later.

As stated above, the project period exceeded the plan while the project cost was within the plan. Therefore, the efficiency of the project is fair.

### 3.3 Effectiveness and Impacts<sup>15</sup> (Rating: ③)

The indicators for measuring effectiveness and impact at the time of the project planning were not necessarily clearly defined. Therefore, the quantitative indicators verifying effectiveness shown in the Table 4 was confirmed in the ex-post evaluation. The numbers of the research papers submitted from YAU and DAR, which were originally set as the indicators of the effectiveness is to be regarded as indicators of the impact measuring the capacity of the human resources trained at each institution. (Explained in latter section, “3.3.2.1 Intended Impact”). Furthermore, this project aims to develop human resources engaged in technology development and extension in response to the needs of markets and farmers through the development of the facilities and the equipment. Therefore improvement of education and training courses using the developed equipment and development of human resources response meeting needs are used for judging the impact.

#### 3.3.1 Effectiveness

##### 3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The status of the achievement of the quantitative indicators showing the effectiveness of the project is as follows (Table 4).

Table 4: Effectiveness (Achievement of Quantitative Indicators)

Quantitative Indicator*1	Baseline	Target	Actual			
	2011	2018	2015	2016	2017	2018
		3 Years After Completion	Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
YAU						
1. Proportion of experimental hours out of total lesson hours in 9 departments (%)	9	12	10	12	14	15
2. Number of curriculums (courses/year)	76	87	76	76	79	81

<sup>15</sup> Sub-rating for Effectiveness is to be put with consideration of Impacts.

3. Number of students and teaching staff (people)* <sup>1</sup>	2,082	2,290	2,427	2,904	2,851	2,756
4. Number of trainees (people/year)* <sup>2</sup>	204	420	-	-	-	-
DAR						
5. Number of trained staff (people/year)	24	29	20	16	20	80
6. Number of trained farmers (people/year)	6	8	0	30	100	50
7. Number of trained students (people/year)	141	170	150	81	80	80
8. Number of trained agricultural engineers (people/year)* <sup>3</sup>	73	88	-	-	-	-
CARTC						
9. Number of total training participants (people/year)	785	942	1,568	1,542	1,534	2,598
VFRDC						
10. Number of trained agricultural engineers (people/year)	139	167	300	368	1,100	1,020
11. Number of trained farmers (people/year)	143	172	150	320	600	739
12. Number of trained students (people/year)	452	542	Engineers' training, which was planned when the indicator was set, was not implemented			

Source: Documents provided by JICA and the implementing agencies

\*1: Because it was identified that the baseline for "3 Number of students and teaching staff" (9,891) was incorrect, compared with the actual data provided by YAU, 2,082 was accurate indicator. Because of this change, the target for 2018 became 2,290 as the preparatory study report stated, "the target will be 10% more than the baseline." This target will be used to evaluate this indicator.

\*2: Currently, YAU provides training to the enrolled students only. No trainees from outside the program are accepted.

\*3: Indicator "8. Number of trained agricultural engineers" could not be confirmed because the training set as the indicator was unclear and there was no data to be collected to identify this indicator.

## (1) Quantitative Indicators of YAU

Indicator 1 "Proportion of experimental hours out of total lesson hours in 9 departments" exceeded the target of 12%. Indicator 2 "Number of curriculums" was 81 at the time of the ex-post evaluation, which did not fulfill the target value of 87. The reason was that two departments, the Department of Animal Science and the Department of Agricultural Engineering, of the nine departments at YAU are still minor courses although they had expected to be promoted to major courses through restructuring with other universities in Myanmar during the planning stage. On the other hand, at YAU, the restructuring of the academic program is under way, and the agricultural extension, biotechnology, food science and microbiology departments were added to then nine agricultural departments at the time of the planning, and YAU has been expanded to 13 departments<sup>16</sup>.

<sup>16</sup> The academic credit system was introduced by the academic year beginning from November 2017. At the time of the evaluation, freshman and sophomore students in the university have adopted the new system (academic credit). The

Indicator 3 “Number of students and teaching staff” was revised at the time of the ex-post evaluation as there were mistakes made in both the baseline and the target values during the planning stage. According to the data provided by YAU at the time of the ex-post evaluation, the baseline value at the planning stage (2011) was 2,082. As the preparatory study report stated that “10% increase from the baseline should be set” as the target, the target (in 2018, three years after project completion) became 2,290. The actual number of students and faculty members in 2018 was 2,756, which fulfilled the target value, and the change in the number from 2015 to 2018 also has achieved the target. Various factors contributed to the increase in the number of students and faculty members, such as reductions in tuition fees due to the increase in budget and the easing of enrolment requirements. Therefore, the evaluation result could not attain information to identify causal relationship between the improvement of facility by the project and the increase in number of students and staff members.

#### (2) Quantitative Indicators of DAR

Both indicators 5 and 6 have fulfilled the target value (Table 4). Indicator 7 “Number of trained students” was intended to provide fourth year students opportunities for facility visit (one day) as training. The training since 2016, however, is to provide a mandatory six month-long internship instead of one day visits for fifth year students (those already graduated). Due to the difference in arrangement, the actual number of the trainees declined to 80, however, the quality of the training as well as the contents given to the trainees have deemed to be exceeding the target value because of intensity of the training.

#### (3) Quantitative Indicators of CARTC

Indicator 9 “Number of total training participants” achieved and exceeded the target value.

#### (4) Quantitative Indicators of VFRDC

Indicator 10 “Number of trained agricultural engineers” and the indicator 11 “Number of trained farmers” have achieved their targets. As for Indicator 12 “Number of trained students,” VFRDC has terminated their training program for agricultural engineer<sup>17</sup>; therefore the actual achievement of the training could not be obtained.

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junior and senior students still use the previous system (semester system), and two different academic systems co-exist. According to the on-going restructuring of the curriculum at YAU, minimum requirement for graduation will be 126 units including internship and thesis during the fifth year academic program. Total of 399 subjects will be offered when the new academic curriculum is fully adopted in the academic year 2026.

<sup>17</sup> According to VFRDC, a priority was given to training for managers, therefore the training for agricultural engineers (mostly officers of MOAI) were terminated as a result of training contents revised from the viewpoints of focusing the resources on the development of high-quality, low-price varieties and improvement of food safety.

On the basis of above, all the quantitative indicators, except indicator 2, together with partially unverified indicators, have achieved their target values. Considering the achievement of these indicators, the project shows high level of effectiveness.

### 3.3.2 Impacts

#### 3.3.2.1 Intended Impacts

##### (1) Quantitative Effects

This project was expected to improve the knowledge skills, and motivation of trained human resources and to enhance the level of research through improvements in facilities and equipment. To identify the status of promoting research activities as a result of these improvements, the number of research papers was counted (Table 5).

YAU published 68 papers in this year, which exceeded the target of 60 per year. According to the interviews carried out at the university, the number of papers published varies depending on the fiscal year as the number of research activities for multiple years has been increasing.

DAR published 21 papers in this year, which exceeded the target of 20 per year. The number of papers may increase during this fiscal year because the number above was counted in the middle of FY 2018 (from April 2018 to March 2019) and was only tentative data before the publication of the research bulletin in which the actual number of the paper published is determined<sup>18</sup>.

Table 5: Quantitative Indicators of Impacts  
(Achievement of the Number of Papers Published)

Indicators	Baseline	Target Value	Actual			
	2011	2018 3 years after completion	2015	2016	2017	2018
			Completion year	1 year after the completion	2 years after the completion	3 years after the completion
YAU						
1. Number of research papers (articles/year)	42	60	83	86	106	68
DAR						
2. Number of research papers (articles/year)	13	20	48	39	39	21

Source: Implementing agencies

##### (2) Qualitative Effects

The following items were set as expected qualitative effects at the time of the ex-ante evaluation:

- Educational/training curriculum and content of test research will satisfy needs of farmers;

<sup>18</sup> The number of academic papers published was confirmed from the information provided by the implementing agencies. Most of these were published on research bulletins issued by the respective agencies, and some of them are published on the bulletins and publications of academic societies.

- Outputs as a research result of university and each research institute will meet consumers' needs; and
- Techniques, knowledge, and motivation of the trained agricultural human resources will improve.

The needs of farmers and consumers recognized by each organization at the time of project planning were “improvement of farmers' income, cultivation technology and knowledge, and technology that can add value to price and quality through production and quality control, applicable for the diverse agricultural conditions in Myanmar<sup>19</sup>” According to interviews to YAU, consumer needs consists of the following four points, "appropriate food supply", "available at any time with reasonable price", "nutrition" and "safety". In order to meet these needs, research institutes set their research themes, and human resources in agricultural sector are trained and educated to meet the needs in accordance with the missions and specialized fields of each institution (Appended Table 2).

The scope of research themes has been expanded by the improvement and the renewal of the facilities and the equipment by the project. Each institution has started conducting researches in accordance with the needs of markets and consumers. YAU, for example, identifies such needs as the selection of rice varieties that respond to severe climate change in recent years and the development of beans resistant to pests and diseases. YAU carries out researches corresponding above mentioned needs of farmers and market (consumers). The research topics to be selected by research assistant, researchers, and students have been set by each laboratory, and instructed by professors or assistant professors who is in charge of operation of multiple studies carried out in a laboratory simultaneously under a common theme. As a result, each laboratory is confirmed to manage efficiently by selecting research topics with higher priority that correspond to needs and by carrying out study with common goals in the laboratory. In CARTC, it was confirmed that many trainees were employees of MOAI, and the training is conducted based on training needs arising from daily works. Particularly, either MOAI or private sector companies engaging in agriculture have employed the majority of YAU graduates. As such, a large number of students have been graduating every year to work in the agricultural sector. From the above, it has been confirmed that the equipment introduced in this project enables research corresponding to the needs of farmers and markets, and training has been conducted in line with the needs of farmers and consumers.

Qualitative changes in the learning process of the learners who are the recipients of knowledge at the institutes was necessary to be evaluated in order to grasp the qualitative effects, "techniques, knowledge, and motivation of the developed agricultural human resources will improve", expected by this project. A series of interviews were conducted with the students enrolled in the YAU graduate school and those in the other institutions to confirm the qualitative changes

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<sup>19</sup> JICA. ditto. p.13

occurred in the learning experience of before and after the project implementation. A face-to-face interview (semi-structured questionnaire survey) targeting a total of 40 students and trainees from all four institutions were carried out<sup>20</sup>. As a result, majority of respondents replied, “learning was enhanced” after the project improved the facility and provided equipment. With regard to changes in the teaching environment, many interviewees thought that the environment for enhancing one’s learning was improved by the introduction of air conditioners and PCs in the classroom.

The question on “teaching method (balance between practical sessions and lectures),” was positively evaluated. The average score was 70 (n=40) out of 100<sup>21</sup>. Responses to the question “whether or not you (participants) are confident to practice the learning acquired through the training and education provided by respective training/educational institutions in the place of employment and the society?” were scored 80 out of 100 (n=40). The responses indicate the participants have high level of confidence in practicing knowledge and skills acquired. In addition, the answers to the question “would you recommend this department to friends and acquaintances?” scored 85 (strongly recommend) (n=34).

Among other responses found in the spaces for additional comment was the teaching method has changed due to introduction of experiment and practice using the equipment. Along with the positive responses from the students, it was confirmed that the improvement in educational environment led by the project had a positive impact on the learning experience of each learner.. Considering the response to other questions, the methodologies and the contents of the research, the education and the training conducted at each institution were appropriate and the learning goals set by each institution are fulfilled to produce tangible learning results.

### 3.3.2.2 Other Positive and Negative Impacts

There has been no relocation of residents or acquisition of land to improve the YAU facilities as construction was carried out on the university’s premises. According to the interview to YAU, during the construction work, measures were taken to minimize the negative impact on the surrounding environment, such as reducing noise/dust and securing traffic flow. The negative impact on the environment and vegetation around the buildings had been minimized by changing the location of the new building slightly and minimize felling as few trees as possible. Based on the above, it is fair to say that there was no impact on the surrounding environment. The both

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<sup>20</sup> Of the nine academic departments in YAU, the study team selected graduate students randomly from the list of highest academic year classes provided by YAU. Four graduate students from each of the seven major academic departments (except major in agriculture engineering and animal husbandry), a total of 28 people were chosen. Four each from other three institutions, a total of 12 were also randomly selected from the most recent participants list provided by these institutions. A questionnaire survey was conducted targeting the total number of 40 students.

<sup>21</sup> To examine the questionnaire survey objectively, respondents answered questions on a scale of 1 to 5, and a score was given to each question (100–80: Strongly agree, 79–60: Agree, 59–40: Agree and disagree, 39–20: Disagree, 19–0: Strongly disagree). For the question “Would you recommend this department to friends and acquaintances?” above, the average score of respondents who agreed with the question (would recommend the department) was 85. Therefore, “Strongly agree” was applied (n=40).



toilets for male and female in the two newly built Experiment and Lecture Buildings have been installed properly in terms of architectural design, location and the number. It was found that a sufficient number was installed in the buildings. According to the interviews to YAU, it was confirmed that there were no complaints or comments regarding their access and cleanliness.

As one of the academic impacts due to the project, conditions for carrying out the on-going TCP, “Project for Capacity Development of Yezin Agricultural University”, were enhanced by improvement of educational environment at YAU. It became possible to strengthen the organizational operation system for YAU faculty members, improve the teaching and research skills of the members, and develop sustainable, practice/research-oriented educational infrastructure by TCP. More advanced research could also be conducted with the support of the experts dispatched by TCP. Through its new research facilities, trained human resources and modern research themes, recognition of YAU’s name has been increasing internationally. This enabled joint research to be conducted with overseas universities and research institutes such as the University of Melbourne in Australia. In this manner, conditions to create and strengthen the synergy with other universities, research institutes, donors and like have been improving.

From the perspective of training and human resource development, training contents and themes became more practical than those in the past. According to the interviews with CARTC, there was an opinion that the area in agricultural production would be improved for selection of new variety and development of cultivation methodologies at the area of agricultural production would be improved through dissemination of the new technology and consequently poverty would be reduced by effectively. By conducting training with themes that are suitable for the various regions and climates in Myanmar, it became possible to assign trained agricultural extension workers for disseminating new agricultural technologies for the farmers throughout the country.

Through human resource development and research studies that have been improved and enhanced by the project, new varieties and their cultivation methods have been developed and promoted, in accordance with the needs of markets and farmers, and “contribution to poverty reduction” in Myanmar, has been realized.

As stated above, the effects expected were largely realized as planned by the project. Therefore, the effectiveness and impact of the project are high.

### **3.4 Sustainability (Rating: ②)**

#### **3.4.1 Institutional/Organizational Aspect of Operation and Maintenance**

It has passed only few years since each organization received the equipment, and they have retained most faculty members, researchers and trainers who were in charge of the selection of the equipment. The facility and the equipment have been utilized properly because the respective themes for their research, education and training are still closely related and relevant to the necessity of the equipment. In terms of daily maintenance of the facility and the equipment, the

institutional arrangement and those who are in charge of management are clarified. For example, YAU has organized an equipment maintenance structure under the office of Rector in laboratories of each department. Similar structures have been confirmed at DAR and other institutions.

According to the interviews, those who utilize the equipment regularly are taking care of regular maintenance. This arrangement is based on an idea that those who use the equipment most may increase the frequency and provide appropriate level of maintenance. This approach is appropriate method to select who the responsible person would be.

Among the staff members who maintain and manage the equipment at YAU, the staff turnover has been about two annually (year 2018) out of 528 maintenance personnel. The number of retirees during the period is not necessarily significant, and most equipment has been maintained. Whether or not the successor is handed over, the technique for maintenance and its appropriateness are left to the presence or absence of the successor, the time of assignment, and the willingness of the predecessor. According to interviews with the other implementing agencies, absence of personnel who are thorough with use and maintenance of equipment due to transfer, leave, long-term training and other reasons cause standard of maintenance and frequency of use to go down. The procedures and the system of maintenance of the equipment at each organization is primarily the responsibility of the laboratory which uses them mainly, and where the responsibility lies is clear. However, whether to accumulate knowledge on maintenance in the form of a manual that users can refer to within the organization and whether to transfer such knowledge to successors as well as take over timing and way depend on the person in charge. From these, although the equipment maintenance structure exists, the O&M manner depend on the choice of each laboratory and the will of the persons in charge. Therefore, the O&M structure still has room for improvement.

#### 3.4.2 Technical Aspect of Operation and Maintenance

Advanced techniques are not required for daily maintenance of the facilities developed at YAU, but cleaning and visual inspections are required on a daily basis. If a problem is discovered, minor repairs can be carried out using existing tools. Because major problems were not apparent in the facilities during the visual inspection at the time of the evaluation, it is fair to say that the implementing agencies generally carried out appropriate maintenance and has the above-described basic techniques.

On the other hand, for the long-term maintenance of new buildings such as the ones constructed in the project, it will be necessary to prepare a maintenance plan and conduct regular inspections and repairs. YAU, however, did not seem to have prepared such a plan. During the preparatory survey study, it has examined the maintenance costs for the initial ten years, however, a precise maintenance plan that shows the basis of the cost estimation was not confirmed. According to YAU, it was found that the maintenance approach YAU regularly practice is “post maintenance

method” which is a methodology to carry out maintenance and repair whenever the problem occurred.

The equipment is effectively used as long as confirmed by a visual inspection carried out during the evaluation. It can be evaluated that they are equipped with daily operation and maintenance technique. Though the equipment introduced by the project has delivered along with its manuals, its description is limited to the names of the control, and very basic functions of switches, etc. There is no written information of correct usage of the equipment, such as proper collection and preparation of specimens, analysis, and proper maintenance methods of the equipment. Based on the interviews with YAU and DAR, it was indicated that the training carried out at the time of the delivery and the installation was only available to limited number of participants for limited time. A comprehensive training, however, have been provided to YAU because the above-mentioned TCP is being implemented. Methods for proper utilization and maintenance have been taught by the project. Therefore, it can be evaluated that advanced equipment has been utilized and operated properly.

As mentioned above, though there still remains some problems in the O&M of equipment requiring advanced skills and technology, the implementing agencies have been equipped with skills and technique for daily O&M. Therefore there is no major technical issues from an aspect of technical sustainability of the project.

### 3.4.3 Financial Aspect of Operation and Maintenance

During the evaluation survey, it was found that some equipment has been left unused due to failure of purchasing consumable and malfunction because of budget shortage, (see “3.4.4 Status of Operation and Maintenance” for details). As a result, the number of equipment items provided to all the implementing agencies is 288, of which the number of the unrepaired and unoperational items is 17. According to the interviews with the implementing agencies, there is a mechanism in Myanmar to apply for budget on expenses related to O&M when formulating budget proposal for the next fiscal year. The amount of budget request made by the implementing agencies, however, is allocated based on the actual estimated price determined after occurrence of breakdown and losing the function. Therefore, depending on the actual timing of the budget request and the amount of expenditure required, such request may not been accepted due to lack of available fund. Although for the 17 non-operating equipment mentioned above, requesting necessary budget was attempted for repair and purchase of consumables prior to the most recent fiscal year 2018/2019 at the time of the ex-post evaluation was conducted, the request has not been accepted, and non-operating equipment has remained unfunctional into next fiscal year. According to interviews, there are various reasons why sufficient budget at an appropriate time is not always secured. For instance, the priority of a budget item varies among university budget allocation from the government and the progress of research priority with or without using broken down equipment

at the laboratory level. It was noted that there were no plans for repair or replacement of consumables available for the breakdown equipment above in the budget of 2018/2019 at the time of the ex-post evaluation. Unless there is an assurance that the maintenance budget is always available, a probability of increasing the number of equipment broken and unfunctioned due to malfunction over years is high.

During the evaluation, all institutions were asked to provide profit and loss statement to confirm and analyze the distribution of expenditure related to O&M of YAU based on the financial documents provided from YAU. According to the information provided by YAU (Appended Table 3), 430 million MMK (about 16% of the annual expenditure) out of total 22.6 billion MMK has been spent for O&M, such as cleaning and repair for the facilities and equipment managed by YAU from the general account of the 2017/18 fiscal year. In addition, the ratio of O&M expenses is mostly occupied by labor cost, and it is considered unlikely that the financial resources for O&M will increase compared to the current level. A majority of equipment will have been past their in-service life since it will be past five years soon since the completion of the project. The cost for O&M as well as need of renewal is projected to increase gradually. Looking at the current financial status, immediate increase of the O&M budget allocation would not be realistic. Therefore, it is not expected to improve the trend of budget shortages significantly in the near future according to the financial status of YAU, and a concern over the future sustainability of the project still remains.

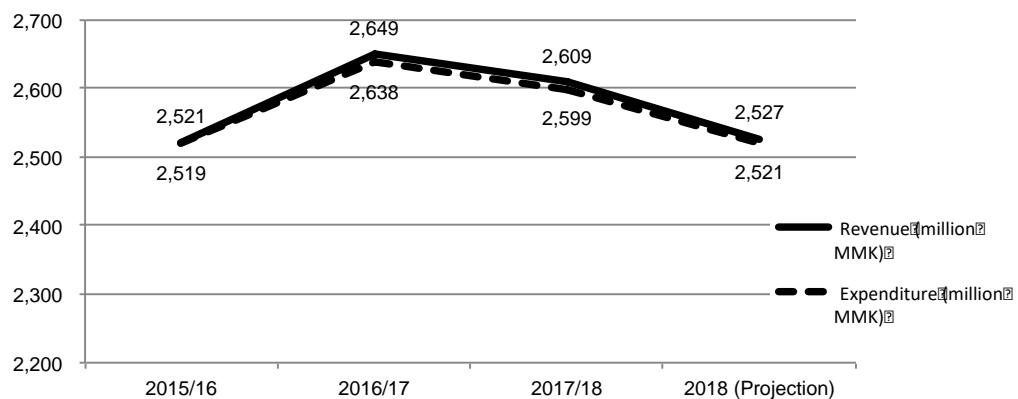


Figure 1: Yearly Trend of the Expenditure/ Revenue of YAU

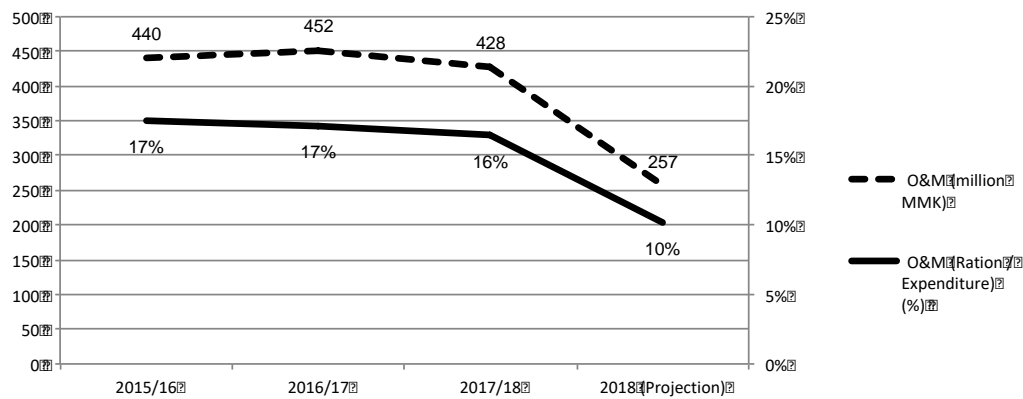


Figure 2: Expenditure for O&M and its Share

#### 3.4.4 Status of Operation and Maintenance

Based on the visual confirmation during the study, the O&M condition of the newly built facilities at YAU is considered generally adequate with no visible deficit were identified. According to interviews with each organization, the new facilities and equipment are utilized appropriately and are used for research, education, and training, respectively. The usage is exclusively on their purpose of each institution education, training and research, respectively. A regular maintenance has been carried out adequately as areas both inside and outside the buildings were kept clean, and people were required to wear slippers before entering the laboratory. As there were no signs of any leakages on the ceilings and walls, no signs of leak marks on the ceiling or wall were observed during the study. Air conditioning was controlled from each room and has been properly managed according to the purpose and the frequency of the room usage. Areas around the machine rooms, power generators, and water tanks were kept locked and well maintained on a daily basis.

On the other hand, it seems that there have been difficulties in maintaining the equipment put in place at an appropriate level and it has been left broken because the budget required to inspect and repair the equipment was not sufficiently secured in a timely manner. At YAU, where the majority of equipment has been delivered, equipment and instruments other than those provided by the ongoing TCP have been checked properly and cleaned on a daily basis by on-going TCP. In addition, departments at YAU have some non-operating equipment and have no prospects of repairing or restoring the equipment (Table 6). Most of the equipment is no longer covered by the warranty and cannot be used or operated again without securing a budget. Other three institutions have not inspected or used some of the equipment as they are having difficulty in securing a budget.

The interviews to YAU and DAR during the ex-post evaluation study revealed that some of the sales agents in Myanmar engaged in the procurement of the equipment did not have the adequate O&M techniques and parts inventory. They do not satisfy the technical level necessary for failure

diagnosis or on-site repairs in case of equipment maintenance. Therefore, it seems that the level of the services domestically available were found insufficient. Majority of items provided by the project are installed in Naypyidaw, away from Yangon where the most service providers are located. Also, even the diagnosis of the problems of the equipment incurs additional cost because the equipment is no longer covered by the warranty. Moreover, it is not easy to estimate cost for repairing because budget is not necessarily secured. Therefore maintenance status of some of the equipment is not fully satisfactory.

On the basis of the above, there is a room of improving of O&M in terms of the institutional/organizational aspect, technical aspect, financial aspect, and current status, therefore the impact of the project is moderate.

Table 6: Operating Status of Equipment Provided

#	Name of Equipment	Current Status, Cause of Not Functioning / Not Maintained
YAU		
Department of Agronomy		
1	Laboratory Rice Mill	Among the product specifications, the range of applicable grain size was limited, and some rice varieties produced in Myanmar could not be used due to the size of some rice exceeding the above range.
2	Seed Counter	Causes significant errors and fluctuations. (The cause is unknown.)
Department of Horticulture		
3	Water Distiller	Membrane <sup>22</sup> shall be replaced due to clogging
4	Automatic Titration Apparatus	Inspection necessary due to breakdown
5	Portable Leaf Area Meter	Battery change necessary due to failure
Department of Botany		
6	Plant Growth Chamber	Timer does not function (cannot repair due to lack of accurate manual).
Department of Agricultural Chemistry		
7	Prefabricated Refrigerator	Temperature sensor failure
8	Draft Chamber	Depending on the conditions of the outside air, the exhaust may flow backward.
DAR		
1	Germination Chamber	Needs inspection and repair, as the temperature and humidity cannot be controlled.
2	UV-Vis Spectrophotometer	Staff members need training, as the method of use is complicated.
3	Digestion Unit (desktop)	Specifications are different from those of the test tube used in the soil analytical laboratory. Need to purchase additional parts.
CARTC		
1	Microscope with Camera	No staff members know how to use since the member who participated in training transferred to a different department.
2	UV-Vis Spectrophotometer	No staff members know how to use since the member who participated in training transferred to a different department.
3	Photo Printer	Needs a service for inspection and repair, as the cause of the failure is unknown.
VFTDC		
1	Incubator (Panasonic)	Unused because there has not been any relevant research themes requiring the incubators until the time of evaluation while it was introduced based on the needs.
2	Oven	Unused because there has not been any relevant research themes requiring the oven until the time of evaluation while it was introduced based on the needs. .
3	Weather Station	Failure of continuous data recording since November 2017 with unknown cause

Source: Documents provided by the implementing agencies

<sup>22</sup> A filter element with a function to screen particles at a molecular level.

## **4. Conclusion, Lessons Learned and Recommendations**

### **4.1 Conclusion**

This project was implemented to meet increasingly diverse and sophisticated needs by improving the facilities and experimental/training equipment at Yezin Agricultural University (YAU) and other agricultural human development institutions in order to improve the institutions for providing efficient education and training, thereby contributing to the development of human resources engaged in the development and dissemination of technology that meet the needs of markets and producers.

The project has been consistent with the development policies of Myanmar from the planning stage to the ex-post evaluation. It has been consistent with the development needs of Myanmar such as improving deteriorating equipment and educational environment required for human resource development as well as creation of improving varieties. The approaches of the project, such as facility improvement and equipment provision, have been appropriate for solving the needs of the implementing agencies to promote human resource development and research. The project was also consistent with Japan's ODA policy at the planning stage, particularly with "assistance for improving the lives of people (including support for the poor and minorities, agriculture development and regional development)" and "assistance for developing capacity building of human resources and system that support the economy and society (including assistance for promotion of democratization)" of Economic Cooperation Policy for Myanmar formulated in April 2012. Thus, the relevance of the project is high.

This project was implemented within the planned cost. Its duration was 8 months longer than planned (136%) because of unpredictable reasons, such as the delay in the preparatory work caused by buried objects found in the planned construction site on YAU's premises and the delay in the procurement of construction materials and customs clearance. Therefore, the efficiency of the project is fair.

Of the quantitative indicators that show the effectiveness of the project, the increase in the number of students and staff members, and the implementation status of experiments and practices respectively exceeded the set of targets at the time of the planning. The indicator for the number of the participants of the training from institutions concerned to the project exceeded the plan. On the other hand, the increase in the number of curriculums fell below the plan because of the delay in promoting some of the university's departments to major courses. The number of papers published by YAU and the Department of Agricultural Research (DAR), which were regarded as quantitative indicators of the impact of this project, confirmed the achievement of the target value. It was discovered that the institutions set new research themes to address the "development of research and human resources meeting the needs of farmers, markets and consumers," which was positioned as one of the qualitative effects of the impact. According to the questionnaire survey conducted to students and participants who completed the training,



improvements of learning environment starting with facilities were highly evaluated. In addition, through improvements in the educational and research environment at YAU, positive impacts of the project emerged such as YAU conducting joint research in cooperation with agricultural research institutions and similar institutions in various countries. Thus, it can be evaluated that both the effectiveness and the impact of the project are high.

With regard to the sustainability of this project, the facility and the equipment installed at the implementing agencies are used by undergraduate and graduate students as well as by researchers. Organizational arrangement for maintenance is established, and barring some equipment, daily maintenance is carried out. In YAU, where technical cooperation project (TCP) is directly assisting, acquiring knowledge and passing on the use and maintenance methods of equipment requiring sophisticated technology are done properly. In other institutions, there are some rooms for improvement for inheriting the maintenance method systematically by developing a manual at laboratory to maintain or promote OJT to replace necessary parts and consumables for some equipment at appropriate timing, even if personnel changes or retire. From a financial point of view, there are some issues in regards to regular inspection of some of the equipment, securing consumables and response to breakdown, such as unable to allocate budget in timely and sufficient manner when repair and maintenance are required. Therefore, the sustainability of the project is fair because its long-term financial sustainability on operation and maintenance (O&M) is questionable.

In light of the above, this project is evaluated to be satisfactory.

## **4.2 Recommendations**

### **4.2.1 Recommendations to the Implementing Agency**

Each institution is highly in need of securing budget, carrying out check-up and repairing the equipment for full usage because some have left unfunctional due to breakdown for a long time. In particular, some of the equipment has not been repaired because of a budget shortfall even though quotations have been obtained. It is desirable to secure a budget promptly within the implementing agencies to make the equipment fully functional.

### **4.2.2 Recommendations to JICA**

Continuous monitoring is desirable so that the implementing agencies can secure a budget and appropriately carry out repair for the un-functional equipment.

## **4.3 Lessons Learned**

### **(1) Implementation of additional training on equipment operation and maintenance**

When the large number of equipment is provided and some of them require advanced and complex techniques as in the case of the project, initial training by consultant or the supplier is

essential at the time of installation. Because of limitation of time and the content of initial training, it is not easy for staff members from the implementing agencies to acquire adequate skills and knowledge. In case of YAU, a TCP was launched immediately after the project. Other institutions, DAR, CARTC, and VFRDC are not subject to the TCP, and opportunities for acquiring techniques related to the provided equipment are limited. According to opinions from related parties, there still remains some questions on how to use machinery and equipment. According to interviewees, further instructions on some of the equipment were necessary in order for users to understand how the equipment is utilized. As a technical cooperation itself may be implemented to acquire the skills using the equipment provided, it is reasonable to a certain extent to carry out a TCP immediately following a grant aid project. In addition, for the purpose of long-term capacity development, additional training employing a technical cooperation scheme is considered necessary. Through the series of training, it may continue to improve the capacity for O&M of equipment, including operation, data analysis, experiment management, as well as budgeting and procurement necessary for proper maintenance of equipment and facility.

#### (2) Long-term maintenance plan

When a building, or large-scale, expensive equipment is provided, it is desirable to confirm O&M condition of implementing agencies and propose them to complete annual O&M plan as a long-term maintenance plan during the Preparatory Survey carried out by consultants.

The ex-post evaluation found that the implementing agency is not allocating sufficient fund to O&M budget despite securing budget is one of binding items in the GA. Institutions always tried to secure a budget for repairs once problems occurred in facilities and equipment, and equipment failure will be remained if a sufficient budget could not be secured. In addition, if the funding were not secured for the current fiscal year, the repairs would not be carried out until next year and the number of such unfunctional equipment would be accumulated.

By preparing a long-term maintenance plan the necessity of securing the budget would be recognized in an early stage by the implementing agencies and would make it easy to make budget arrangement. There is an advantage for enabling measures of O&M easily linked to the planned budget execution as it promotes to make a plan of O&M and repair easily (See the following column “Key considerations for providing equipment requiring advanced skills and knowledge for O&M.”)

[Column] Key considerations for providing equipment requiring advanced skills and knowledge for operation and maintenance

The project provided such precision measuring equipment as gas chromatography (GC) and other expensive machinery<sup>23</sup>. As the equipment analyses very small substances at molecular level, advanced skills and knowledge are required to operate the equipment. What should be considered when providing such equipment to developing countries?

The project emphasizes human resource development and research for meeting the needs of farmers and consumers. GC was requested by YAU for measuring the volumes of residues from use of pesticide and other agricultural chemical used to prevent insects and pests, and the resistance to them. When selecting and operating the equipment, the following considerations were given so that the equipment produces required results:

- A TCP was launched immediately after the delivery of the equipment. In this project, short-term experts were dispatched to provide instructions on the equipment that required advanced operation techniques and improve the techniques of the researchers in Myanmar.
- To implement the training in Japan, a research institutes that use the same GC provided to YAU hosted the trainees dispatched from YAU so that the trainees were able to acquire the skills and knowledge necessary for the proper GC operation.
- Some reagents and consumables that cannot be procured in Myanmar were purchased and arranged in Japan and provided to the Myanmar side together with the equipment.
- When regular check-up and repairs were needed, some part of the expenses was supported by the budget associated to the TCP.
- As described above, the advanced equipment has been effectively used through the ongoing support for maintenance of the equipment and for improving techniques through collaboration with the TCP.

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<sup>23</sup> Three (3) sets of gas chromatographers were provided to YAU. Of two sets installed at the Department of Horticulture, and one set was installed at common laboratory. Other examples of the precision measuring machinery include two microscopes with digital camera to DAR and CARTC (one each), and two ultraviolet and visible absorption spectrometers to DAR and CARTC (one each).



Gas Chromatography provided at YAU

Based on the efforts made by the project and the on-going TCP, the following table summarizes the items taking the needs and environments of the recipients into the considerations when selecting and introducing advanced equipment. In consideration of these issues, it is important to confirm the technology and system for O&M of the implementing agencies and the technology for proper use in order to maintain a given performance for a long period of time.

**Issues to be Considered (Introduction of Advanced Equipment)**

Stage	Item	Points of attention
Equipment selection	Confirmation of needs	<ul style="list-style-type: none"> <li>Confirmation of the relevance of the equipment selected (clarification of the purpose of use, amount of investment against expected outputs (cost-effectiveness))</li> <li>Confirmation of consistency with the missions of the target institutions.</li> </ul>
	Confirmation and examination of available utilities and environment	<ul style="list-style-type: none"> <li>The quality of the water available (the need of water filter installation), stability of power supply (need of stabilizer and generator for stable power supply)</li> <li>Prospects for securing reagents and consumables (availability of the authentic products from authorized dealers, availability of the purchase by small lots)</li> <li>Stable supply of career gas such as nitrogen and helium, etc.</li> </ul>
	Specifications	<ul style="list-style-type: none"> <li>Defining the most appropriate specifications</li> </ul>
	Organization of O&M	<ul style="list-style-type: none"> <li>Confirmation of the institutional and organizational arrangement for proper maintenance.</li> <li>Securing a budget necessary for maintenance</li> <li>Technical level of the manufacturer / service agent, availability of manufacturer's offices / agents and engineers capable for providing services</li> <li>Warranty information (period and coverage)</li> </ul>

		<ul style="list-style-type: none"> <li>• Details of technology / services provided, availability of on-site repairs, necessity to return the equipment to the factory for maintenance, availability of repair in the country that the equipment is delivered</li> <li>• Securing maintenance personnel, clarification of responsibilities of engaged persons/managers</li> </ul>
	Transportation and customs procedures	<ul style="list-style-type: none"> <li>• Details of customs procedures</li> <li>• Confirmation of taxes to be paid and distribution channels</li> </ul>
	Maintenance plan	<ul style="list-style-type: none"> <li>• Confirm service life of comparable machinery and equipment as a reference and develop a long-term maintenance plan</li> <li>• Securing budget</li> </ul>
After provision	Trial operation at the time of inspection/introduction	<ul style="list-style-type: none"> <li>• Check if the equipment is installed correctly</li> <li>• Confirmation of functions based on the specifications</li> </ul>
	Operation techniques	<ul style="list-style-type: none"> <li>• Medium- to long-term transfer of operation techniques through technical cooperation and other schemes (to the extent possible)</li> <li>• Improvement in operation techniques through individual training</li> </ul>
	Maintenance cost	<ul style="list-style-type: none"> <li>• Improvement in daily operation records (log books)</li> <li>• Records and maintenance cost calculations based on the years of useful life</li> <li>• Examination of disposal or retirement if necessary, based on the maintenance cost and effect</li> </ul>

Source: Documents provided by JICA and the implementing agencies, interviews with experts

**Appended Table 1: Equipment Provided and the Number of Items**

Recipient Institutions	Main Equipment	Number of Items	
		Plan	Result
YAU*		275	228
Department of Agronomy	Dockage Tester, Grain Taste Analyzer, Draft Chamber, Plant Growth Chamber, Heliograph, Photosynthesis Meter, UV-VIS Spectrophotometer, etc.	61	57
Department of Botany	Plant Growth Chamber, Heliograph, Photosynthesis Meter, Microscope with Camera, Clean Bench, UV-VIS Spectrophotometer, Temperature Control Germination Equipment, etc.	48	38
Department of Agricultural Chemistry	Draft Chamber, Atomic Absorption Spectrophotometer, Gas Chromatography, Refrigerated Centrifuge, Real Time PCR, Growth Chamber, etc.	41	35
Department of Plant Pathology	Draft Chamber, Clean Bench, UV-VIS Spectrophotometer, Refrigerated Centrifuge, Real Time PCR, Growth Chamber, etc.	42	45
Department of Entomology	Draft Chamber, Microscope with Camera, Constant Temperature and Humidity Room, High Performance Liquid Chromatography, High Speed Refrigerated Centrifuge, etc.	54	31
Department of Horticulture	Plant Growth Chamber, Clean Bench, Refrigerated Centrifuge, Real Time PCR, UV Image Recorder, Micro Spectrophotometer, Gas Chromatography (TCD), Gas Chromatography (FID), etc.	75	41
Department of Agricultural Economics	Computer, Printer, etc.	7	5
Department of Animal Science	Computer, Printer, etc.	8	4
Department of Agricultural Engineering	Tractor (45HP), Roll Baler, Combine Harvester, etc.	32	24
DAR	Seed Germination Storage, Growth Chamber, Photosynthesis Meter, Clean Bench, UV-VIS Spectrophotometer, etc.	51	44
CARTC	UV-VIS Spectrophotometer, Tractor (45HP), Head-feeding Combine Harvester, etc.	33	31
VFRDC	Heliograph, Tractor (45HP), etc.	31	26
<b>Total**</b>		<b>275</b>	<b>228</b>

Source: Documents provided by JICA

\* The total number of types of equipment provided to YAU does not match the total number of types of equipment provided to each department because some types of equipment are shared by multiple departments.

\*\* The total number of types of equipment provided to the institutions does not match the total number of types of equipment provided to each organization because any overlapping equipment is excluded.

**Appended Table 2: Response to Qualitative Indicators at Each Institution**

Qualitative Indicators	Response
<b>YAU</b>	
(1) Educational and training curriculums, and examination and training contents meet the needs of farmers and consumers	The provision of equipment as part of the project made it possible to develop curriculums related to agricultural biotechnology, food science, microbiology, etc.
(2) Research outputs of the university and research institutes meet the needs of consumers	It was required to meet the following four consumer needs: “Appropriate food supply,” “Food can be purchased anytime at appropriate prices,” “Nutrition,” and “Safety.” Improvements the project made in facilities and equipment made it possible for the university’s research infrastructure to address more advanced and complicated research themes and meet these needs.
(3) Skills, knowledge, and motivation of trained agricultural human resources improve	No information on agricultural human resources (farmers) was provided as the university mainly trains researchers and students.
<b>DAR</b>	
(1) Educational and training curriculums, and examination and training contents meet the needs of farmers and consumers	The developed equipment made it possible to study utilizing the technique at a genetic or molecular level such as gene modification to develop waterproof varieties resistant to climate change and high yield/quality varieties, and pathology and biological study to identify and prevent pests and diseases.
(2) Research outputs of the university and research institutes meet the needs of consumers	With the developed equipment, the studies contributing to consumers’ needs have been undertaken such as reduction of agrochemical use by developing varieties resistant to pests and diseases utilizing the introduction of new technologies including gene modification.
(3) Skills, knowledge, and motivation of trained agricultural human resources improve	By accepting graduate students who would like to study in the agricultural sector in the future in the laboratory equipped with the developed equipment, human resources with advanced knowledge and technology are developed.
<b>CARTC</b>	
(1) Educational and training curriculums, and examination and training contents meet the needs of farmers and consumers	Edit and distribute a booklet targeted for agricultural extension workers, or main participants of CARTC training. Utilizing the developed equipment, the ways to support farmers who are tackling the issues in markets are examined.
(2) Research outputs of the university and research institutes meet the needs of consumers	The developed equipment by the project makes it possible to promote the production of high quality seeds. Accordingly, CRTC staff members are learning the stable production method of high quality seeds based on the study results of other agricultural human resources development institutions.
(3) Skills, knowledge, and motivation of trained agricultural	Promote improvements in knowledge and techniques on

Qualitative Indicators		Response
	human resources improve	adaptive research <sup>24</sup> as well as English and computer skills.
VFRDC		
	(1) Educational and training curriculums, and examination and training contents meet the needs of farmers and consumers	<ul style="list-style-type: none"> <li>• Techniques to cultivate fruits and vegetables, and techniques to produce safe food products are improved utilizing the more developed equipment.</li> <li>• Development of cultivation methods and techniques for horticultural crops</li> <li>• Among the diverse needs of farmers, they particularly need: (1) high yield/quality and safe crops, (2) management of postharvest treatment including agrochemical use for mold proof, antiseptis and sprout inhibition, and (3) prospective crop varieties resistant to pests and diseases.</li> </ul> <p>The center has conducted research to promote organic farming and Good Agricultural Practices (GAP)<sup>25</sup> to contribute to the production of safe food.</p>
	(2) Research outputs of the university and research institutes meet the needs of consumers	All the research findings satisfy farmers' needs for cultivation techniques. Effects of stress caused by non-biological causes such as disasters, drought, flood damages due to climate change on the fruit production. VFRDC's research outputs contribute to meeting the growing consumer needs for food safety.
	(3) Skills, knowledge, and motivation of trained agricultural human resources improve	No information was provided as the center mainly trains researchers.

Source: Documents provided by the implementing agencies

\*1: DAR has conducted research after setting annual research themes for individual laboratories and these research themes were not set based on the equipment provided.

<sup>24</sup> Adaptive research is defined by FAO as "the use of research in enhancing productivity or solving problems, without losing sight of the economic and environmental consequences of any widespread application of actions recommended as a result of the research."

<sup>25</sup> GAP stands for Good Agricultural Practices. GAP refers to the agricultural production process control to secure agricultural sustainability in such aspects as food safety, environmental conservation and occupational safety.



**Appended Table 3: Profit and Loss Statement of YAU (2015/16 - 2018/19)**

(Unit: Million MMK)

I. General Account	2015/16	2016/17	2017/18	2018 (6 months) <sup>26</sup>
1. Revenue	2,521.017	2,649.488	2,608.972	1,263.310
(1) Budget	2,521.017	2,563.386	2,522.176	1,263.310
(2) Grant	0.000	86.102	86.796	0.000
2. Expenditure (a)	2,518.920	2,637.803	2,598.972	1,260.310
Salary	1,123.279	1,202.824	1,244.446	726.567
Travel Expenses	29.499	51.936	48.576	15.821
Outsourcing service, wages, overhead expenses	777.662	787.393	722.989	370.295
O&M, Cleaning	<u>440.125</u>	<u>452.085</u>	<u>427.693</u>	128.276
Training, Research	148.355	143.565	155.268	19.351
<b>3. Balance</b>	<u><b>2.097</b></u>	<u><b>11.685</b></u>	<u><b>10.000</b></u>	<u><b>3.000</b></u>
II. Special Account	2015-16	2016-17	2017-18	2018 (6months)
1. Revenue	8,461.137	1,641.789	2,170.272	230.857
(1) Budget	2,001.997	1,323.194	656.000	206.438
(2) Grant	6,459.140	318.595	1,514.272	24.419
2. Expenditure	8,461.137	1,641.789	2,170.272	230.857
1-Construction	4,335.139	765.044	488.908	76.264
2-Miscellaneous	3,324.555	51.260	1,464.451	28.150
3-Machinery and Equipment	259.200	37.812	52.889	16.928
4-Transport	0.000	0.000	43.494	0.000
5-Office Equipment	0.000	72.634	37.064	17.253
6-Furniture	0.000	154.168	8.131	64.693
7-Others	542.243	560.871	75.335	27.569
<b>3. Balance</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>

Source: Implementing Agencies

<sup>26</sup> The financial data of data available was limited to 6 months, the estimated figures were used by multiplying twice for analysis.

**Appended Table 4: Issues Other Than Deficit Observed in the Equipment Provided**

Issues	Details of Deficit / Causes
Equipment does not operate as reagents and other consumables cannot be obtained	<p>In general, it is difficult to obtain reagents with the following reasons:</p> <ul style="list-style-type: none"> <li>• Consumables cannot be purchased due to a budget shortfall.</li> <li>• Equivalent products are not sold in Myanmar. To purchase them, they need to be imported, or a purchase request made to external experts.</li> <li>• Since the type of the content and minimum lot size on sale of the required agents is too large, therefor the prices become very expensive.</li> <li>• The quality of reagents sold is not satisfactory (distribution of fake products, etc.).</li> </ul>
Equipment is not repaired or checked on a regular basis	<ul style="list-style-type: none"> <li>• Consumables cannot be purchased due to a budget shortfall and so regular inspections and calibrations (adjustment of scales and sensor of measuring devices, etc.) are not performed.</li> </ul>
Adequacy of confirmation of the specifications during product selection	<p>For example, both the supplied rice milling machines and counting machines satisfy the specifications on the catalogue, such as particle size and mass to be measured, some products may not work properly due to other characteristics (size of grain, hardness and shape, density, etc. of diversity of Myanmar’s agricultural products (e.g. beans and rice)).</p>

End